2018 WYOMING MATHEMATICS

CONTENT AND PERFORMANCE STANDARDS

WYOMING STATE BOARD OF EDUCATION

Effective AUGUST 15, 2018

TO BE FULLY IMPLEMENTED IN DISTRICTS BY THE BEGINNING OF SCHOOL YEAR 2021-2022

ACKNOWLEDGEMENT

The Wyoming State Board of Education would like to thank the Wyoming Department of Education, as well as educators, parents and community members, business and industry representatives, community college representatives, and the University of Wyoming representatives for their help with the development of these math standards.

Jillian Balow, Superintendent of Public Instruction

Wyoming Department of Education

Megan Degenfelder, Chief Policy Officer

Laurie Hernandez, Division Director

Standards and Assessment Division

Barb Marquer, Standards Team Supervisor

Jill Stringer, Catherine Palmer, Sharla Dowding, Trenton Vonburg, and Rob Black—WDE Facilitators

Wyoming Department of Education
Hathaway Building, 2nd Floor
2300 Capitol Avenue
Cheyenne, WY 82002-0050

Higher Education Committee

The Higher Education Committee, consisting of 6 members from the community college and university level, reviewed the current math standards in order to provide feedback for the Math Standards Review Committee's consideration. After studying the 2012 Math Standards, the committee came to two principle conclusions: (i) The eight standards for mathematical practice are more important than any individual mathematical content articulated in the standards; and (ii) the content standards (the non-plus standards) represent a reasonable expectation for students entering credit-bearing college-level math courses.

Math Standard Review Committee (MSRC)

The Math Standards Review Committee was made up of thirty-eight (38) members including educators, parents, and community members from around the state of Wyoming. The MSRC reviewed a compilation of comments from regional community members, K—16 Wyoming educators, and findings from a Higher Education Committee around the current 2012 Wyoming Math Standards. The MSRC also evaluated the 2012 Math Standards, and discussions centered on research, national standards, and other exemplar states' math standards. For the development of the new 2018 Math Standards, the group came to consensus and agreed to use the current standards as a foundation from which to build upon and enhance through revisions, additions, and adaptations. The MSRC also chose to incorporate multiple states' resources when developing the new math standards including: Arizona, South Carolina, Washington, and Indiana, in addition to Wyoming's 2012 Math Standards. The MSRC found these states had philosophies that mirrored the committee's vision for the goal and direction necessary for Wyoming students with the new 2018 Wyoming Math Content and Performance Standards.

Parent Sub-Committee

In the spirit of being champions for all Wyoming kids, we understand successes and failures are a part of the learning journey. Winston Churchill is often given credit for saying, "Success is not final, failure is not fatal: it is the courage to continue that counts." This is what we want for our children, the courage to continue when faced with challenging tasks. As our children learn mathematics throughout their education, they will have opportunities to succeed and celebrate achievements.

As parents, we want children in Wyoming to be critical thinkers and to push the boundaries of mathematical understanding. We believe it is no longer acceptable to say, "I was never good at math, either" or to accept this for our children. We want them to learn and grow their mathematical skills to have the foundational knowledge to succeed in all endeavors.

The Mathematical Standards Review Committee (MSRC) started our meetings in June 2017 to review the mathematical standards for Wyoming K-12. The MSRC was comprised of educators, parents, and community members; all had a voice in every decision. It was a long process that provided valuable discussions and unique experiences, and in the end, we believe that our voices were heard.

We, as parents, play a vital role in our children's education. Mathematics is a significant portion of that educational process. Our children need inspiration, motivation, ability, and the opportunity to explore the mathematical world around them. They deserve to be given ample freedom to manipulate and explore the tools necessary to succeed in mathematics, now and in the future. The resulting revised standards document supports these goals we want for the children of Wyoming. Coupled with excellent instructional support from our Wyoming teachers, our children will have the opportunity to become confident and independent learners that can achieve great things in their lifetime and assist others to do the same.

2018 Wyoming Math Content and Performance Standards

Introduction

The Wyoming Math Content and Performance Standards (WyCPS) were last reviewed and approved in 2012 in accordance with Wyoming State Statute W.S. 21-2-304(c). The 2018 Wyoming Math Content and Performance Standards were developed collaboratively through the contributions of Math Standard Review Committee (MSRC) members from across the state. The committee's work was informed and guided by initial public input through community forums, as well as input solicited from specific stakeholder groups.

Introduction to Standards

Content Standards

Content standards define what students are expected to know and be able to do by the time they graduate. They do not dictate what methodology or instructional materials should be used, nor how the material is delivered.

Benchmarks

Benchmarks specify what students are expected to know and be able to do at the end of each of the grade levels. Benchmarks specify the skills and content students must master in order to demonstrate proficiency of the content standard by the time they graduate. In this standards document, you will find the benchmarks are broken out into individual grades for Kindergarten through 8th grade (K-8) and into Conceptual Categories at the high school grade levels (9-12).

Advanced Standards (+)

The high school standards specify the mathematics that all students should study to be college and career ready. Each standard **without** a **(+)** symbol should be in the common mathematics curriculum for all students. Advanced mathematics standards, those designated **with** a **(+)** sign, are integrated into the higher level math courses after Algebra II. These standards encourage student experiences in higher level mathematical thinking and/or STEM pathways.

(Adapted from CCSS https://edu.wyoming.gov/downloads/standards/final-2012-math-standards.pdf)

Rationale

Mathematics is the language that defines the blueprint of the universe. Mathematics is woven into all parts of our lives and is more than a list of skills to be mastered. The essence of mathematics is the ability to employ critical thinking and reasoning to solve problems. To be successful in mathematics, one must see mathematics as sensible, useful, and worthwhile. The 2018 Wyoming Mathematics Content and Performance Standards address two kinds of knowledge: mathematical content and mathematical practice.

Why Do We Have Standards for Mathematics?

Uniform and consistent mathematical education is necessary as it ensures that all students in Wyoming are prepared for success in and out of the classroom. Therefore, the 2018 Wyoming Mathematics Content and Performance Standards:

Provide students, parents, and educators focus and coherence through application including understanding of mathematical concepts and processes.

- Align K-12 with clearly defined goals and outcomes for learning.
- Emphasize conceptual understanding.
- Encourage multiple models, representations and strategies.
- Use technology to optimize mathematical understanding.

Develop students' mathematical thinking.

- Develop reasoning, solving, representing, proving, communicating, and connecting across contexts and applications.
- Recognize and identify mathematics in the world around us.
- Engage students in making sense, building conceptual understanding, developing procedural fluency, and employing adaptive reasoning.
- Build constructive attitudes to see mathematics as sensible, useful and worthwhile, and to increase confidence in one's own ability to do mathematics.

Mathematical Literacy

"Mathematical literacy is an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognize the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens."

https://www.achieve.org/files/StrongStandards.pdf

Why do we have the Standards for Mathematical Practice?

Procedural knowledge alone will not prepare our 21st Century students to be globally competitive. Mathematical thinkers also visualize problems and recognize that multiple strategies may lead to a single solution. They realize mathematics is applicable outside of the classroom and are confident in their ability to apply mathematical concepts to all aspects of life. The Standards for Mathematical Practice cultivate mathematically literate and informed citizens. Using mathematics as a means of synthesizing complex concepts and making informed decisions is paramount to college and career success. The Standards for Mathematical Practice develop skills that serve students beyond the math classroom.

http://www.corestandards.org/Math/Practice/

Standards for Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Computational Thinking

Computational thinking is necessary and meaningful in mathematics. Computational thinking has developed into competencies in problem solving, critical thinking, productivity, and creativity. Over time, engaging in computational thought builds a student's capacity to persevere, work efficiently, gain confidence, tolerate ambiguity, generalize concepts, and communicate effectively. In order to adapt to global advancements in technology, students will need to use their computational thinking skills to formulate, articulate, and discuss solutions in a meaningful manner.

Modeling

Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

The basic modeling cycle involves: (1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable, (6) reporting on the conclusions and the reasoning behind them. http://www.corestandards.org/Math/Content/HSM/

Mathematics | Standards for Mathematical Practice

"The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy). "

Source: http://www.corestandards.org/Math/Practice/

1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

2018 Wyoming Math Content and Performance Standards

Each standards page will integrate cross-curricular connections with the math standards.

Wyoming Cross-Curricular Connections

- 2016 Science
- 2014 Career & Vocational Education (CVE)
- 2014 Physical Education (PE)
- 2014 Social Studies
- 2013 Fine & Performing Arts (FPA)
- 2013 Foreign Language
- 2012 ELA
- 2012 Health

These standards can be found on the Wyoming Department of Education Website at http://edu.wyoming.gov/educators/standards

International Society for Technology in Education (ISTE) Connections

"Today's students must be prepared to thrive in a constantly evolving technological landscape. The ISTE standards are designed to empower student voice and ensure that learning is a student-driven process."

1. Empowered Learner
2. Digital citizen
3. Knowledge Constructor
4. Innovative Designer
5. Computational Thinker
6. Creative Communicator
7. Global Collaborator

The 2017 ISTE Standards for Students can be found at https://www.iste.org/standards/for-students

Computer Science Teachers Association (CSTA) Connections

"Today's students must be well-educated citizens in a computing-intensive world and to be prepared for careers in the 21st century; our students must have a clear understanding of the principles and practices of computer science."

The CSTA Standards can be found at https://www.csteachers.org/page/standards

Financial Literacy Connections

"The goal of financial education is to help students achieve a level of financial literacy; to help them become financially capable consumers."

Resource from http://www.jumpstart.org/assets/files/2015_NationalStandardsBook.pdf

How to Read This Document

Grade Level

Math Standard

S.ID means Statistics and Probability, Interpreting Categorical and Quantitative Data

Benchmark

The skills and content students should understand and be able to do by the end of the grade levels.

Conceptual Category (high school only)

Domain

Cluster of related standards.

Wyoming 2018 Mathematics Content and Performance Standards

HS

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID Summarize, represent, and interpret data on two categorical and quantitative variables	Mathematical Practices
S.ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. A. Use a function to describe data trends to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

B. Informally assess the fit of a function by plotting and analyzing residuals.

Example

Example:

Measure the wrist and neck size of each person in your class and make a scatterplot. Find the least squares regression line. Calculate and interpret the correlation coefficient for this linear regression model. Graph the residuals and evaluate the fit of the linear equations.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Science	ELA
HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.	**W.9-10.2.d** Use precise language and domain-specific vocabulary to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3d** Knowledge Constructor		☑ Computational Thinking ☐ Financial Literacy

Grade-Level Example

Example(s) are suggested options to demonstrate a benchmark. Multiple strategies may be used.

Wyoming Cross-Disciplinary Connections

Connections to other Wyoming Content & Performance Standards. These are intended to be suggestions and may be relevant depending on curriculum and instruction.

Advanced Standard (+) (high school only)

Advanced mathematics standards that students should learn in order to take advanced courses.

Modeling

Symbol denotes modeling to be considered in instruction.

Mathematical Practices

Describe varieties of skills and expertise that math educators at all levels should seek to develop in their students.

Cross-Disciplinary Connections

Connections to real-world concepts and standards. These are intended to be suggestions and may be relevant depending on curriculum and instruction.

2018 WYOMING MATH CONTENT AND PERFORMANCE STANDARDS REVIEW COMMITTEE (2017-2018)

Jessica Anson	Sweetwater School District #1	**Keren Meister-Emerich**	Retired, Laramie County School District #1
David Anton	University of Wyoming	**Keri Malson**	Kaycee
Katie Barngrover	Fremont County School District #2	**Isaac Mayes**	Big Horn County School District #4
Jamie Bates	Casper	**Dave Mullens**	Retired Engineer, Laramie
Stephanie Boren	Hot Springs County School District #1	**Nancy Nelson**	Big Horn County School District #3
Kristin Cavallier	Laramie County School District #1	**Dr. Cynthia Porter**	Natrona County School District #1
Carrie Jo Calvert	Fremont County School District #21	**Gar Powell**	Uinta County School District #1
Preston Eckerdt	Park County School District #1	**Nan Frazier**	Fremont County School District #25
Andre Francis	Eastern Wyoming College	**Megan Rourke**	NWCCD—Gillette College
Terrill Clay Gibbons	Worland	**Joshua Sanderlin**	Array School of Technology & Design
Zachary Hall	Cheyenne	**Margaret Schilling**	Retired, Laramie County School District #1
Joyce Hammer	Connections Academy, Lusk	**Amy Shoales**	Laramie
Analysia Heikkila	Fremont County School District #1	**Liesl Sisson**	Platte County School District #2
Cassie Hetzel	Hot Springs County School District #1	**Kerrie Spinney**	Northwest College
Patrick Ivers	Retired, UW/LCCC Math, Laramie	**Debra Swedberg**	Casper College
Anne Ivie	Thermopolis	**Donna Tinsley**	Campbell County School District #1
Allen Johnson	Teton County School District #1	**Theodore Wambeke**	Park County School District #6
Mary Kellogg	Fremont County School District #25	**Susan Wilson**	Sheridan #2 Board of Trustees
Juanita Mair	Uinta County School District #6	**Lee Zimmer**	Sheridan County School District #1

Mathematics | Kindergarten

In Kindergarten, instructional time should focus on two critical areas: (1) representing, relating, and operating on whole numbers, initially with sets of objects; (2) describing shapes and space. More learning time in Kindergarten should be devoted to numbers than to other topics.

(1) Students use numbers, including written numerals, to represent quantities and to solve quantitative problems, such as counting objects in a set; counting out a given number of objects; comparing sets or numerals; modeling simple joining and separating situations with sets of objects; or, eventually with equations such as 5 + 2 = 7 and 7 – 2 = 5. (Kindergarten students should see addition and subtraction equations; although student writing of equations in kindergarten is encouraged, it is not required.) Students choose, combine, and apply effective strategies for answering quantitative questions, including quickly recognizing the cardinalities of small sets of objects, counting and producing sets of given sizes, counting the number of objects in combined sets, or counting the number of objects that remain in a set after some are taken away.

(2) Students describe their physical world using geometric ideas (e.g., shape, orientation, spatial relations) and vocabulary. They identify, name, and describe basic two-dimensional shapes, such as, squares, triangles, circles, rectangles, and hexagons; presented in a variety of ways (e.g., with different sizes and orientations), as well as three-dimensional shapes. They use basic shapes and spatial reasoning to model objects in their environment and to construct more complex shapes.

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In Kindergarten, students begin to build the understanding that doing mathematics involves solving problems and discussing how they solved them. Students can explain the meaning of a problem and look for ways to solve it. Students check their thinking by using concrete objects or pictures to help them conceptualize and solve problems. Students are also working on increasing stamina as they work on problems.

2. Reason abstractly and quantitatively.

Students begin to recognize what a number is and that it also represents a specific quantity. Then, they connect the quantity to written symbols. Students make meaning of word problems and use manipulatives to express and solve their thinking. Students are also working on increasing stamina as they work on problems.

3. Construct viable arguments and critique the reasoning of others.

Students construct arguments using concrete illustrations, such as objects, pictures, drawings, and actions. They also begin to develop their mathematical communication skills as they participate in mathematical discussions involving questions such as, “How did you get that? and Why is that true?” They explain their thinking to others and respond to others’ thinking by making connections. Students are also working on increasing stamina as they work on problems.

4. Model with mathematics.

Students experiment with representing problem situations in multiple ways including using objects, acting out, drawing pictures, numbers, words (mathematical language), making a chart or list, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed.

5. Use appropriate tools strategically.

Students begin to explore the different available tools when thinking about the concepts of numbers. They begin to learn which tools help strengthen their understanding of concepts. For instance, kindergarteners may decide that it might be advantageous to use linking cubes to represent two quantities and then compare the two representations side-by-side.

6. Attend to precision.

As kindergarteners begin to develop their mathematical communication skills, they try to use clear and precise mathematical vocabulary in their discussions with others and in their own reasoning. Students learn to attend to the shapes of numbers, quickly recognize quantities (subitizing), and simple drawings to show their work.

7. Look for and make use of structure.

Students begin to notice a number pattern or structure. For instance, students recognize the pattern that exists in the teen numbers; every teen number is written with a 1 (representing one ten) and ends with the digit that is first stated, and the pattern of numbers 0-9 repeat in the following numbers of 20, 30, etc. They also recognize that 3 + 2 = 5 and 2 + 3 = 5.

8. Look for and express regularity in repeated reasoning.

Students notice repetitive actions in counting and computation, etc. For example, they may notice that the next number in a counting sequence is one more. When counting by tens, the next number in the sequence is ten more (or one more group of ten). Students also notice that when adding two numbers, order of adding doesn’t affect the sum (commutative property).

Wyoming 2018 Mathematics Content and Performance Standards

Counting and Cardinality

K.CC.A Know number names and the count sequence.	Mathematical Practices
K.CC.A.1 A. Count to 100 by ones and by tens. B. Count backwards by ones from 20.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science

K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Counting and Cardinality

K.CC.A Know number names and the count sequence.	Mathematical Practices
K.CC.A.2 Count forward beginning from a given number within the known sequence (instead of having to begin at 1).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science	FPA
K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.	**FPA4.I.D.4** Students demonstrate the ability to dance to a musical phrase, responding to dynamic changes.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Counting and Cardinality

K.CC.A Know number names and the count sequence.	Mathematical Practices	Example
K.CC.A.3 Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 (Zero) representing a count of no objects).	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

ELA

SL.K.5 Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Counting and Cardinality	K.CC.B Count to tell the number of objects.	Mathematical Practices
	K.CC.B.4 Understand the relationship between numbers and quantities; connect counting to cardinality. A. Use one-to-one correspondence when counting objects. B. Understand that the last number name said, tells the number of objects counted regardless of their arrangement. C. Understand that each successive number name refers to a quantity that is one more, and each previous number name refers to a quantity that is one less.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example: When counting objects, say the number names in the standard order pairing each object with one and only one number name and each number name with one and only one object.

Wyoming Cross-Disciplinary Connections

Science	ELA
K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.	**SL.K.5** Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Counting and Cardinality

K.CC.B Count to tell the number of objects.	Mathematical Practices
K.CC.B.5 When counting: A. Answer the question "how many?" by counting up to 20 objects arranged in a line, a rectangular array, a circle, or as many as 10 objects in a scattered configuration. B. Given a number from 1-20, count out that many objects.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science	ELA
K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.	**SL.K.5** Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

K

Counting and Cardinality

K.CC.C Compare numbers	Mathematical Practices
K.CC.C.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group. (Include groups with up to ten objects.)	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science	ELA
K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.	**RI.K.1** Demonstrate understanding of the organization and basic features of print. **W.K.7** Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). **SL.K.5** Use words and phrases acquired through conversations, reading and being read to, and responding to texts.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Counting and Cardinality

K.CC.C Compare numbers	Mathematical Practices
K.CC.C.7 Compare two numbers between 1 and 10 presented as written numerals.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science	ELA
K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull. **K-ESS3-2** Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.	**RI.K.1** Demonstrate understanding of the organization and basic features of print. **W.K.7** Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). **SL.K.3** Ask and answer questions in order to seek help, get information, or clarify something that is not understood.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

K

Operations and Algebraic Thinking

K.OA.D Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.	Mathematical Practices
K.OA.D.1 Model situations that involve representing addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Drawings need not show details, but should show the mathematics in the problem.

Wyoming Cross-Disciplinary Connections

Science	ELA	Health
K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.	**W.K.7** Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).	**HE2.3.4** Identify characteristics of effective listening skills to enhance health or reduce/avoid health risks (e.g., eyes on speaker, etc.). PCD, IP/S, FA

Cross-Disciplinary Connections

ISTE	Computer Science	
	1A-AP-08 Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks.	☑ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

K.OA.D Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

K.OA.D.2 Solve word problems using objects and drawings to find sums up to 10 and differences within 10.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: My family has ___ members, your family has ____ members. How many altogether? How many more members are in your family than in mine?

Wyoming Cross-Disciplinary Connections

Science	CVE
K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.	**CV5.3.1** Students identify and define real-world problems and meaningful questions for investigation.

Cross-Disciplinary Connections

ISTE	Computer Science	
3a,d Knowledge Constructor **5c** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

K

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	K.OA.D Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.	Mathematical Practices	Example
	K.OA.D.3 Decompose numbers less than or equal to 10 in more than one way.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	By using objects or drawings, and modeling how to record each decomposition by a drawing or equation. **Example:** 5 = 2 + 3 and 5 = 4 + 1 and 5 = 2 + 2 + 1. (Part/Part/Whole)

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

K.OA.D Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.	Mathematical Practices
K.OA.D.4 For any number from 1 to 9, find the number that makes 10 when added to the given number.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Example: By using objects or drawings, and record the answer with a drawing or equation.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

K.OA.D Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.	Mathematical Practices
K.OA.D.5 Fluently add and subtract within 5.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

K.NBT.E Work with numbers 11-19 to gain foundations for place value.	Mathematical Practices	Example
K.NBT.E.1 Describe, explore, and explain how the counting numbers 11 to 19 is: A. Composed of ten ones and more ones. B. Decomposed into ten ones and more ones.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

K

Measurement and Data

K.MD.F Describe and compare measurable attributes.

K.MD.F.1 Describe several measurable attributes of one or more objects.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Students compare shoes in ways that they are alike and different, thinking about how tall the shoe is, how light the shoe is and which is heavier. Non-defining attributes are those that do not define a mathematical characteristic: color, orientation, overall size.

Adapted from: http://www.nctm.org/Classroom-Resources/Lessons/Alike-and-Different/

Wyoming Cross-Disciplinary Connections

Science	ELA	Health
K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull. **K-ESS2-1** Use and share observations of local weather conditions to describe patterns over time.	**W.K.7** Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). **RI.K.1** With prompting and support, ask and answer questions about key details in a text.	**HE2.3.4** Identify characteristics of effective listening skills to enhance health or reduce/avoid health risks (e.g., eyes on speaker, etc.). PCD, IP/S, FA **HE2.4.8** Describe the ways people are similar and different. FAM, VP/B

Cross-Disciplinary Connections

ISTE	Computer Science	
3a,d Knowledge Constructor **5c** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

K

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

K.MD.F Describe and compare measurable attributes.

K.MD.F.2 Make direct comparisons of the length, capacity, weight, and temperature of objects, and recognize which object is shorter/longer, taller, lighter/heavier, warmer/cooler, and which holds more/less.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Students compare shoes in ways that they are alike and different, thinking about how tall the shoe is, how light the shoe is and which is heavier.

Adapted from: http://www.nctm.org/Classroom-Resources/Lessons/Alike-and-Different/

Wyoming Cross-Disciplinary Connections

Science

K-PS2-2 Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

K-PS3-1 Make observations to determine the effect of sunlight on Earth's surface.

ELA

RI.K.1 With prompting and support, ask and answer questions about key details in a text.

W.K.2 Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.

W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).

SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

K

Measurement and Data

K.MD.G Classify objects and count the number of objects in each category.	Mathematical Practices
K.MD.G.3 Classify objects into given categories; count the numbers of objects in each category and sort the categories by count. (Limit category counts to be less than or equal to 10.)	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: Use living and nonliving examples to sort and classify.

Wyoming Cross-Disciplinary Connections

Science	ELA
K-ESS2-1 Use and share observations of local weather conditions to describe patterns over time.	**W.K.7** Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).

Cross-Disciplinary Connections

ISTE	Computer Science	
5c Computational Thinker		☑ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

K.MD .G Classify objects and count the number of objects in each category.	Mathematical Practices
K.MD.G.4 Identify U.S. coins by name (pennies, nickels, dimes, and quarters).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Social Studies

SS2.3.2 Identify how price may affect buying, selling, and saving decisions.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	K.G.H Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).	Mathematical Practices	Example
	K.G.H.1 Describe objects in the environment using the names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Modeling

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	**K.G.H Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).**	**Mathematical Practices**
	K.G.H.2 Correctly name shapes regardless of their orientations or overall size.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	**Computer Science**	☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	K.G.H Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).	Mathematical Practices
	K.G.H.3 Identify shapes as two-dimensional or three-dimensional.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	K.G.I Analyze, compare, create, and compose shapes.	Mathematical Practices	Example
	K.G.I.4 Analyze and compare two- and three-dimensional shapes, using informal language to describe their similarities, differences, and attributes.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	K.G.I Analyze, compare, create, and compose shapes.	Mathematical Practices	Example
	K.G.I.5 Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

K

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	K.G.I Analyze, compare, create, and compose shapes.	Mathematical Practices
	K.G.I.6 Use simple shapes to compose squares, rectangles, and hexagons.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Kindergarten Resources

Standard/Page Number	Resource/Link
K.MD.F.1 on page 25.	Adapted from: http://www.nctm.org/Classroom-Resources/Lessons/Alike-and-Different/
K.MD.F.2 on page 26.	Adapted from: http://www.nctm.org/Classroom-Resources/Lessons/Alike-and-Different/
Grade Level Math Practices on page 11.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | Grade 1

In Grade 1, instructional time should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; (4) reasoning about attributes of, and composing and decomposing geometric shapes.

(1) Students develop strategies for adding and subtracting whole numbers based on their prior work with small numbers. They use a variety of models, including discrete objects and length-based models (e.g., cubes connected to form lengths), to model add-to, take-from, put-together, take-apart, and compare situations to develop meaning for the operations of addition and subtraction, and to develop strategies to solve arithmetic problems with these operations. Students understand connections between counting and addition and subtraction (e.g., adding two is the same as counting on two). They use properties of addition to add whole numbers and to create and use increasingly sophisticated strategies based on these properties (e.g., "making tens") to solve addition and subtraction problems within 20. By comparing a variety of solution strategies, children build their understanding of the relationship between addition and subtraction.

(2) Students develop, discuss, and use efficient, accurate, and generalizable methods to add within 100 and subtract multiples of 10. They compare whole numbers (at least to 100) to develop understanding of and solve problems involving their relative sizes. They think of whole numbers between 10 and 100 in terms of tens and ones (especially recognizing the numbers 11 to 19 as composed of a ten and some ones). Through activities that build number sense, they understand the order of the counting numbers and their relative magnitudes.

(3) Students develop an understanding of the meaning and processes of measurement, including underlying concepts such as iterating (the mental activity of building up the length of an object with equal-sized units) and the transitivity principle for indirect measurement For example, if object A is heavier than object B, and object B is heavier than object C, then object A is heavier than object C through indirect measurement. Students engage in activities that lay the foundation to tell time to the hour and half hour, and to identify and differentiate the value of standard US coins.

(4) Students compose and decompose plane or solid figures (e.g., put two triangles together to make a quadrilateral) and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, determine how they are alike and different, and develop the background for measurement and initial understandings of properties such as congruence and symmetry.

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In first grade, students realize that doing mathematics involve solving problems and discussing how they solved them. Students explain the meaning of a problem and look for ways to solve it. Students may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by revisiting their work and asking themselves, "Does this make sense? "or, "Should I try another strategy.? Students are also working on increasing stamina as they work on problems.

2. Reason abstractly and quantitatively.

Students recognize that a number represents a specific quantity. They connect the quantity to written symbols. Quantitative reasoning means being able to explain through manipulatives or drawings what a problem means while attending to the meanings of the quantities. Students make meaning of a problem situation and translate into a number sentence.

3. Construct viable arguments and critique the reasoning of others.

First graders construct arguments using concrete illustrations referents, such as objects, pictures, drawings, and actions. They also practice their mathematical communication skills as they participate in mathematical discussions involving questions like, "How did you get that?" Explain your thinking, "Why is that true?" They not only explain their own thinking, but listen to others' explanations. They decide if the explanations make sense and ask questions for clarity.

4. Model with mathematics.

Students experiment with representing problem situations in multiple ways including using objects, acting out, drawing pictures, numbers, words (mathematical language), making a chart or list, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed.

5. Use appropriate tools strategically.

Students begin to consider the different tools available when thinking about the concepts of number. They evaluate the available tools (including concrete manipulatives, drawings, estimation, and applications) when solving a mathematical problem and decide when certain tools might be helpful and give a reason for using the tool to solve the problem. For instance, first graders decide it might be best to use colored chips to model an addition problem.

6. Attend to precision.

Students begin to develop their mathematical communication skills. They try to use clear and precise mathematical vocabulary in their discussions with others and in their own reasoning. Students learn to express their work with mathematical language and symbols.

7. Look for and make use of structure.

First graders begin to discern a number pattern or structure. For instance, if students recognize 12 + 3 = 15, then they also know 3 + 12 = 15. (Commutative property of addition.) To add 4 + 6 + 4, the first two numbers can be added to make a ten, so 4 + 6 + 4 = 10 + 4 = 14. Students continue to develop their understanding of patterns in our number system.

8. Look for and express regularity in repeated reasoning.

Students notice repetitive actions in counting and computation, etc. When children have multiple opportunities to add and subtract ten, including multiples of ten, then they notice the pattern and gain a better understanding of place value. Students also notice that when adding two numbers, order of adding doesn't affect the sum (commutative property). They also notice that three numbers create a family when adding or subtracting (2+3=5 and 5-2=3).

1st

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

1.OA.A Represent and solve problems involving addition and subtraction.	Mathematical Practices
1.OA.A.1 Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, by using objects, drawings, or equations with a symbol for the unknown number to represent the problem.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science	ELA	CVE
1-ESS1-2.Make observations at different times of year to relate the amount of daylight to the time of year.	**W.1.7** Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). **W.1.8** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.	**CV5.3.1** Students identify and define real-world problems and meaningful questions for investigation.

Cross-Disciplinary Connections

ISTE	Computer Science	
	1A-AP-09 Model the way programs store and manipulate data by using numbers or other symbols to represent information.	☑ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

1.OA.A Represent and solve problems involving addition and subtraction.	Mathematical Practices	Example
1.OA.A.2 Solve word problems that call for the addition of three whole numbers whose sum is less than or equal to 20, by using objects, drawings, or equations. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

CVE

CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	**1.OA.B Understand and apply properties of operations and the relationship between addition and subtraction.**	**Mathematical Practices**
	1.OA.B.3 Apply commutative and associative properties of addition as strategies to add and subtract.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Example: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)

*Teacher Note: This is fact families and number bonds. (Students need not use formal terms for these properties.)

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	1.OA.B Understand and apply properties of operations and the relationship between addition and subtraction.	Mathematical Practices	Example
	1.OA.B.4 Understand subtraction as an unknown-addend problem.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	1.OA.C Add and subtract within 20.	Mathematical Practices	Example
	1.OA.C.5 Relate counting to addition and subtraction using strategies, such as, by counting on and back.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	**Example**: Counting on two in order to add two.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	1.OA.C Add and subtract within 20.	Mathematical Practices	Example
	1.OA.C.6 Add and subtract within 20, demonstrating fluency in addition and subtraction within 10. Use strategies such as counting on; making ten using the relationship between addition and subtraction.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	**1.OA.D Work with addition and subtraction equations.**	**Mathematical Practices**
	1.OA.D.7 Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Example: Which of the following equations are true and which are false?

a. 6 = 6

b. 7 = 8 – 1

c. 5 + 2 = 2 + 5

d. 4 + 1 = 5 + 2

Wyoming Cross-Disciplinary Connections

FPA

FPA4.1.M.3 Students improvise simple rhythms, melodies and accompaniments using a variety of traditional and nontraditional sounds.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	**1.OA.D Work with addition and subtraction equations.**	**Mathematical Practices**	**Example**
	1.OA.D.8 Determine the unknown whole number in an addition or subtraction equation relating three whole numbers.	**MP.1** **Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** **Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** **Look for and make use of structure.** **MP.8** **Look for and express regularity in repeated reasoning.**	**Example:** Determine the unknown that makes the equation true in each of the equations: a. 8 + __ = 11 b. 5 = __ - 3 c. 6 + 6 = __

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	**Computer Science**	☐ **Computational Thinking** ☐ **Financial Literacy**

1st

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	1.NBT.E Extend the counting sequence.	Mathematical Practices	Example
	1.NBT.E.1 Extend the number sequences to 120. In this range: A. Count forward and backward, starting at any number less than 120. B. **R**ead numerals. C. Write numerals. D. Represent a number of objects with a written numeral.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

1.NBT.F Understand place value.	Mathematical Practices	Example
1.NBT.F.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: A. 10 can be thought of as a bundle of ten ones — called a "ten". B. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. C. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	1.NBT.F Understand place value.	Mathematical Practices
	1.NBT.F.3 Compare pairs of two-digit numbers based on the values of the tens digit and the ones digits, recording the results of comparisons with the words "is greater than," "is equal to," "is less than," and with the symbols >, =, and <.	**MP.1** **Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** **Attend to precision.** **MP.7** **Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science	ELA
1-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	**RI.1.1** Ask and answer questions about key details in a text. **RI.1.2** Identify the main topic and retell key details of a text. **RI.1.10** With prompting and support, read informational texts appropriately complex for grade 1.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

1st

Number and Operations in Base Ten

1.NBT.G Use place value understanding and properties of operations to add and subtract.	Mathematical Practices
1.NBT.G.4 Add within 100, using concrete models or drawings and strategies based on place value: A. Including adding a two-digit number and a one-digit number. B. Adding a two-digit number and a multiple of 10. C. Understand that in adding two-digit numbers, adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. D. Relate the strategy to a written method and explain the reasoning used.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

ELA

RI.1.1 Ask and answer questions about key details in a text.

RI.1.2 Identify the main topic and retell key details of a text.

RI.1.10 With prompting and support, read informational texts appropriately complex for grade 1.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

1.NBT.G Use place value understanding and properties of operations to add and subtract.	Mathematical Practices
1.NBT.G.5 Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used .	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** **Attend to precision.** **MP.7** **Look for and make use of structure.** **MP.8** **Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

ELA

RI.1.1 Ask and answer questions about key details in a text.

RI.1.2 Identify the main topic and retell key details of a text.

RI.1.10 With prompting and support, read informational texts appropriately complex for grade 1.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

1st

Number and Operations in Base Ten

1.NBT.G Use place value understanding and properties of operations to add and subtract.	Mathematical Practices
1.NBT.G.6 Subtract multiples of 10 from an equal or larger multiple of 10 both in the range 10-90, using concrete models, drawings, and strategies based on place value.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

Science	ELA
1-LS1-2 Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	**RI.1.1** Ask and answer questions about key details in a text. **RI.1.2** Identify the main topic and retell key details of a text. **RI.1.10** With prompting and support, read informational texts appropriately complex for grade 1.

Cross-Disciplinary Connections

ISTE	Computer Science	
	1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.	☑ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

1st

Measurement and Data

1.MD.H Measure lengths indirectly and by iterating length units.	Mathematical Practices
1.MD.H.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Students make clay snakes, given a tower of cubes, each student compares his or her snake to the tower. Then students make statements such as, "My snake is longer than the cube tower. Your snake is shorter than the cube tower."

Adapted from: https://www.engageny.org/resource/prekindergarten-mathematics-module-4-topic-a-lesson-3/file/116496

Wyoming Cross-Disciplinary Connections

Science	ELA	FPA
1-LS3-1 Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	**RI.1.1** Ask and answer questions about key details in a text. **W.1.7** Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). **W.1.8** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.	**FPA4.1.M.2** Students perform independently and with others a varied repertoire of music, developing pitch accuracy, rhythm, posture, dynamics, and steady beat.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

1st

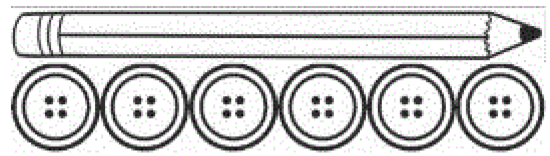
Measurement and Data

1.MD.H Measure lengths indirectly and by iterating length units.	Mathematical Practices
1.MD.H.2 Use nonstandard units to show the length of an object as the number of same size units of length with no gaps or overlaps.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Use but not limited to cubes, counting bears, links, etc. that are the same size. Teacher discretion.

Activity: Have students use connecting blocks or some other nonstandard unit to measure three pencils and then put them in order from shortest to longest. For example, students may use buttons to measure the pencils and determine that a pencil is 6 buttons long.



Adapted from: https://www.doe.in.gov/sites/default/files/standards/mathematics/grade-1-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

Science	FPA
1-PS4-4 Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.	**FPA4.1.M.5** Students read and notate simple rhythm, dynamics and pitch notation.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

1.MD.I Work with time and money.

1.MD.I.3

A. Tell and write time in hours and half-hours using analog and digital clocks.

B. Identify U.S. coins by value (pennies, nickels, dimes, quarters).

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

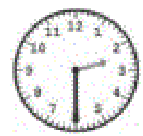
MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: What time does the clock show?



Adapted from: https://www.doe.in.gov/sites/default/files/standards/mathematics/grade-1-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

Social Studies	CVE
SS2.3.2 Identify how price may affect buying, selling, and saving decisions. **SS2.4.2** Identify tools and technologies that make life easier (e.g., cars for getting one place to another, washing machines for washing clothes, or flashlights to see in the dark).	**CV5.5.2** Students examine family, community, monetary, and school systems.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

1.MD.J Represent and interpret data.	Mathematical Practices
1.MD.J.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

ELA	CVE
W.1.7 Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions). **W.1.8** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.	**CV5.4.4** Students interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (*Adapted from CCSS RI.4.7)

Cross-Disciplinary Connections

ISTE	Computer Science	
	1A-DA-07 Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.	☑ **Computational Thinking** ☐ **Financial Literacy**

1st

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	1.G.K Reason with shapes and their attributes.	Mathematical Practices	Example
	1.G.K.1 Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); for a wide variety of shapes; build and draw shapes to possess defining attributes.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	1.G.K Reason with shapes and their attributes.	Mathematical Practices
	1.G.K.2 Use two-dimensional shapes (rectangles, squares, trapezoids, rhombuses, and triangles) or three-dimensional shapes (cubes, rectangular prisms, cones, and cylinders) to create a composite figure, and create new figures from the composite figure.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

1st

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	1.G.K Reason with shapes and their attributes.	Mathematical Practices	Example
	1.G.K.3 Partition circles and rectangles into two and four equal shares and: A. Describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. B. Describe the whole as two of, or four of the shares. C. Recognize that decomposing into more equal shares creates smaller shares.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Grade 1 Resources

Standard/Page Number	Resource/Link
1.MD.H.1 on page 50.	https://www.engageny.org/resource/prekindergarten-mathematics-module-4-topic-a-lesson-3/file/116496
1.MD.H.2 on page 51.	https://www.doe.in.gov/sites/default/files/standards/mathematics/grade-1-resource-guide.pdf
1.MD.I.3 on page 52.	https://www.doe.in.gov/sites/default/files/standards/mathematics/grade-1-resource-guide.pdf
Grade Level Math Practices on page 36.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | Grade 2

In Grade 2, instructional time should focus on four critical areas: (1) extending understanding of base-ten notation; (2) building fluency with addition and subtraction; (3) using standard units of measure; and (4) describing and analyzing shapes.

(1.) Students extend their understanding of the base-ten system. This includes ideas of counting in fives, tens, and multiples of hundreds, tens, and ones, as well as number relationships involving these units, including comparing. Students understand multi-digit numbers (up to 1000) written in base-ten notation, recognizing that the digits in each place represent amounts of thousands, hundreds, tens, or ones (e.g., 853 is 8 hundreds + 5 tens + 3 ones).

(2) Students use their understanding of addition to develop fluency with addition and subtraction within 100. They solve problems within 1000 by applying their understanding of models for addition and subtraction. They develop, discuss, and use efficient, accurate, generalizable methods to compute sums and differences of whole numbers in base-ten notation, using their understanding of place value and the properties of operations. They select and accurately apply methods that are appropriate for the context and the numbers involved to mentally calculate sums and differences for numbers with only tens or only hundreds.

(3) Students recognize the need for standard units of measure (centimeter and inch) and they use rulers and other measurement tools with the understanding that linear measure involves an iteration of units. They recognize that the smaller the unit, the more iterations they need to cover a given length. Students engage in activities that lay the foundation to tell time in five minute increments, and are able to use standard US currency up to $10 to solve problems.

(4) Students describe and analyze shapes by examining their sides and angles. Students investigate, describe, and reason about decomposing and combining shapes to make other shapes. Through building, drawing, and analyzing two- and three-dimensional shapes, students develop a foundation for understanding area, volume, congruence, similarity, and symmetry in later grades.

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In second grade, students realize that doing mathematics involves solving problems and discussing how they solved them. Students explain the meaning of a problem and look for ways to solve it. They may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by asking themselves, “Does this make sense?” They make conjectures about the solution and plan out a problem-solving approach. Students work on increasing stamina.

2. Reason abstractly and quantitatively.

Students recognize that a number represents a specific quantity and connect the quantity to written symbols. Quantitative reasoning entails being able to explain through manipulatives or drawings what a problem means, while attending to the meanings of the quantities. Students make meaning of a problem situation and translate into a number sentence. Second graders begin to know and use different properties of operations and relate addition and subtraction.

3. Construct viable arguments and critique the reasoning of others.

Second graders may construct arguments using concrete illustrations, such as objects, pictures, drawings, and actions. They practice their mathematical communication skills as they participate in mathematical discussions involving questions like, “How did you get that?” Explain your thinking, “Why is that true?” They not only explain their own thinking, but listen to others’ explanations and compare strategies. They decide if the explanations make sense and ask appropriate questions for clarity.

4. Model with mathematics.

Students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart or list, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed.

5. Use appropriate tools strategically.

Students decide how and when to use the available tools appropriately and efficiently when solving a mathematical problem. Students reason whether or not a tool was helpful in solving the problem. For instance, second graders may decide to solve a problem by drawing a picture rather than writing an equation.

6. Attend to precision.

Students begin to develop their mathematical communication skills, (orally and written) They use clear and precise mathematical language and symbols when explaining their own reasoning.

7. Look for and make use of structure.

Second graders look for patterns. For instance, they adopt mental math strategies based on patterns (making ten, fact families, doubles, adding and subtracting numbers by place, and equal shares). Their understanding of the number system develops into 3- and 4- digit numbers.

8. Look for and express regularity in repeated reasoning.

Second grade students notice repetitive actions in counting and computation, etc. When children have multiple opportunities to add and subtract, they look for shortcuts, such as tens are added to tens, ones are added to ones, and sometimes the ones make a new ten. They also notice when a whole is shared into equal groups, the size of the share gets smaller the more shares.

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	2.OA.A Represent and solve problems involving addition and subtraction.	Mathematical Practices	Example
	2.OA.A.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, by using drawings and equations with a symbol for the unknown number to represent the problem.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	Common Core Addition and Subtraction Table Source: http://www.corestandards.org/Math/Content/mathematics-glossary/Table-1/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
	1A-AP-09 Model the way programs store and manipulate data by using numbers or other symbols to represent information.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

2.OA.B Add and subtract within 20.	Mathematical Practices	Example
2.OA.B.2 Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know automatically all sums of two one-digit numbers based on strategies.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	**Example:** Automaticity should be grounded in efficient strategies such as: doubles, 5-wise (5+2, 5+4), decomposing to create a ten and leftovers (8+6 = 8+2+4), relationships between addition and subtraction, related combinations, known combinations. Once conceptual understanding is achieved, students can practice for automaticity.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	2.OA.C Work with equal groups of objects to gain foundations for multiplication.	Mathematical Practices
	2.OA.C.3 Determine whether a group (up to 20) has an odd or even number of objects (i.e. by pairing objects or counting them by 2s). A. If the number of objects is even, then write an equation to express this as the sum of two equal addends. B. If the number of objects group is odd, then write an equation to express this as a sum of a near double (double plus 1).	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

*Teacher Note: this relates to doubles and doubles plus one in addition and subtraction and also a foundation for multiplication with repeated addition.

Wyoming Cross-Disciplinary Connections

FPA

FPA4.1.A.1 Students create and revise original art to express ideas, experiences, and stories.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

2nd

Operations and Algebraic Thinking

2.OA.C Work with equal groups of objects to gain foundations for multiplication.	Mathematical Practices	Example
2.OA.C.4 Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	2.NBT.D Understand place value.	Mathematical Practices
	2.NBT.D.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; and demonstrate that: A. 100 can be thought of as a bundle of ten tens — called a "hundred." B. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). C. Three-digit numbers can be decomposed in multiple ways (e.g. 524 can be decomposed as 5 hundreds, 2 tens and 4 ones or 4 hundreds, 12 tens, and 4 ones, etc.)	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science

2-ESS1-1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

Cross-Disciplinary Connections

ISTE		
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	2.NBT.D Understand place value.	Mathematical Practices
	2.NBT.D.2 Skip-count by 10s and 100s within 1000 starting at any given number.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Examples:

A. Counting by 10s: 217, 227, 237, 257, ...

B. Counting by 100s: 345, 445, 545,645, ...

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
	1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

2.NBT.D Understand place value.	Mathematical Practices	Example
2.NBT.D.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	**Example:** Standard/Numeral form: 364 Word form: Three hundred sixty-four Expanded form: 300+60+4

Wyoming Cross-Disciplinary Connections

ELA

SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

2.NBT.D Understand place value.	Mathematical Practices	Example
2.NBT.D.4 Compare pairs of three-digit numbers based on meanings of the hundreds, tens, and ones digits, using the words "is greater than," "is equal to," "is less than," and with the symbols >, =, and < to record the results of comparisons.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

2.NBT.E Use place value understanding and properties of operations to add and subtract.	Mathematical Practices	Example
2.NBT.E.5 Add and subtract within 100 using strategies based on place value, properties of addition, and/or the relationship between addition and subtraction.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	**Example:** 54+38 (50+30) + (4+8) 54+30 = 84; 84+6+2 = 92 54+(38+2) = 94; 94-2 = 92

Wyoming Cross-Disciplinary Connections

Science

2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

2.NBT.E Use place value understanding and properties of operations to add and subtract.	Mathematical Practices
2.NBT.E.6 Add up to four two-digit numbers using strategies based on place value and/or properties of addition.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

ELA

RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.

RI.2.3 Describe how characters in a story respond to major events and challenges.

W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

2.NBT.E Use place value understanding and properties of operations to add and subtract.	Mathematical Practices
2.NBT.E.7 Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of addition, and/or the relationship between addition and subtraction: A. Relate the strategy to a written method and explain the reasoning used. B. Understand that in adding or subtracting three-digit numbers, add or subtract hundreds and hundreds, tens and tens, ones and ones. C. Understand that sometimes it is necessary to compose or decompose tens or hundreds.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

*Teacher Note: It is strongly recommended that students should practice writing about math and communicating their thoughts in math journals .

Wyoming Cross-Disciplinary Connections

ELA

RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.

RI.2.3 Describe how characters in a story respond to major events and challenges.

W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

Cross-Disciplinary Connections

ISTE	Computer Science	
	IA-AP-08 Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks.	☑ **Computational Thinking** ☐ **Financial Literacy**

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	2.NBT.E Use place value understanding and properties of operations to add and subtract.	Mathematical Practices
	2.NBT.E.8 Mentally: A. Add 10 or 100 to a given number 100-900, and B. Subtract 10 or 100 from a given number 100-900.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

2nd

Number and Operations in Base Ten

2.NBT.E Use place value understanding and properties of operations to add and subtract.	Mathematical Practices
2.NBT.E.9 Explain why addition and subtraction strategies work, using place value and the properties of addition. (Explanations may be supported by drawings, objects, or written form.)	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.

RI.2.3 Describe how characters in a story respond to major events and challenges.

W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

SL.2.2 Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	2.MD.F Measure and estimate lengths in standard units.	Mathematical Practices	Example
	2.MD.F.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	2.MD.F Measure and estimate lengths in standard units.	Mathematical Practices	Example
	2.MD.F.2 Measure the same object or distance using a standard unit of one length and then a standard unit of a different length. Explain how the two measurements relate to the size of the unit chosen.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	**Example:** Measure a pencil in inches and then measure it in centimeters. Explain why centimeters give a larger number than inches do.

Wyoming Cross-Disciplinary Connections

FPA

FPA.4.1.M.2 Students perform independently and with others a varied repertoire of music, developing pitch accuracy, rhythm, posture, dynamics, and steady beat.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

2nd

Measurement and Data	2.MD.F Measure and estimate lengths in standard units.	Mathematical Practices	Example
	2.MD.F.3 Estimate lengths using units of inches, feet, centimeters, and meters.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	2.MD.F Measure and estimate lengths in standard units.	Mathematical Practices	Example
	2.MD.F.4 Measure in standard length units to determine how much longer one object is than another.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

2.MD.G Relate addition and subtraction to length.	Mathematical Practices	Example
2.MD.G.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

2nd

Measurement and Data

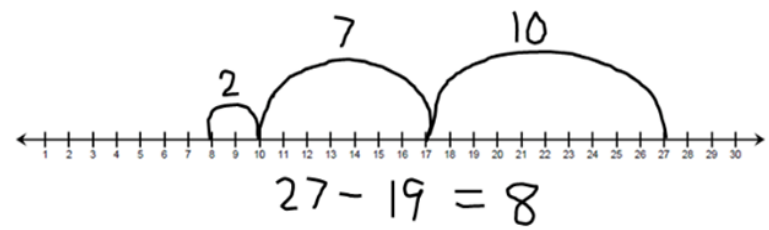
2.MD.G Relate addition and subtraction to length.	Mathematical Practices
2.MD.G.6 Use a number line diagram with equally spaced points to: A. Represent whole-number sums and differences within 100 on a number line diagram. B. Locate the multiple of 10 before and after a given number within 100.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Part A:

Example: **There were 27 students on the bus. 19 got off the bus. How many students are on the bus?**

Student A: I used a number line. I started at 27. I broke up 19 into 10 and 9. That way, I could take a jump of 10. I landed on 17. Then I broke the 9 up into 7 and 2. I took a jump of 7. That got me to 10. Then I took a jump of 2. That's 8. So, there are 8 students now on the bus.



Part B:

Example: The number 46 is located between 40 and 50.

*Teacher note: this is a visual for understanding the patterns in numbers. This is not about students creating number lines. This is about understanding how to use the number line as a tool.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	2.MD.H Work with time and money.	Mathematical Practices
	2.MD.H.7 Tell and write time from analog and digital clocks in five minute increments using a.m. and p.m.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Social Studies

SS2.4.2 Identify tools and technologies that make life easier (e.g., cars for getting one place to another, washing machines for washing clothes, or flashlights to see in the dark).

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

2.MD.H Work with time and money.	Mathematical Practices	Example
2.MD.H.8 Solve word problems up to $10 involving dollar bills, quarters, dimes, nickels, and pennies, using $ (dollars) and ¢ (cents) symbols appropriately.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	**Example:** A student is given 1 quarter, 2 dimes and 3 pennies. • How many cents would he/she have? • What could be another way to show the same amount of money with different coins? **Example:** Jack buys a toy for 58¢ and hands the clerk $5.00. What change should he get back?

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

2.MD.I Represent and interpret data.

Mathematical Practices

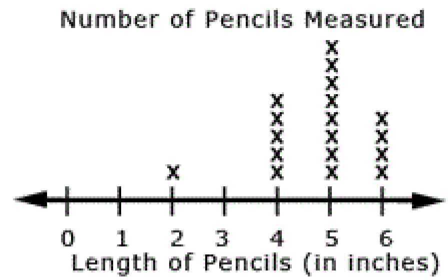
2.MD.I.9 Generate measurement data based on whole units and show data by making a line plot.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example:

This standard emphasizes representing data using a line plot. Students will use the measurement skills learned in earlier standards to measure objects. Line plots are first introduced in this grade level. A line plot can be thought of as plotting data on a number line. An interactive whiteboard may be used to create and/or model line plots.



Adapted from: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

2.MD.I Represent and interpret data.

2.MD.I.10 Use data to:

A. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories.

B. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Compare distances a toy car travels from a ramp, and graph. Tie to physical science activity.

Wyoming Cross-Disciplinary Connections

Science

2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

PE

PE 2.2.1 Students identify current levels of personal health-related fitness.

ELA

RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.

RI.2.8 Describe how reasons support specific points the author makes in a text.

W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.

W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

W.2.8 Recall information from experiences or gather information from provided sources to answer a question.

SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.

Social Studies

SS2.5.3 Use the human features of a community to describe what makes that community special (e.g., cultural, language, religion, food, clothing political, economic, population, and types of jobs in an area) and why others want to move there or move away from there.

CVE

CVE.5.4.4 Students interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (*Adapted from CCSS RI.4.7)

Cross-Disciplinary Connections

ISTE

Computer Science

1A-DA-07 Identify and describe patterns in data visualizations, such as charts or graphs, to make predictions.

- [x] **Computational Thinking**
- [ ] **Financial Literacy**

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	2.G.J Reason with shapes and their attributes.	Mathematical Practices
	2.G.J.1 Identify triangles, quadrilaterals, pentagons, hexagons, and cubes. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. (Sizes are compared directly or visually, not compared by measuring.)	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

FPA

FPA4.1.A.2 Students investigate and apply a variety of materials, resources, technologies and processes to communicate experiences and ideas through art.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

2nd

Geometry	2.G.J Reason with shapes and their attributes.	Mathematical Practices	Example
	2.G.J.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

2nd

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	2.G.J Reason with shapes and their attributes.	Mathematical Practices	Example
	2.G.J.3 Partition circles and rectangles into two, three, or four equal shares by: A. Describing the shares using the words *halves, thirds, half of, a third of,* etc. B. Describing the whole as two halves, three thirds, four fourths. C. Recognizing that equal shares of identical wholes need not have the same shape.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Grade 2 Resources

Standard/Page Number	Resource/Link
2.OA.A.1 on page 60.	http://www.corestandards.org/Math/Content/mathematics-glossary/Table-1/
2.MD.I.9 by page 81.	Adapted from: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
Grade Level Math Practices on page 59.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | Grade 3

In Grade 3, student learning is focused on four critical areas: (1) develop understanding of multiplication and division including strategies for multiplication and division within 100; (2) develop understanding of fractions, especially unit fractions (fractions with numerator 1); (3)develop understanding of the structure of rectangular arrays and of area; (4) describe and analyze two-dimensional shapes.

(1) Students develop an understanding of the meanings of multiplication and division of whole numbers through activities and problems involving equal-sized groups, arrays, and area models; multiplication is finding an unknown product, and division is finding an unknown factor in these situations. For equal-sized group situations, division can require finding the unknown number of groups or the unknown group size. Students use properties of operations to calculate products of whole numbers, using increasingly sophisticated strategies based on these properties to solve multiplication and division problems involving single-digit factors. By comparing a variety of solution strategies, students learn the relationship between multiplication and division.

(2) Students develop an understanding of fractions, beginning with unit fractions. Students view fractions in general as being built out of unit fractions, they use fractions along with visual fraction models to represent parts of a whole. Students understand that the size of a fractional part is relative to the size of the whole. For example, 1/2 of the paint in a small bucket could be less paint than 1/3 of the paint in a larger bucket, but 1/3 of a ribbon is longer than 1/5 of the same ribbon because when the ribbon is divided into 3 equal parts, the parts are longer than when the ribbon is divided into 5 equal parts. Students are able to use fractions to represent numbers equal to, less than, and greater than one. They solve problems that involve comparing fractions by using visual fraction models and strategies based on noticing equal numerators or denominators.

(3) Students recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-size units of area required to cover the shape without gaps or overlaps a square with sides of unit length being the standard unit for measuring area. Students understand that rectangular arrays can be decomposed into identical rows or into identical columns. By decomposing rectangles into rectangular arrays of squares, students connect area to multiplication, and justify using multiplication to determine the area of a rectangle.

(4) Students describe, analyze, and compare properties of two-dimensional shapes. They compare and classify shapes by their sides and angles, and connect these with definitions of shapes. Students also relate their fraction work to geometry by expressing the area of part of a shape as a unit fraction of the whole.

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In third grade, students know that doing mathematics involves solving problems and discussing how they solved them. Students explain to themselves the meaning of a problem and look for ways to solve it. Third grade students may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by asking themselves, “Does this make sense? “They listen to the strategies of others and will try different approaches. They often will use another method to check their answers.

2. Reason abstractly and quantitatively.

Students recognize that a number represents a specific quantity. They connect the quantity to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities.

3. Construct viable arguments and critique the reasoning of others.

Students may construct arguments using concrete referents, such as objects, pictures, and drawings. They refine their mathematical communication skills as they participate in mathematical discussions involving questions such as, “How did you get that? and “Why is that true?” They explain their thinking to others and respond to others’ thinking.

4. Model with mathematics.

Students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Students should evaluate their results in the context of the situation and reflect on whether the results make sense.

5. Use appropriate tools strategically.

Students consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use graph paper to find all the possible rectangles that have a given perimeter. They compile the possibilities into an organized list or a table, and determine whether they have all the possible rectangles.

6. Attend to precision.

As students develop their mathematical communication skills, they try to use clear and precise language in their discussions with others and in their own reasoning. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, when figuring out the area of a rectangle they record their answers in square units.

7. Look for and make use of structure.

Students look closely to discover a pattern or structure. For example, students use properties of operations as strategies to multiply and divide (commutative and distributive properties).

8. Look for and express regularity in repeated reasoning.

Students notice repetitive actions in computation and look for shortcut methods. For example, students may use the distributive property as a strategy for using products they know to solve products that they don’t know. For example, if students are asked to find the product of 7 x 8, they might decompose 7 into 5 and 2 then multiply 5 x 8 and 2 x 8 to arrive at 40 + 16 or 56. In addition, third graders continually evaluate their work by asking themselves, “Does this make sense?”

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	3.OA.A Represent and solve problems involving multiplication and division.	Mathematical Practices	Example
	3.OA.A.1 Represent the concept of multiplication of whole numbers using models including, but not limited to, equal-sized groups ("groups of"), arrays, area models, repeated addition, and equal "jumps" on a number line.	**MP.1** **Make sense of problems and persevere in solving them.** **MP.2** **Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** **Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** **Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

3.OA.A Represent and solve problems involving multiplication and division.	Mathematical Practices	Example
3.OA.A.2 Represent the concept of division of whole numbers (resulting in whole number quotients) using models including, but not limited to, partitioning, repeated subtraction, sharing, and inverse of multiplication.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

CVE	ELA
CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation. **CV5.3.2** Students plan and manage activities to develop a solution or complete a project.	**L.3.4** Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies. **L.3.6** Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

3rd

Operations and Algebraic Thinking

3.OA.A Represent and solve problems involving multiplication and division.	Mathematical Practices
3.OA.A.3 Solve multiplication and division word problems within 100 using appropriate modeling strategies and equations.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

CVE

CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.

CV5.3.2 Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

3.OA.A Represent and solve problems involving multiplication and division.	Mathematical Practices	Example
3.OA.A.4 Determine the unknown whole number in a multiplication or division equation relating three whole numbers when the unknown is a missing factor, product, dividend, divisor, or quotient. (Students need not know formal terms.)	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	3.OA.B Understand properties of multiplication and the relationship between multiplication and division.	Mathematical Practices	Example
	3.OA.B.5 Apply properties of multiplication as strategies to multiply and divide. (Students need not use formal terms for these properties.)	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

3.OA.B Understand properties of multiplication and the relationship between multiplication and division.	Mathematical Practices	Example
3.OA.B.6 Understand division as an unknown-factor problem.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	3.OA.C Multiply and divide within 100.	Mathematical Practices
	3.OA.C.7 Fluently multiply and divide with factors 1 - 10 using mental strategies. By end of Grade 3, know automatically all products of one-digit factors based on strategies.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

3.OA.D Solve problems involving the four operations, and identify and explain patterns in arithmetic.	Mathematical Practices
3.OA.D.8 Solve two-step word problems (limited to the whole number system) using the four basic operations. Students should apply the Order of Operations when there are no parentheses to specify a particular order. A. Represent these problems using equations with a symbol standing for the unknown quantity. B. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	
3c,d Knowledge Constructor		☐ Computational Thinking ☐ Financial Literacy

3rd

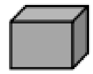
Wyoming 2018 Mathematics Content and Performance Standards

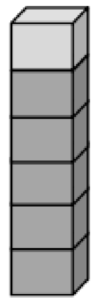
Operations and Algebraic Thinking

3.OA.D Solve problems involving the four operations, and identify and explain patterns in arithmetic.	Mathematical Practices
3.OA.D.9 Identify arithmetic patterns and explain the relationships using properties of operations.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example:

1. Each  has a value of 9. Complete the equations to find the total value of the tower of blocks.



$\_\_\_\_ \times 9 = (5 + \_\_\_\_) \times 9$

$= (5 \times \_\_\_\_) + (\_\_\_\_ \times \_\_\_\_)$

$= 45 + \_\_\_\_$

$= \_\_\_\_$

2. Hector solves 9 × 8 by subtracting 1 eight from 10 eights. Draw a model, and explain Hector's strategy.

Source: https://www.engageny.org/file/34966/download/math-g3-m3-topic-d-lesson-12.pdf?token=Vir-k0Ou

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

3rd

Number and Operations in Base Ten	3.NBT.E Use place value understanding and properties of operations to perform multi-digit arithmetic (a range of algorithms may be used).	Mathematical Practices	Example
	3.NBT.E.1 Use place value understanding to round whole numbers to the nearest 10 or 100.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

3.NBT.E Use place value understanding and properties of operations to perform multi-digit arithmetic (a range of algorithms may be used).	Mathematical Practices	Example
3.NBT.E.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of addition, and/or the relationship between addition and subtraction.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	3.NBT.E Use place value understanding and properties of operations to perform multi-digit arithmetic (a range of algorithms may be used).	Mathematical Practices	Example
	3.NBT.E.3 Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of multiplication.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations –Fractions

3.NF.F Develop understanding of fractions as numbers. (Limited to denominators 2, 3, 4, 6, and 8) *use horizontal fractions	Mathematical Practices
3.NF.F.1 Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations –Fractions

3.NF.F Develop understanding of fractions as numbers. (Limited to denominators 2, 3, 4, 6, and 8) *use horizontal fractions	Mathematical Practices
3.NF.F.2 Understand and represent fractions on a number line diagram. A. Represent a fraction 1/b on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line. B. Represent a fraction a/b on a number line diagram by marking off a lengths 1/b from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

3.NF.F Develop understanding of fractions as numbers. (Limited to denominators 2, 3, 4, 6, and 8) *use horizontal fractions	Mathematical Practices
3.NF.F.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. A. Understand two fractions as equivalent if they are the same size, or the same point on a number line. B. Recognize and generate simple equivalent fractions. Explain why the fractions are equivalent. C. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. D. Compare two fractions with the same numerator or the same denominator, by reasoning about their size, Recognize that valid comparisons rely on the two fractions referring to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

CVE	ELA
CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation. **CV5.3.2** Students plan and manage activities to develop a solution or complete a project.	**L.3.4** Determine or clarify the meaning of unknown and multiple -meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies. **L.3.5** Demonstrate understanding of word relationships and nuances in word meanings. **L.3.6** Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

3.MD.G Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.	Mathematical Practices	Example
3.MD.G.1 Use analog clocks to tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Modeling

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

3.MD.G Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.	Mathematical Practices
3.MD.G.2 Measure and estimate liquid volumes and masses of objects using grams (g), kilograms (kg), and liters (L). (Excludes compound units such as cm^3 and finding the geometric volume of a container.) Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units. (Excludes multiplicative comparison problems involving notions of “times as much.”)	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

CVE

CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.

CV5.3.2 Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

3.MD.H Represent and interpret data.

3.MD.H.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled graphs.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

PE
PE 5.2.1 Students assess current levels of personal health-related fitness.

CVE
CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.
CV5.3.2 Students plan and manage activities to develop a solution or complete a project.

Health
HE 4.4.7 Set a measurable short-term personal health goal and monitor progress on achieving the goal (e.g., brush teeth two times per day, walk 10,000 steps every day). PA, NUT, IP/S

Cross-Disciplinary Connections

ISTE
5b Computational Thinker

Computer Science

☑ **Computational Thinking**
☐ **Financial Literacy**

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

3.MD.H Represent and interpret data.	Mathematical Practices
3.MD.H.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Use the data to create a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

CVE	ELA
CV5.4.4 Students interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (*Adapted from CCSS RI.4.7) **CV5.3.2** Students plan and manage activities to develop a solution or complete a project.	**L.3.4** Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Cross-Disciplinary Connections

ISTE	Computer Science	
5b Computational Thinker	**1B-DA-06** Organize and present collected data visually to highlight relationships and support a claim.	☑ **Computational Thinking** ☐ **Financial Literacy**

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

3.MD.I Geometric measurement: understand concepts of area and relate area to multiplication and to addition.	Mathematical Practices	Example
3.MD.I.5 Understand area as an attribute of plane figures and understand concepts of area measurement, such as square units without gaps or overlaps.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

3rd

Measurement and Data

3.MD.I Geometric measurement: understand concepts of area and relate area to multiplication and to addition.	Mathematical Practices
3.MD.I.6 Measure areas by counting unit squares (square cm, square m, square in., square ft, and improvised units).	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

3.MD.I Geometric measurement: understand concepts of area and relate area to multiplication and to addition.	Mathematical Practices
3.MD.I.7 Relate area to the operations of multiplication and addition. A. Find the area of a rectangle with whole-number side lengths (dimensions) by multiplying them. Show that this area is the same as when counting unit squares. B. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning. **C.** Use area models to represent the distributive property in mathematical reasoning. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and b + c is the sum of a × b and a × c. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

3rd

Measurement and Data

3.MD.J Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.	Mathematical Practices
3.MD.J.8 Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different area or with the same area and different perimeter.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	3.G.K Reason with shapes and their attributes.	Mathematical Practices	Example
	3.G.K.1 Use attributes of quadrilaterals to classify rhombuses, rectangles, and squares. Understand that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

ELA	CVE	FPA
SL.3.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly. **L.3.6** Acquire and use accurately grade -appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.	**CV5.3.1** Students identify and define real-world problems and meaningful questions for investigation. **CV5.3.2** Students plan and manage activities to develop a solution or complete a project.	**FPA 4.1.A.3** Students apply the elements and principles of design to their artwork. **FPA 4.4.A.1** Students identify connections between the visual arts and other disciplines in the curriculum.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

3rd

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	3.G.K Reason with shapes and their attributes.	Mathematical Practices	Example
	3.G.K.2 Partition rectangles, regular polygons, and circles into parts with equal areas. Express the area of each part as a unit fraction of the whole.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Grade 3 Resources

Standard/Page Number	Resource/Link
3.OA.D.9 on page 96.	https://www.engageny.org/file/34966/download/math-g3-m3-topic-d-lesson-12.pdf?token=Vir-k0Ou
Grade Level Math Practices on page 87.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | Grade 4

In Grade 4, student learning is focused on three critical areas: (1) develop understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) develop understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; (3) understand that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.

(1) Students generalize their understanding of place value to 1,000,000, and the relative sizes of numbers in each place. They apply their understanding of models for multiplication (equal-sized groups, arrays, area models), place value, and properties of operations, in particular the distributive property, as they develop, discuss, and use efficient, accurate, and generalizable methods to compute products of multi-digit whole numbers. Depending on the numbers and the context, they select and accurately apply appropriate methods to estimate or mentally calculate products. They develop fluency with efficient procedures for multiplying whole numbers. They understand and explain why the procedures work based on place value and properties of operations; and use them to solve problems. Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication as they develop, discuss, and use efficient, accurate, and generalizable procedures to find quotients involving multi-digit dividends. They select and accurately apply appropriate methods to estimate and mentally calculate quotients, and interpret remainders based upon the context.

(2) Students develop understanding of fraction equivalence and operations with fractions. They recognize that two different fractions can be equal (e.g., 15/9 = 5/3), they develop methods for generating and recognizing equivalent fractions. Students extend previous understanding about how fractions are built from unit fractions, composing fractions from unit fractions, decomposing fractions into unit fractions, and using the meaning of fractions and multiplication to multiply a fraction by a whole number.

(3) Students describe, analyze, compare, and classify two-dimensional figures. Through building, drawing, and analyzing two-dimensional figures, students deepen their understanding of properties of two-dimensional objects and use them to solve problems involving symmetry.

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In grade four, students know that doing mathematics involves solving problems and discussing how they solved them. Students explain to themselves the meaning of a problem and look for ways to solve it. Third grade students may use concrete objects or pictures to help them conceptualize and solve problems. They may check their thinking by asking themselves, “Does this make sense? “They listen to the strategies of others and will try different approaches. They will often use another method to check their answers.

2. Reason abstractly and quantitatively.

Students recognize that a number represents a specific quantity. They connect the quantity to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities. They extend this understanding from whole numbers to their work with fractions and decimals. Students write simple expressions, record calculations with numbers, and represent or round numbers using place value concepts.

3. Construct viable arguments and critique the reasoning of others.

Students may construct arguments using concrete referents, such as objects, pictures, and drawings. They explain their thinking and make connections between models and equations. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like, “How did you get that?” and “Why is that true?” They explain their thinking to others and respond to others’ thinking.

4. Model with mathematics.

Students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect different representations and explain the connections. They should be able to use all of these representations as needed. Students should evaluate their results in the context of the situation and reflect on whether the results make sense.

5. Use appropriate tools strategically.

Students consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use graph paper or a number line to represent and compare decimals, they may use protractors to measure angles. They use other measurement tools to understand the relative size of units within a system and express measurements given in larger units in terms of smaller units.

6. Attend to precision.

As students develop their mathematical communication skills, they try to use clear and precise language in their discussions with others and in their own reasoning. They are careful about specifying units of measure and stating the meaning of the symbols they choose. For instance, they use appropriate labels when creating a line plot.

7. Look for and make use of structure.

Students look closely to discover a pattern or structure. For instance, students use properties of operations to explain calculations (partial products model). They relate representations of counting problems such as tree diagrams and arrays to the multiplication principal of counting. They generate number or shape patterns that follow a given rule.

8. Look for and express regularity in repeated reasoning.

Students notice repetitive actions in computation to make generalizations Students use models to explain calculations and understand how algorithms work. They also use models to examine patterns and generate their own algorithms. For example, students use visual fraction models to write equivalent fractions.

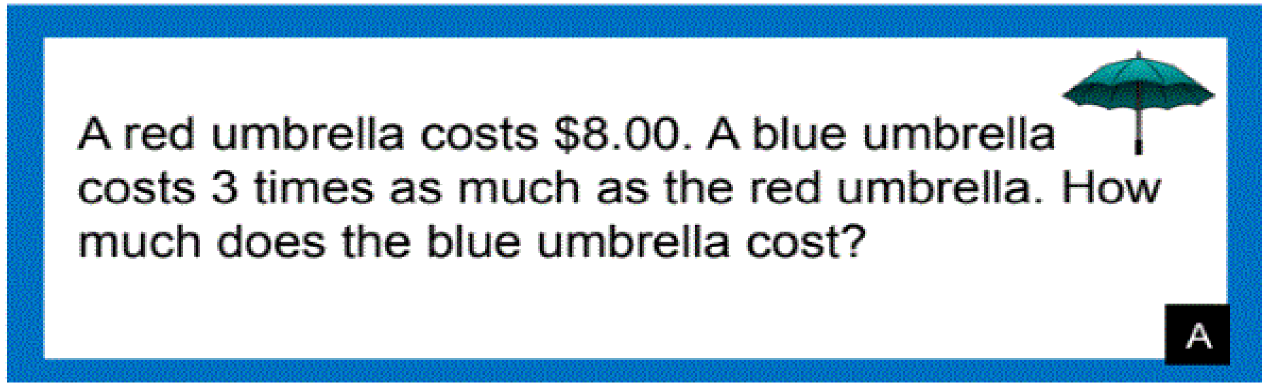
Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

4.OA.A Use the four operations with whole numbers to solve problems.	Mathematical Practices
4.OA.A.1 Intentionally removed **4.OA.A.2** Multiply or divide to solve word problems involving multiplicative comparison, by using strategies including, but not limited to, drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example:



Source for appendix: https://drive.google.com/open?id=0B79xRIb9WGbFR3FJcHZFRENkNXM

Website: https://www.k-5mathteachingresources.com/support-files/word-problems-multiplicative-comparison.pdf

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

4.OA.A Use the four operations with whole numbers to solve problems.	Mathematical Practices
4.OA.A.3 Solve multi-step word problems posed with whole numbers, including problems in which remainders must be interpreted. A. Represent these problems using equations with a letter standing for the unknown quantity. B. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA	CVE
L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies. **L.3.6** Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships	**CV5.3.1** Students identify and define real-world problems and meaningful questions for investigation. **CV5.3.2** Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	4.OA.B Develop understanding of factors and multiples.	Mathematical Practices
	4.OA.B.4 Demonstrate an understanding of factors and multiples. A. Find all factor pairs for a whole number in the range 1-100. B. Recognize that a whole number is a multiple of each of its factors. C. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number. **D.** Determine whether a given whole number in the range 1-100 is prime or composite.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

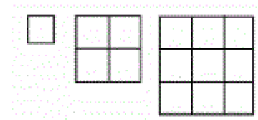
Operations and Algebraic Thinking

4.OA.C Generate and analyze patterns.	Mathematical Practices
4.OA.C.5 Given a pattern, explain a rule that the pattern follows and extend the pattern. Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Examples:

1. Work with a partner. Use square tiles to copy and extend the pattern below until you have a sequence of six square arrays.



2. Draw the square arrays on grid paper. Write a multiplication equation to represent each square array.
3. Describe any patterns that you notice in the number of tiles in consecutive square arrays.
4. If you continued making square arrays, how many square tiles would you need to make the 9th term in the sequence? What about the 20th? Explain your thinking.

Sources: https://drive.google.com/open?id=0B79xRIb9WGbFbWlIQ0JZajdKeTA
https://drive.google.com/open?id=1oNGVawzANnFUiUf2aF6vHLxG1fV4L_wReJzpEwAzTDg

Wyoming Cross-Disciplinary Connections

FPA

FPA 4.1.M.4 Students create music using a variety of traditional and nontraditional sound sources.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	4.NBT.D Generalize place value understanding for multi-digit whole numbers (limited to numbers less than or equal to 1,000,000).	Mathematical Practices	Example
	4.NBT.D.1 Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

4.NBT.D Generalize place value understanding for multi-digit whole numbers (limited to numbers less than or equal to 1,000,000).	Mathematical Practices
4.NBT.D.2 Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

4.NBT.D Generalize place value understanding for multi-digit whole numbers (limited to numbers less than or equal to 1,000,000).	Mathematical Practices	Example
4.NBT.D.3 Use place value understanding to round multi-digit whole numbers to any place.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	4.NBT.E Use place value understanding and properties of operations to perform multi-digit arithmetic (limited to whole numbers less than or equal to 1,000,000).	Mathematical Practices	Example
	4.NBT.E.4 Add and subtract multi-digit whole numbers using place value strategies including the standard algorithm.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

4.NBT.E Use place value understanding and properties of operations to perform multi-digit arithmetic (limited to whole numbers less than or equal to 1,000,000).	Mathematical Practices
4.NBT.E.5 Use strategies based on place value and the properties of multiplication to: A. Multiply a whole number of up to four digits by a one-digit whole number. B. Multiply a pair of two-digit numbers. **C.** Use appropriate models to explain the calculation, such as by using equations, rectangular arrays, and/or area models.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

4.NBT.E Use place value understanding and properties of operations to perform multi-digit arithmetic (limited to whole numbers less than or equal to 1,000,000).	Mathematical Practices
4.NBT.E.6 Use strategies based on place value, the properties of multiplication, and/or the relationship between multiplication and division to find quotients and remainders with up to four-digit dividends and one-digit divisors. Use appropriate models to explain the calculation, such as by using equations, rectangular arrays, and/or area models.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions	4.NF.F Extend understanding of fraction equivalence and ordering (limited to denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100).	Mathematical Practices
	4.NF.F.1 Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions	4.NF.F Extend understanding of fraction equivalence and ordering (limited to denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100).	Mathematical Practices
	4.NF.F.2 Compare two fractions with different numerators and different denominators by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. A. Recognize that comparisons are valid only when the two fractions refer to the same whole. **B.** Record the results of comparisons with symbols >, =, or <. **C.** Justify the conclusions by using a visual fraction model.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

FPA

FPA 4.1.M.5 Students read and notate simple rhythm, dynamics and pitch notation.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

4.NF.G Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers (limited to denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100).

4.NF.G.3 Understand a fraction a/b with a > 1 as a sum of unit fractions (1/b).

A. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
B. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions by using a visual fraction model.
C. Add and subtract mixed numbers with like denominators by replacing each mixed number with an equivalent fraction, and/or by using properties of addition and the relationship between addition and subtraction.
D. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.

Mathematical Practices

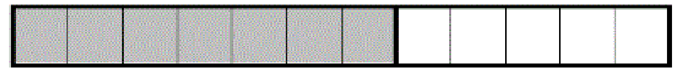
MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

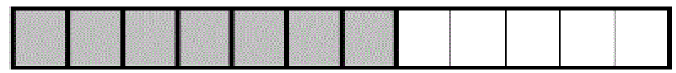
Example:
Decompose the fraction $\frac{7}{12}$ into a sum of fractions in 3 different ways. Use visual fraction models to show that these compositions are equivalent.

Possible Answers:

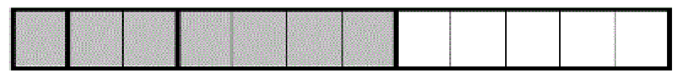
$\frac{7}{12}$



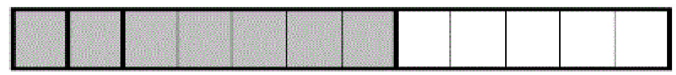
$\frac{1}{12}+\frac{1}{12}+\frac{1}{12}+\frac{1}{12}+\frac{1}{12}+\frac{1}{12}+\frac{1}{12}$



$\frac{1}{12}+\frac{2}{12}+\frac{4}{12}$



$\frac{1}{12}+\frac{1}{12}+\frac{5}{12}$



Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

CVE

CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.

CV5.3.2 Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

4.NF.G Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers (limited to denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100).	Mathematical Practices
4.NF.G.4 Apply and extend an understanding of multiplication by multiplying a whole number and a fraction. A. Understand a fraction *a/b* as a multiple of *1/b*. B. Understand a multiple of *a/b* as a multiple of *1/b*, and use this understanding to multiply a fraction by a whole number. C. Solve real-world problems involving multiplication of a fraction by a whole number, using visual fraction models and equations to represent the problem.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. MP.7 Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example:

Rewrite the following addition expression as a multiplication expression and then evaluate the expression: $\frac{3}{10}+\frac{3}{10}+\frac{3}{10}+\frac{3}{10}$

Solution:

$$4\times\frac{3}{10}=(4\times 3)\times\frac{1}{10}=12\times\frac{1}{10}=\frac{12}{10}$$

Wyoming Cross-Disciplinary Connections

CVE

CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.

CV5.3.2 Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ **Computational Thinking** ☐ **Financial Literacy**

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions	4.NF.H Understand decimal notation for fractions, and compare decimal fractions.	Mathematical Practices	Example
	4.NF.H.5 Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

4.NF.H Understand decimal notation for fractions, and compare decimal fractions.	Mathematical Practices	Example
4.NF.H.6 Use decimal notation for fractions with denominators 10 or 100.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

4.NF.H Understand decimal notation for fractions, and compare decimal fractions.	Mathematical Practices	Example
4.NF.H.7 Compare and order decimal numbers to hundredths and justify by using concrete and visual models. Record the results of comparisons with the words "is greater than," "is equal to," "is less than," and with the symbols >, =, and <.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	4.MD.I Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	Mathematical Practices	Example
	4.MD.I.1 Know relative sizes of measurement units within one system of units including, but not limited to, km, m, cm; kg, g; lb, oz.; l L, ml; hr, min, sec; ft, in., gal., qt. pt., c., . Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

ELA

L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.3.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	4.MD.I Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	Mathematical Practices
	4.MD.I.2 Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. Assessment Boundary: Use denominators of 2, 4, 8 and decimals up to hundredths. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Lois wants to send a box of oranges to a friend by mail. The box of oranges cannot exceed a mass of 10 kg. If each orange has a mass of 200 g, what is the maximum number she can send?

Source: helpingwithmath.com

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
3c Knowledge Constructor		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

4th

Measurement and Data	4.MD.I Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.	Mathematical Practices
	4.MD.I.3 Apply the area and perimeter formulas for rectangles in real world and mathematical problems.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	4.MD.J Represent and interpret data.	Mathematical Practices
	4.MD.J.4 Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

PE	Health
PE5.2.1 Students assess current levels of personal health-related fitness.	**HE4.4.7** Set a measurable short-term personal health goal and monitor progress on achieving the goal (e.g., brush teeth two times per day, walk 10,000 steps every day). PA, NUT, IP/S

Cross-Disciplinary Connections

ISTE	Computer Science	
5b Computational Thinker		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	4.MD.K Geometric measurement: understand concepts of angle and measure angles.	Mathematical Practices
	4.MD.K.5 Regarding angles: A. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint. B. Understand concepts of angle measurement. An angle is measured with reference to a circle with its center at the common endpoint of the rays.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	4.MD.K Geometric measurement: understand concepts of angle and measure angles.	Mathematical Practices	Example
	4.MD.K.6 Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	4.MD.K Geometric measurement: understand concepts of angle and measure angles.	Mathematical Practices	Example
	4.MD.K.7 Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems.	**MP.1** **Make sense of problems and persevere in solving them.** **MP.2** **Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** **Model with mathematics.** **MP.5** **Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	4.G.L Draw and identify lines and angles, and classify shapes by properties of their lines and angles.	Mathematical Practices
	4.G.L.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA	FPA
L.3.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies. **L.3.6** Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.	**FPA 4.1.A.3** Students apply the elements and principles of design to their artwork. **FPA 4.4.A.1** Students identify connections between the visual arts and other disciplines in the curriculum.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

4th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	**4.G.L Draw and identify lines and angles, and classify shapes by properties of their lines and angles.**	**Mathematical Practices**
	4.G.L.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

FPA

FPA 4.1.A.3 Students apply the elements and principles of design to their artwork.

FPA 4.4.A.1 Students identify connections between the visual arts and other disciplines in the curriculum.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ **Computational Thinking** ☐ **Financial Literacy**

4th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	4.G.L Draw and identify lines and angles, and classify shapes by properties of their lines and angles.	Mathematical Practices	Example
	4.G.L.3 Identify line-symmetric figures. Recognize and draw lines of symmetry for two-dimensional figures.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

FPA

FPA 4.1.A.3 Students apply the elements and principles of design to their artwork.

FPA 4.4.A.1 Students identify connections between the visual arts and other disciplines in the curriculum

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Grade 4 Resources

Standard/Page Number	Resource/Link
4.OA.A.2 on page 115.	https://www.k-5mathteachingresources.com/support-files/word-problems-multiplicative-comparison.pdf
4.OA.C.5 on page 118.	https://drive.google.com/open?id=0B79xRIb9WGbFbWlIQ0JZajdKeTA https://drive.google.com/open? id=1oNGVawzANnFUiUf2aF6vHLxG1fV4L_wReJzpEwAzTDg
4.MD.I.2 on page 133.	helpingwithmath.com
Grade Level Math Practices on page 114.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | Grade 5

In Grade 5, student learning is focused on three critical areas: (1) develop fluency with addition and subtraction of fractions; develop understanding of the multiplication of fractions and of division fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extend division to 2-digit divisors, integrating decimal fractions into the place value system; developing understanding of operations with decimals to hundredths, and fluency with whole number and decimal operations; (3) develop understanding of volume.

(1) Students apply their understanding of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators, as equivalent calculations with like denominators. They develop fluency in calculating sums and differences of fractions, to make reasonable estimates of them. Students also use the meaning of fractions, multiplication and division, including the relationship between multiplication and division to understand and explain why the procedures for multiplying and dividing fractions make sense. (Note: this is limited to the case of dividing unit fractions by whole numbers and whole numbers by unit fractions.)

(2) Students develop understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths, efficiently and accurately.

(3) Students recognize volume as an attribute of three-dimensional space. They understand that volume can be measured by finding the total number of same-size units of volume required to fill the space without gaps or overlaps. They understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. They select appropriate units, strategies, and tools for solving problems that involve estimating and measuring volume. They decompose three-dimensional figures and find volumes of right rectangular prisms by viewing them as decomposed into layers of arrays of cubes. They measure necessary attributes of figures in order to determine volumes to solve real world and mathematical problems.

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In grade five, students solve problems by applying their understanding of operations with whole numbers, decimals, and fractions including mixed numbers. They solve problems related to volume and measurement conversions. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?".

2. Reason abstractly and quantitatively.

Students recognize that a number represents a specific quantity. They connect quantities to written symbols and create logical representation of the problem at hand, while considering both the appropriate units involved and the meaning of quantities. They extend this understanding from whole numbers to their work with fractions and decimals. Students write simple expressions that record calculations with numbers and represent or round numbers using place value concepts.

3. Construct viable arguments and critique the reasoning of others.

Students may construct arguments using concrete referents, such as objects, pictures, and drawings. They explain calculations based upon models and properties of operations and rules that generate patterns. They demonstrate and explain the relationship between volume and multiplication. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like, "How did you get that?" and "Why is that true?" They explain their thinking to others and respond to others' thinking.

4. Model with mathematics.

Students experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, to create equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Fifth graders should evaluate their results in the context of the situation and whether the results make sense. They also evaluate the utility of models to determine which models are most useful and efficient to solve problems.

5. Use appropriate tools strategically.

Fifth graders consider the available tools, including estimation, when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use unit cubes to fill a rectangular prism and then use a ruler to measure the dimensions. They use graph paper to accurately create graphs and solve problems, or to make predictions from real world data.

6. Attend to precision.

Students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to expressions, fractions, geometric figures, and coordinate grids. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, when figuring out the volume of a rectangular prism, they record their answers in cubic units.

7. Look for and make use of structure.

Students look closely to discover a pattern or structure. For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. They examine numerical patterns and relate them to a rule or a graphical representation.

8. Look for and express regularity in repeated reasoning.

Students use repeated reasoning to understand algorithms and make generalizations about patterns. Students connect place value and their prior work with operations to understand algorithms to fluently multiply multi-digit numbers and to perform all operations with decimals to hundredths. Students explore operations with fractions with visual models and begin to formulate generalizations.

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	5.OA.A Write, interpret, and/or evaluate numerical expressions.	Mathematical Practices
	5.OA.A.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.5.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

5th

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking

5.OA.A Write, interpret, and/or evaluate numerical expressions.	Mathematical Practices
5.OA.A.2 Write simple expressions requiring parentheses that record calculations with numbers, and interpret numerical expressions without evaluating them.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.

Wyoming Cross-Disciplinary Connections

ELA

L.5.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Operations and Algebraic Thinking	5.OA.B Analyze patterns and relationships.	Mathematical Practices
	5.OA.B.3. Generate two numerical patterns with each pattern having its own rule. Explain informally the relationship(s) between corresponding terms in the two patterns. A. Form ordered pairs consisting of corresponding terms from the two patterns. **B.** Graph the ordered pairs on a coordinate plane.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA	FPA
L.5.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.	**FPA 8.1.M.4** Students compose and arrange music within specified guidelines

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

5th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	5.NBT.C Understand the place value system.	Mathematical Practices
	5.NBT.C.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
3a,d Knowledge Constructor **5c** Computational Thinker		☐ **Computational Thinking** ☑ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	5.NBT.C Understand the place value system.	Mathematical Practices
	5.NBT.C.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole number exponents to denote powers of 10.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

ELA

L.5.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.5.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

5th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

5.NBT.C Understand the place value system.	Mathematical Practices
5.NBT.C.3 Read, write, and compare decimals to thousandths. A. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form. **B.** Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example:

347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000)

Wyoming Cross-Disciplinary Connections

ELA

L.5.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.5.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

5th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	5.NBT.C Understand the place value system.	Mathematical Practices
	5.NBT.C.4 Use place value understanding to round decimals to any place to a given place. Assessment Boundary: Limit place value to the thousandths.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten

5.NBT.D Perform operations with multi-digit whole numbers and with decimals to hundredths.	Mathematical Practices
5.NBT.D.5 Multiply multi-digit whole numbers using place value strategies including the standard algorithm.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

5th

Number and Operations in Base Ten

5.NBT.D Perform operations with multi-digit whole numbers and with decimals to hundredths.	Mathematical Practices	Example
5.NBT.D.6 Find whole-number quotients with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of multiplication, and/or the relationship between multiplication and division, including the standard algorithm. Use appropriate models to Illustrate and explain the calculation, such as equations, rectangular arrays, and/or area models. Assessment Boundary: The standard algorithm for division will not be assessed.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations in Base Ten	5.NBT.D Perform operations with multi-digit whole numbers and with decimals to hundredths.	Mathematical Practices	Example
	5.NBT.D.7 Add, subtract, multiply, and divide decimals to hundredths using concrete models or drawings, and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; Relate the strategy to a written method and explain the reasoning used.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	**Wyoming Cross-Disciplinary Connections**

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

5.NF.E Use equivalent fractions as a strategy to add and subtract fractions.	Mathematical Practices	Example
5.NF.E.1 Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

5th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions	5.NF.E Use equivalent fractions as a strategy to add and subtract fractions.	Mathematical Practices
	5.NF.E.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

CVE

CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.

CV5.3.2 Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

5th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

5.NF.F Apply and extend previous understandings of multiplication and division to multiply an divide fractions.	Mathematical Practices	Example
5.NF.F.3 Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers by using visual fraction models or equations to represent the problem.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

5.NF.F Apply and extend previous understandings of multiplication and division to multiply an divide fractions.	Mathematical Practices
5.NF.F.4 Extend the concept of multiplication to multiply a fraction or whole number by a fraction. A. Recognize the relationship between multiplying fractions and finding the areas of rectangles with fractional side lengths. B. Interpret multiplication of a fraction by a whole number and a whole number by a fraction and compute the product. C. Interpret multiplication in which both factors are fractions less than one and compute the product.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

5th

Number and Operations—Fractions

5.NF.F Apply and extend previous understandings of multiplication and division to multiply an divide fractions.	Mathematical Practices
5.NF.F.5 Justify the reasonableness of a product when multiplying with fractions. A. Estimate the size of the product based on the size of the two factors. B. Explain why multiplying a given number by a number greater than 1 (improper fractions, mixed numbers, whole numbers) results in a product larger than the given number. C. Explain why multiplying a given number by a fraction less than 1 results in a product smaller than the given number. **D.** Explain why multiplying the numerator and denominator by the same number has the same effect as multiplying the fraction by 1.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.

SL.5.1.a Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

SL.5.1.b Follow agreed-upon rules for discussions and carry out assigned roles.

SL.5.1.c Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

SL.5.1.d Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

SL.5.2 Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

SL.5.3 Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

5th

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

5.NF.F Apply and extend previous understandings of multiplication and division to multiply an divide fractions.	Mathematical Practices
5.NF.F.6 Solve real world problems involving multiplication of fractions and mixed numbers by using visual fraction models or equations to represent the problem.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

CVE

CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.

CV5.3.2 Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	
3c Knowledge Constructor		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Number and Operations—Fractions

5.NF.F Apply and extend previous understandings of multiplication and division to multiply an divide fractions.	Mathematical Practices
5.NF.F.7 Extend the concept of division to divide unit fractions and whole numbers by using visual fraction models and equations. A. Interpret division of a unit fraction by a non-zero whole number and compute the quotient. B. Interpret division of a whole number by a unit fraction and compute the quotient. C. Solve real-world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions by using visual fraction models and equations to represent the problem.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

CVE

CV5.3.1 Students identify and define real-world problems and meaningful questions for investigation.

CV5.3.2 Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	
3c Knowledge Constructor		☐ **Computational Thinking** ☐ **Financial Literacy**

5th

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	5.MD.G Convert like measurement units within a given measurement system.	Mathematical Practices
	5.MD.G.1 Solve multi-step real world problems by converting among different-sized standard measurement units within a given measurement system.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☑ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

5.MD.H Represent and interpret data.	Mathematical Practices
5.MD.H.2 Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions to solve problems involving information presented in line plots.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

PE	Health
PE 5.2.1 Students assess current levels of personal health-related fitness.	**HE 6.4.7** Monitor progress toward achieving a short-term personal health goal and analyze why it is achieved or not achieved (e.g., the goal to be physically active for 30 minutes every day was not achieved because of snowy weather and no community facility was available for exercise). PA, NUT, PH

Cross-Disciplinary Connections

ISTE	Computer Science	
5b Computational Thinker	**1B-DA-06** Organize and present collected data visually to highlight relationships and support a claim.	☑ **Computational Thinking** ☐ **Financial Literacy**

5th

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	5.MD.I Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.	Mathematical Practices
	5.MD.I.3 Recognize volume as an attribute of three-dimensional figures and understand concepts of volume measurement such as "unit cube" and a volume of *n* cubic units.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA

L.5.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

L.5.6 Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data

5.MD.I Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.	Mathematical Practices
5.MD.I.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Measurement and Data	5.MD.I Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.	Mathematical Practices
	5.MD.I.5 Relate volume to the operations of multiplication and solve real world and mathematical problems involving volume. A. Find the volume of a right rectangular prism with whole number dimensions by multiplying them. Show that this volume is the same as when counting unit cubes. **B.** Find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems given the formulas V =(l)(w)(h) and V = (B)(h) for rectangular prisms.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

5th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	5.G.J Graph points on the coordinate plane to solve real-world and mathematical problems.	Mathematical Practices
	5.G.J.1 Understand a coordinate system. A. The x- and y- axes are perpendicular number lines that intersect at 0 (the origin). B. Any point on the coordinate plane can be represented by its coordinates. C. The first number in an ordered pair is the x-coordinate and represents the horizontal distance from the origin. D. The second number in an ordered pair is the y-coordinate and represents the vertical distance from the origin.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

ELA	PE
L.5.4 Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies. **L.5.6** Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.	**PE 5.2.1** Students assess current levels of personal health-related fitness.

Cross-Disciplinary Connections

ISTE	Computer Science	☑ Computational Thinking ☐ Financial Literacy
5b Computational Thinker	**1B-DA-06** Organize and present collected data visually to highlight relationships and support a claim. **1B-DA-07** Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.	

5th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

5.G.J Graph points on the coordinate plane to solve real-world and mathematical problems.	Mathematical Practices
5.G.J.2 Plot and interpret points in the first quadrant of the coordinate plane to represent real-world and mathematical situations.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science	ELA	CVE
5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. **5-ESS2-1** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	**L.5.4** Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies. **L.5.6** Acquire and use accurately grade-appropriate conversational, general academic, and domain specific words and phrases, including those that signal spatial and temporal relationships.	**CV5.3.1** Students identify and define real-world problems and meaningful questions for investigation. **CV5.3.2** Students plan and manage activities to develop a solution or complete a project.

Cross-Disciplinary Connections

ISTE	Computer Science	
5b Computational Thinker	**1B-DA-06** Organize and present collected data visually to highlight relationships and support a claim. **1B-DA-07** Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.	☑ Computational Thinking ☑ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

5th

Geometry

5.G.K Classify two-dimensional figures into categories based on their properties.	Mathematical Practices
5.G.K.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. Assessment Boundary: Use polygons only.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

FPA

FPA 8.1.A.3 Students analyze the use of the elements and principles of design in their artwork.

FPA 8.4.A.1 Students describe ways in which the principles and subject matter of other disciplines taught in the school are interrelated with the visual arts.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

5th

Geometry

5.G.K Classify two-dimensional figures into categories based on their properties.	Mathematical Practices
5.G.K.4 Classify polygons in a hierarchy based on properties.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

FPA

FPA 8.1.A.3 Students analyze the use of the elements and principles of design in their artwork.

FPA 8.4.A.1 Students describe ways in which the principles and subject matter of other disciplines taught in the school are interrelated with the visual arts.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Grade 5 Resources

Standard/Page Number	Resource/Link
Grade Level Math Practices on page 143.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | Grade 6

In Grade 6, instructional time should focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; (4) developing understanding of statistical thinking.

(1) Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.

2) Students use the meaning of fractions, multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular, negative integers. They reason about the order and absolute value of rational numbers and the location of points in all four quadrants of the coordinate plane.

(3) Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as $3x = y$) to describe relationships between quantities.

(4) Students begin to develop their ability to think statistically, by building on and reinforcing their understanding of number. Students recognize that a data distribution may not have a definite center and different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (range or interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different sets of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected.

Students in Grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Students will be given the opportunity to determine formulas for the areas of triangles and parallelograms through the use of manipulatives or inquiry based exploration. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in Grade 7 by drawing polygons in the coordinate plane.

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In grade 6, students solve problems involving ratios and rates and discuss (verbally or in writing) how they solve them. Students analyze the problem (including what is given, not given, and what is being asked), identify what strategies are needed, recognize multiple pathways to a solution, and make an initial attempt to solve the problem. Students analyze the result for validity and refine strategies if necessary.

2. Reason abstractly and quantitatively.

Students recognize a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students begin to contextualize to understand the meaning of the number or variable as it relates to the problem.

3. Construct viable arguments and critique the reasoning of others.

Students begin to contextualize to understand the meaning of the number or variable as it relates to the problem. They make conjectures, explore validity, reason mathematically, justify, evaluate their own thinking.

4. Model with mathematics.

Students can clearly show their work by using diagrams, words, symbols or pictures. They are able to identify important quantities in a practical situation and map their relationships using tools such as, diagrams, two-way tables, graphs, flowcharts or formulas. They can recognize and analyze those relationships mathematically to draw conclusions. They can interpret their mathematical results of problems involving non-negative rational numbers in the context of the situation and reflect on whether the results make sense.

5. Use appropriate tools strategically.

Students consider available tools (including estimation, concrete models, and technology), and decide when certain tools might be helpful. They choose the representation (table, graph, equation, words) that best suits the problem. Students use concrete models to develop insight into ratios and other concepts. Students extend this insight to more abstract representations, including pictures and symbols. Students understand the limitations of each tool. Tools might include: unifix cubes, fraction bars, base-ten blocks, number lines, graph paper, calculator, paper and pencil, and others.

6. Attend to precision.

Students continue to refine their mathematical communication and reasoning skills by using clear language in their discussions with others. Students define variables, including their relationship, specify units of measure, and label each axis accurately. Students use appropriate terminology when referring to rates, ratios, geometric figures, data displays, and components of expressions, equations or inequalities. Students use appropriate symbols, labels, and units of measure when solving problems with calculations that are accurate and efficient. The answer to the problem matches what was asked in the problem.

7. Look for and make use of structure.

Students routinely seek patterns or structure to model and solve problems. They recognize that patterns exist in ratio tables. Students notice patterns and identify strategies for creating equivalent expressions. Students identify complicated expressions or figures as compositions of simple parts.

8. Look for and express regularity in repeated reasoning.

Students use repeated reasoning to understand algorithms and make generalizations about patterns. They construct examples and models that confirm their generalization. They develop short cuts and check for reasonableness of answers. Students ask questions such as, "How would we verify that?" and "How is this similar to patterns with whole numbers?"

Wyoming 2018 Mathematics Content and Performance Standards

6th

Ratios and Proportional Relationships

6.RP.A Understand ratio concepts and use ratio reasoning to solve problems.	Mathematical Practices
6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Modeling

Example

Example: The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."

Wyoming Cross-Disciplinary Connections

Science

MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

MS-PS4-1 Use mathematical representations to describe a simple model for waves, which includes how the amplitude of a wave is related to the energy in a wave.

MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.

MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

MS-ESS1-1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.

MS-ESS3-4 Construct an argument supported by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems.

FPA

FPA8.4.M.2 Students describe ways in which other disciplines are interrelated with music.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

6th

Ratios and Proportional Relationships

6.RP.A Understand ratio concepts and use ratio reasoning to solve problems.	Mathematical Practices
6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Modeling

Example

Example: "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar."

Example: "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."

Wyoming Cross-Disciplinary Connections

SCIENCE

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

6th

Wyoming 2018 Mathematics Content and Performance Standards

Ratios and Proportional Relationships

6.RP.A Understand ratio concepts and use ratio reasoning to solve problems.	Mathematical Practices
6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. A. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. B. Solve unit rate problems including those involving unit pricing and constant speed. C. Understand that a percentage is a rate per 100 and use this to solve problems involving wholes, parts, and percentages. D. Use ratio reasoning to convert measurement units; convert units appropriately when multiplying or dividing quantities. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Examples on resource page.

Wyoming Cross-Disciplinary Connections

Science

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

MS-PS4-1 Use mathematical representations to describe a simple model for waves, which includes how the amplitude of a wave is related to the energy in a wave.

MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems.

FPA

FPA8.4.M.2 Students describe ways in which other disciplines are interrelated with music.

SOCIAL STUDIES

SS8.3.4 Explain or illustrate how money is used by individuals, groups, and financial institutions.

CVE

CV8.5.2 Career-aware students plan tasks recognizing human resources, financial and timeline constraints that take into account priorities and goals.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☑ Financial Literacy

6th

Wyoming 2018 Mathematics Content and Performance Standards

The Number System

6.NS.B Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

6.NS.B.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions by using visual fraction models and equations to represent the problem.

Mathematical Practices

MP.1 **Make sense of problems and persevere in solving them.**
MP.2 **Reason abstractly and quantitatively.**
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 **Model with mathematics.**
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 **Look for and make use of structure.**
MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: Create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. How many 3/4-cup servings are in 2/3 of a cup of yogurt?

Wyoming Cross-Disciplinary Connections

Science

MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

The Number System

6.NS.C Compute fluently with multi-digit numbers and find common factors and multiples.

Mathematical Practices

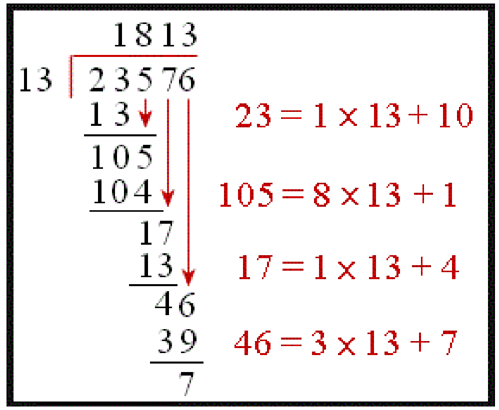
6.NS.C.2 Divide multi-digit numbers using efficient and generalizable procedures including, but not limited to the standard algorithm.

Assessment boundary: Use up to 5-digit dividend, 2-digit divisors.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example:



Source: https://www.intmath.com/basic-algebra/img/long-division.png

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

The Number System

6.NS.C Compute fluently with multi-digit numbers and find common factors and multiples.

6.NS.C.3 Add, subtract, multiply, and divide manageable multi-digit decimals using efficient and generalizable procedures including, but not limited to the standard algorithm for each operation.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example:

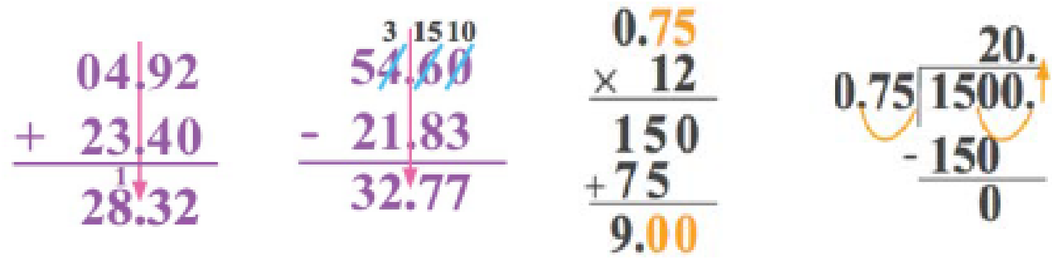


Image: Learn Zillion

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

The Number System

6.NS.C Compute fluently with multi-digit numbers and find common factors and multiples.

6.NS.C.4 Find common factors and multiples using two whole numbers.

A. Find the greatest common factor of two whole numbers less than or equal to 100.
B. Find the least common multiple of two whole numbers less than or equal to 12.
C. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.

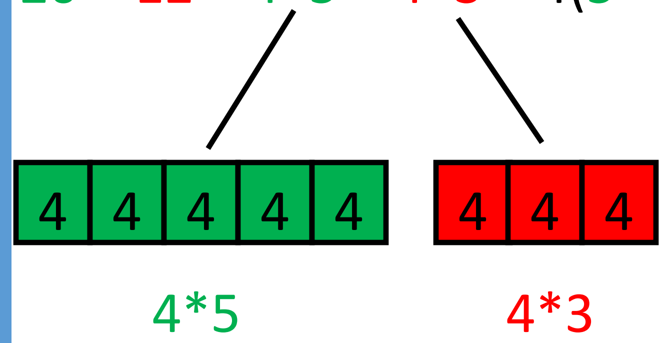
Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example:

$$20 + 12 = 4*5 + 4*3 = 4(5 + 3)$$



Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	**Computer Science**	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

The Number System

6.NS.D Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.D.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values and use them to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: For each of the actions given, describe an action that will get you back where you started.

- Earn 8 dollars. (Spend 8 dollars)
- It gets 5 degrees warmer. (It gets 5 degrees colder)
- Travel south 3 kilometers. (Travel north 3 kilometers)
- Run backward 9 steps. (Run forwards 9 steps)

Wyoming Cross-Disciplinary Connections

SCIENCE

MS-PS1-4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

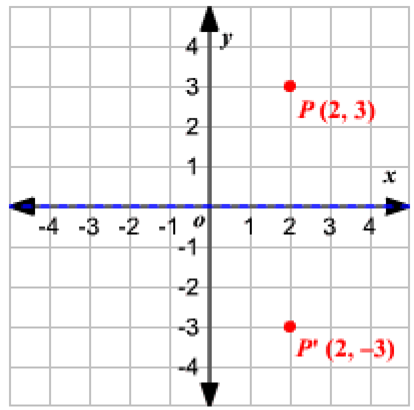
The Number System

6.NS.D Apply and extend previous understandings of numbers to the system of rational numbers.	Mathematical Practices
6.NS.D.6 Extend the understanding of the number line to include all rational numbers and apply this concept to the coordinate plane. A. Understand the concept of opposite numbers, including zero, and their relative locations on the number line. B. Understand that signs of numbers in ordered pairs indicate locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. C. Find and position rational numbers on a horizontal or vertical number line diagram; find and position pairs of rational numbers on a coordinate plane.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example: The opposite of 3 is -3. The opposite of -3 is 3. The opposite of zero is itself.

Example: A reflection of a point over the x -axis is shown.



The rule for a reflection over the x -axis is (x,y)→(x,−y).

Source: https://www.varsitytutors.com/hotmath/hotmath_help/topics/reflections

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

The Number System

6.NS.D Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.D.7 Understand ordering and absolute value of rational numbers.

A. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.

B. Write, interpret, and explain statements of order for rational numbers in real-world contexts.

C. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.

D. Distinguish comparisons of absolute value from statements about order.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

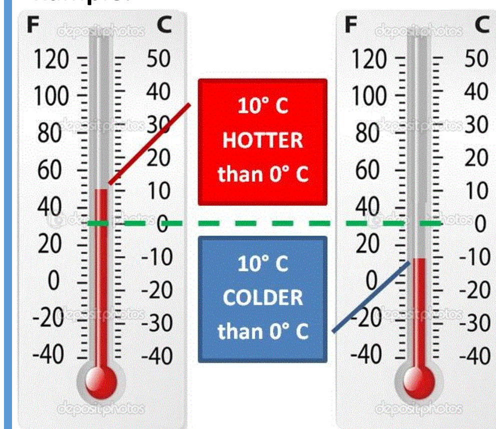
Example

Example: Interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.

Example: An account balance of -50 dollars is less than an account balance of –30 dollars. -50 is a greater debt because |-50| is greater than |-30|.

Example: Write –3°C > –7°C to express the fact that –3°C is warmer than –7°C.

Example:



Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

6th

The Number System

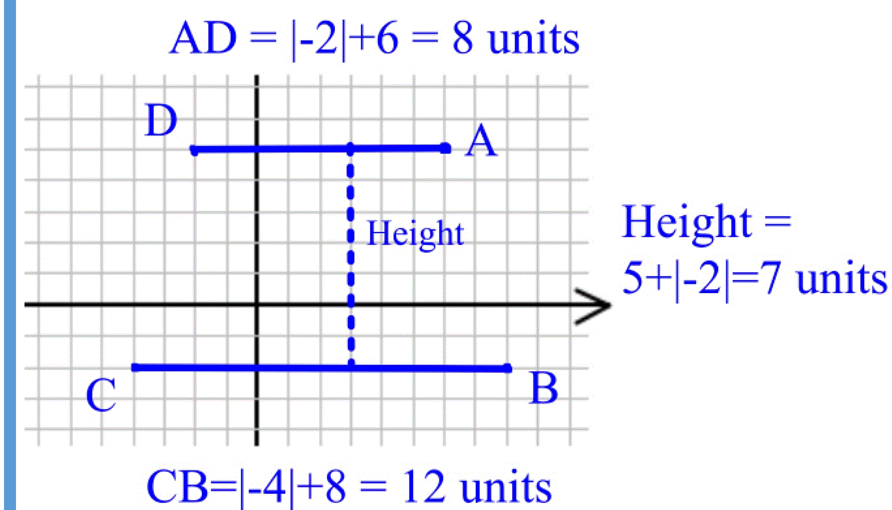
6.NS.D Apply and extend previous understandings of numbers to the system of rational numbers.	Mathematical Practices
6.NS.D.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Find distances between points with the same first coordinate or the same second coordinate; relate absolute value and distance.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example:

- Graph the trapezoid A(6, 5), B(8, −2), C(−4, −2), D(−2, 5).
- Find the length of the bottom base (segment CB).
- Find the length of the top base (segment AD).
- Use grid units to find the distance between the two bases, which is called the height. Use grid units.



Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations	6.EE.E Apply and extend precious understandings of arithmetic to algebraic expressions.	Mathematical Practices	Example
	6.EE.E.1 Write and evaluate numerical expressions involving whole-number exponents.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

6.EE.E Apply and extend precious understandings of arithmetic to algebraic expressions.	Mathematical Practices
6.EE.E.2 Write, read, and evaluate expressions in which letters stand for numbers. A. Write expressions that record operations with numbers and with letters standing for numbers. B. Identify parts of an expression using mathematical terms (sum, difference, term, product, factor, quotient, coefficient, constant). C. Use Order of Operations to evaluate algebraic expressions at using positive rational numbers and whole-number exponents. Include expressions that arise from formulas in real-world problems.	**MP.1** Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Express the calculation "Subtract y from 5" as 5 – y; Review other keywords like 'plus', 'more than', 'product'. This is worth emphasizing because all other word combinations are converted to equations or to expressions in the order in which they occur. Subtraction (aka "less than") is an exception in that the first component is what is taken away from or comes second after the calculation "Subtract y from 5" as 5 – y.

Use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.

Wyoming Cross-Disciplinary Connections

SCIENCE

MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

6.EE.E Apply and extend precious understandings of arithmetic to algebraic expressions.	Mathematical Practices	Example
6.EE.E.3 Apply the properties of operations to generate equivalent expressions.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	**Example:** Apply the distributive property to the expression 3(2 + x) to produce the equivalent expression 6 + 3x; i.e. 3(2+x) = 6 + 3x. **Example:** Apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); i.e. 24x + 18y = 6(4x + 3y).

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations	6.EE.E Apply and extend precious understandings of arithmetic to algebraic expressions.	Mathematical Practices	Example
	6.EE.E.4 Identify when two expressions are equivalent.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	**Example:** The expressions y + y + y and 3y are equivalent because they represent the same number regardless of which number y stands.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations	6.EE.F Reason about and solve one-variable equations and inequalities.	Mathematical Practices	Example
	6.EE.F.5 Understand a solution to an equation or an inequality makes the equation or inequality true. Use substitution to determine whether a given number in a specified set makes an equation or inequality true.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	**Example:** Given, 2x + 5 = 11, which numbers in the set make this equation true: {1,2,3,4,5}; for 3x +1 < 20, which numbers in the set make this true? {4,5,6,7,8} ?

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking
1c Empowered Learner		☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

6.EE.F Reason about and solve one-variable equations and inequalities.	Mathematical Practices
6.EE.F.6 Use variables to represent unknown numbers and write expressions when solving a real-world or mathematical problem. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example: Gym Membership: you pay $50 per month and $2 for each time you workout. Write an expression that represents your monthly cost for exercising d days a month .

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**2-AP-11** Create clearly named variables that represent different data types and perform operations on their values.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

6.EE.F Reason about and solve one-variable equations and inequalities.	Mathematical Practices
6.EE.F.7 Write and solve real-world and mathematical problems in the form of one-step, linear equations involving nonnegative rational numbers. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example: Write an equation for the problem and solve it. Be sure to define your variable. You want to buy a new smart TV that costs $1575. You check your savings-account balance and realize that to buy the smart TV, you will need $125 more than what you have in your savings account. How much money do you have in your savings account?

Wyoming Cross-Disciplinary Connections

Science	CVE
MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. **MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services. **MS-ESS2-6** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	**CV8.3.1** Career-aware students identify real-world problems and efficiently locate & effectively use various sources of information for informed decision making.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations	6.EE.F Reason about and solve one-variable equations and inequalities.	Mathematical Practices
	6.EE.F.8 Write an inequality of the form x > c or x < c to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form x > c or x < c have infinitely many solutions; represent solutions of such inequalities on number line diagrams. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example: Write an inequality for the problem below, and solve it. Show your solutions on a number line. Be sure to define your variable. Wyoming Air Lines will allow you to fly with suitcases that weigh no more than 30 pounds. If your suitcase weighs 10 pounds and the Chromebook you need to bring on your trip weigh 2 pounds, how many pounds of clothes and other items can you pack?

Wyoming Cross-Disciplinary Connections

CVE

CV8.3.1 Career-aware students identify real-world problems and efficiently locate & effectively use various sources of information for informed decision making.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

6.EE.G Represent and analyze quantitative relationships between dependent and independent variables.	Mathematical Practices
6.EE.G.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity (dependent variable), in terms of the other quantity (independent variable). Analyze their relationship using graphs and tables, and relate these to the equation.	**MP.1** **Make sense of problems and persevere in solving them.** **MP.2** **Reason abstractly and quantitatively.** **MP.3** **Construct viable arguments and critique the reasoning of others.** **MP.4** **Model with mathematics.** **MP.5** **Use appropriate tools strategically.** **MP.6** **Attend to precision.** **MP.7** **Look for and make use of structure.** **MP.8** **Look for and express regularity in repeated reasoning.**

Modeling

Example

Example: In a motion problem that has constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.

Wyoming Cross-Disciplinary Connections

SCIENCE

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS1-2 Develop and use models to describe the parts, functions, and basic processes of cells.

MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS1-6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS1-7 Develop a model to describe how food molecules (sugar) are rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**2-AP-11** Create clearly named variables that represent different data types and perform operations on their values.	☑ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

6.G.H Solve real-world and mathematical problems involving area, surface area, and volume.

6.G.H.1 Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science

MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

ELA

L.6.4 Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of a specific word choice on meaning and tone.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner

Computer Science

2-AP-14 Create procedures with parameters to organize code and make it easier to reuse.

- [x] **Computational Thinking**
- [ ] **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	6.G.H Solve real-world and mathematical problems involving area, surface area, and volume.	Mathematical Practices	Example
	6.G.H.2 Find the volume of a right rectangular prism with fractional edge lengths in the context of solving real-world and mathematical problems by applying the formulas V = (l)(w)(h) and V = (B)(h), and label with appropriate units. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**2-AP-14** Create procedures with parameters to organize code and make it easier to reuse.	☑ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	6.G.H Solve real-world and mathematical problems involving area, surface area, and volume.	Mathematical Practices	Example
	6.G.H.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	**Example:** Triangle PQR and triangle QRS have vertices P(–9,7), Q(4,7), R(4,–3), and S(10,–3). What is the area, in square units, of quadrilateral PQSR?

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

6th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

6.G.H Solve real-world and mathematical problems involving area, surface area, and volume.	Mathematical Practices
6.G.H.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures in the context of solving real-world and mathematical problems.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Statistics and Probability

6.SP.I Develop understanding of statistical variability.	Mathematical Practices
6.SP.I.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS2-1 Ask questions about a common household appliance, collect data to reverse-engineer the appliance and learn how it's design has evolved, describe how scientific discoveries, technological advances, and engineering design played significant roles in its development, and explore how science, engineering and technology might be used together or individually in producing improved versions of the appliance.

Health

HE8.2.5 Analyze how peers, culture, and media can influence decisions students make about health practices and risk behaviors (e.g., time, fiscal, etc.).
SEXUALITY, ATOD, ME

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **5b** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

6th

Statistics and Probability

6.SP.I Develop understanding of statistical variability.	Mathematical Practices
6.SP.I.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS2-1 Ask questions about a common household appliance, collect data to reverse-engineer the appliance and learn how it's design has evolved, describe how scientific discoveries, technological advances, and engineering design played significant roles in its development, and explore how science, engineering and technology might be used together or individually in producing improved versions of the appliance.

Health

HE8.2.5 Analyze how peers, culture, and media can influence decisions students make about health practices and risk behaviors (e.g., time, fiscal, etc.). SEXUALITY, ATOD, ME

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **5b** Computational Thinker		☑ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

6th

Statistics and Probability

6.SP.I Develop understanding of statistical variability.	Mathematical Practices	Example
6.SP.I.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Modeling

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS2-1 Ask questions about a common household appliance, collect data to reverse-engineer the appliance and learn how it's design has evolved, describe how scientific discoveries, technological advances, and engineering design played significant roles in its development, and explore how science, engineering and technology might be used together or individually in producing improved versions of the appliance.

ELA

RL.6.7 Compare and contrast the experience of reading a story, drama, or poem to listening to or viewing an audio, video, or live version of the text, including contrasting what they "see" and "hear" when reading the text to what they perceive when they listen or watch.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3b** Knowledge Constructor	**2-DA-07** Represent data using multiple encoding schemes. **2-DA-09** Refine computational models based on the data they have generated.	☑ Computational Thinking ☐ Financial Literacy

6th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

6.SP.J Summarize and describe distributions.	Mathematical Practices
6.SP.J.4 Display numerical data in plots on a number line, including dot plots, stem-and-leaf plots, histograms, and box plots.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. .
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS2-1 Ask questions about a common household appliance, collect data to reverse-engineer the appliance and learn how it's design has evolved, describe how scientific discoveries, technological advances, and engineering design played significant roles in its development, and explore how science, engineering and technology might be used together or individually in producing improved versions of the appliance.

ELA

RL.6.1 Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3c** Knowledge Constructor **5b** Computational Thinker **6a,c,d** Creative Communicator	**2-DA-07** Represent data using multiple encoding schemes. **2-DA-09** Refine computational models based on the data they have generated.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

6.SP.J Summarize and describe distributions.

6.SP.J.5 Summarize numerical data sets in relation to their real-world context.

A. Report the sample size.
B. Describe the context of the data under investigation, including how it was measured and its units of measurement.
C. Find quantitative measures of center (median, mode and mean) and variability (range and interquartile range). Describe any overall pattern (including outliers, clusters, and distribution), with reference to the context in which the data was gathered.
D. Justify the choice of measures of center (median, mode, or mean) based on the shape of the data distribution and the context in which the data was gathered.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: If the distribution is symmetric, the mean and mean absolute deviation are the best center-spread measure combo to use. When the data is skewed, the median and interquartile range are the center-spread pair of choice

Wyoming Cross-Disciplinary Connections

Science
MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. .
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS2-1 Ask questions about a common household appliance, collect data to reverse-engineer the appliance and learn how it's design has evolved, describe how scientific discoveries, technological advances, and engineering design played significant roles in its development, and explore how science, engineering and technology might be used together or individually in producing improved versions of the appliance.
MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

ELA
RI.6.1 Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
W.6.7 Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

Social Studies—SS8.6.3 Use digital tools to research, design, and present social studies concepts (e.g., understand how individual responsibility applies in usage of digital media). https://www.iste.org/standards/nets-for-students.

PE
PE8.2.1 Students create and monitor a personal plan using current levels of fitness and physical activity.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☐ Financial Literacy

Grade 6 Resources

Standard/Page Number	Resource/Link/Example(s)
6.RP.A.3 on page 174.	**Example:** Are the ratios 16:8 and 2:1 equivalent? **Example:** If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed? **Example:** Recognize that 25% (twenty five per cent) means twenty five per 100 and equate that to 25/100. 119% is still 199/100;0.17% is the same as .17/100 and then to create as a proper fraction = (17/100)/100 = 17/10,000. **Example:** Convert 3 feet to inches; knowing that there are 12 inches in each foot, we can say that 12 inches = 1 foot; so 3 feet = 3 (1 foot) = 3 (12 inches) = 36 inches; Convert 6 feet to yards; knowing that there are 3 feet are in one yard, 6 feet = 2(3 feet) = 2(1 yard) = 2 yards. What is ½ of ⅔ of cup? ½ x ⅔ = ⅓.
6.NS.C.2 on page 176.	https://www.intmath.com/basic-algebra/img/long-division.png
6.NS.C.3 on page 177.	Image: LearnZillion
6.NS.D.6 on page 180.	https://www.varsitytutors.com/hotmath/hotmath_help/topics/reflections
Grade Level Math Practices on page 171.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | Grade 7

In Grade 7, instructional time should focus on four critical areas: (1) develop understanding of and applying proportional relationships; (2) develop understanding of operations with rational numbers and working with expressions and linear equations; (3) solve problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; (4) draw inferences about populations based on samples.

(1) Students extend their understanding of ratios and develop understanding of proportionality to solve single-and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

(2) Students develop a unified understanding of number by recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

(3) Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8, they reason about relationships among two- dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two-and three-dimensional objects which are composed of triangles, quadrilaterals, polygons, cubes and right prisms.

(4) Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In grade 7, students solve real world problems involving ratios, rates, proportions, rational numbers and geometric concepts and discuss (verbally or in writing) how they solve them. Students analyze the problem (including what is given, not given, and what is being asked), identify what strategies are needed, choose an appropriate pathway, then make an initial attempt to solve the problem. Students analyze the result for validity and refine strategies if necessary.

2. Reason abstractly and quantitatively.

Students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.

3. Construct viable arguments and critique the reasoning of others.

Students construct arguments using verbal or written explanations that involve solving problems with rational numbers. They make conjectures, explore validity, reason mathematically, justify, evaluate their own thinking and the thinking of other students.

4. Model with mathematics.

Students can clearly show their work by using diagrams, words, symbols or pictures. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and/or formulas. They can analyze those relationships mathematically to draw conclusions. They interpret their mathematical results of problems involving rational numbers in the context of the situation and reflect on whether the results make sense.

5. Use appropriate tools strategically.

Students consider available tools (including estimation, concrete models, and technology as appropriate), and decide when certain tools might be helpful. Students develop more efficacy with technology. They choose the representation (table, graph, equation, words) that best suits the problem. Students use concrete models to develop insight into proportions and other concepts. Students then extend this insight to more abstract representations, including pictures and symbols. Students understand the limitations of each tool. Tools might include: integer tiles, algebra tiles, geometric nets, number lines, graphing technology, scientific calculator, paper and pencil, and others.

6. Attend to precision.

Students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students define variables, including their relationship, specify units of measure, and label each axis accurately. Student use appropriate terminology when referring to rates, ratios, proportions, probability models, geometric figures, data displays, and components of expressions, equations or inequalities. Students use appropriate symbols, labels, and units of measure when solving problems with calculations that are accurate and efficient. Answer to the problem matches what was asked in the problem.

7. Look for and make use of structure.

Students routinely seek patterns or structure to model and solve problems. They recognize that patterns exist in ratio tables and make connections with the constant of proportionality in a table and the slope of a graph. Students recognize patterns and identify and develop strategies for creating equivalent expressions. Students identify complicated expressions or figures as compositions of simple parts.

8. Look for and express regularity in repeated reasoning.

Students routinely seek patterns or structure to model and solve problems. They apply properties to solve problems based upon patterns they have identified. Students examine patterns to generate equations and describe relationships. Students simplify complicated expressions into simple terms. Students recognize the effects of transformations and describe them in terms of congruence and similarity.

Wyoming 2018 Mathematics Content and Performance Standards

Ratios and Proportional Relationships

7.RP.A Analyze proportional relationships and use them to solve real-world and mathematical problems.	Mathematical Practices
7.RP.A.1 Compute unit rates, including those involving complex fractions, with like or different units. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example: If a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction (1/2)/(1/4) miles per hour, equivalently 2 miles per hour.

Wyoming Cross-Disciplinary Connections

Science

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☐ Financial Literacy

7th

Wyoming 2018 Mathematics Content and Performance Standards

Ratios and Proportional Relationships

7.RP.A Analyze proportional relationships and use them to solve real-world and mathematical problems.	Mathematical Practices
7.RP.A.2 Recognize and represent proportional relationships between quantities. A. Decide whether two quantities in a table or graph are in a proportional relationship. B. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. C. Represent proportional relationships with equations. D. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example: If total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.

Sources: https://www.engageny.org/resource/released-2017-3-8-ela-and-mathematics-state-test-questions

Wyoming Cross-Disciplinary Connections

Science

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
MS-PS4-1 Use mathematical representations to describe a simple model for waves, which includes how the amplitude of a wave is related to the energy in a wave.
MS-LS1-6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
MS-LS1-7 Develop a model to describe how food molecules (sugar) are rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS1-1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.
MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ESS3-4 Construct an argument supported by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems.

CVE

CV8.5.2 Career-aware students plan tasks recognizing human resources, financial and timeline constraints that take into account priorities and goals.

FPA

FPA8.4.M.2 Students describe ways in which other disciplines are interrelated with music.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☑ Financial Literacy

7th

Wyoming 2018 Mathematics Content and Performance Standards

Ratios and Proportional Relationships

7.RP.A Analyze proportional relationships and use them to solve real-world and mathematical problems.	Mathematical Practices
7.RP.A.3 Solve multistep real world and mathematical problems involving ratios and percentages.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Science	CVE
MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. **MS-LS1-6** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. **MS-LS1-7** Develop a model to describe how food molecules (sugar) are rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system. **MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	**CV8.5.2** Career-aware students plan tasks recognizing human resources, financial and timeline constraints that take into account priorities and goals.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☑ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

7th

The Number System

7.NS.B Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.	Mathematical Practices
7.NS.B.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers. A. Describe situations in which opposite quantities combine to make zero (the additive identity). B. Understand that p + q represents the distance |q| from p whose placement is determined by the sign of q. Interpret sums of rational numbers by describing real-world contexts. C. Show that a number and its opposite have a sum of 0 (are additive inverses). D. Understand subtraction of rational numbers as adding the additive inverse, p - q = p + (-q). Apply this principal in real-world contexts. E. Apply properties of addition as strategies to add and subtract rational numbers. Modeling	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example: A hydrogen atom has 0 charge because its constituents proton and electron are oppositely charged.

Example: It is 5 degrees Celsius outside. A winter storm suddenly makes the temperature drop to negative 15 degrees Celsius.

What was the temperature change? 5+|-15| = 20 degree temperature change.

Example: -2 + 2 = 0

Example: Sara's account had $10 in it. She wrote a check for $15. What is her balance? 10-15 represents $10 in the account, subtract $15 spent by the check. 10+(-15) represents $10 in the account add a negative charge of $15. Both result in a balance of -$5.

Wyoming Cross-Disciplinary Connections

Science

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused changes in global temperatures over time.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

The Number System

7.NS.B Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

7.NS.B.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

A. 1. Understand that the multiplicative inverse of a number is its reciprocal and their product is equal to one (the multiplicative identity).
   2. Understand positive and negative sign rules for multiplying rational numbers. Interpret products of rational numbers by describing real-world contexts.

B. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers is a rational number. Recognize that if p and q are integers then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.

C. Apply properties of multiplication (commutative, associative, distributive, or properties of identity and inverse elements) to multiply and divide rational numbers.

D. Convert a rational number to a decimal. Recognize that rational numbers can be written as fractions or decimal numbers that terminate or repeat.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: 3*(1/3) = 1

Example: 4 students each take a turn digging in the same hole. If each student digs three feet down, how deep is the hole when they are finished? 4*(-3)= -12 means the hole is twelve feet in depth. Sign rules: positive times positive equals positive, negative times negative is positive, and positive times negative is negative.

Example: -(12/4) = -12/4 = 12/-4.

Example: Your mom paid $12 for you and three friends to go to the show. What is each persons' debt to your mom? The debt is $3 which can be represented as -$3.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

The Number System

7.NS.B Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.	Mathematical Practices
7.NS.B.3 Solve real-world and mathematical problems involving the four arithmetic operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS1-7 Develop a model to describe how food molecules (sugar) are rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations	7.EE.C Use properties of operations to generate equivalent expressions.	Mathematical Practices
	7.EE.C.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking
1c Empowered Learner		☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

7.EE.C Use properties of operations to generate equivalent expressions.	Mathematical Practices
7.EE.C.2 Recognize that algebraic expressions may have a variety of equivalent forms that reveal different information, and determine an appropriate form for a given real-world situation.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example: a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."

Wyoming Cross-Disciplinary Connections

CVE

CV8.5.2 Career-aware students plan tasks recognizing human resources, financial and timeline constraints that take into account priorities and goals.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☑ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

7.EE.D Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	Mathematical Practices
7.EE.D.3 Solve multi-step real-world and mathematical problems involving rational numbers. Include fraction bars as a grouping symbol.	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50.

Example: If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

Wyoming Cross-Disciplinary Connections

Science	CVE
MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. **MS-PS2-2** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.	**CV8.5.2** Career-aware students plan tasks recognizing human resources, financial and timeline constraints that take into account priorities and goals. **CV8.3.1** Career-aware students identify real-world problems and efficiently locate & effectively use various sources of information for informed decision making.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☑ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

7.EE.D Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.EE.D.4 Apply the concepts of linear equations and inequalities in one variable to real-world and mathematical situations.

A. Write and fluently solve linear equations of the form $ax + b = c$ and $a(x + b) = c$ where a, b, and c are rational numbers.
B. Write and solve multi-step linear equations that include the use of the distributive property and combining like terms. Exclude equations that contain variables on both sides.
C. Write and solve two-step linear inequalities. Graph the solution set on a number line and interpret its meaning.
D. Identify and justify the steps for solving multi-step linear equations and two-step linear inequalities.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: The perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

Example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.

Wyoming Cross-Disciplinary Connections

Science

MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-ESS1-2 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
MS-ESS1-4 Construct a scientific explanation based on evidence from rocks and rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ESS3-4 Construct an argument supported by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems.
MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused changes in global temperatures over time.

CVE

CV8.3.1 Career-aware students identify real-world problems and efficiently locate & effectively use various sources of information for informed decision making.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner

Computer Science

2-AP-11 Create clearly named variables that represent different data types and

☑ **Computational Thinking**
☐ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

7.G.E Draw, construct, and describe geometrical figures and describe the relationships between them.

Mathematical Practices

7.G.E.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing.

Modeling

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: If the scale is 1 in : 3 ft, what is the area of a bedroom that is 3 in by 4 in on a scale drawing?

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions**.**

Social Studies

SS8.5.1 Use and create models of the Earth to analyze the interactions of physical and human systems to demonstrate global interconnectedness.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner

5c Computational Thinker

Computer Science

2-AP-14 Create procedures with parameters to organize code and make it easier to reuse.

- [x] **Computational Thinking**
- [ ] **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

7.G.E Draw, construct, and describe geometrical figures and describe the relationships between them.	Mathematical Practices
7.G.E.2 Draw geometric shapes with given conditions using a variety of tools (e.g., ruler and protractor, or technology). Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Examples of technology could include, but are not limited to, Geometer's Sketchpad and Mathematica.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c,d Empowered Learner **4b** Innovative Designer	**2-AP-14** Create procedures with parameters to organize code and make it easier to reuse.	☑ **Computational Thinking** ☐ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	7.G.E Draw, construct, and describe geometrical figures and describe the relationships between them.	Mathematical Practices
	7.G.E.3 Describe the two-dimensional figures that result from slicing three-dimensional figures parallel to the base, as in plane sections of right rectangular prisms and right rectangular pyramids. Modeling	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example: The cross-section of a rectangular pyramid is a rectangle. The cross section of a rectangular prism is a rectangle.

Wyoming Cross-Disciplinary Connections

ELA

L.7.4.b Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., belligerent, bellicose, rebel).

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

7th

Geometry	7.G.F Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	Mathematical Practices	Example
	7.G.F.4 Investigate the concept of circles. A. Demonstrate an understanding of the proportional relationships between diameter, radius, and circumference of a circle. B. Understand that pi is defined by the constant of proportionality between the circumference and diameter. C. Given the formulas for circumference and area of circles, solve real-world and mathematical problems. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	**Example:** Find the circumference of a steering wheel that is 45 cm in diameter. Find the area of a pizza with a diameter of 12 inches. Find the length of the minute hand on a clock whose circumference is 66 cm.

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-ESS1-2 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**2-AP-14** Create procedures with parameters to organize code and make it easier to reuse.	☑ **Computational Thinking** ☐ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	7.G.F Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	Mathematical Practices
	7.G.F.5 Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example:

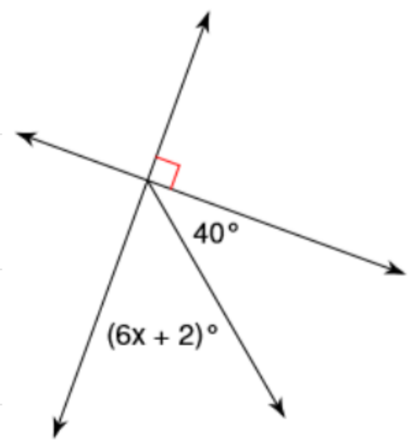


Image from Kuta Software

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**2-AP-14** Create procedures with parameters to organize code and make it easier to reuse.	☑ **Computational Thinking** ☐ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

7.G.F Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

7.G.F.6 Solve real-world and mathematical problems involving

A. area and surface area of objects composed of triangles and quadrilaterals;
B. volume of objects composed only of right prisms having triangular or quadrilateral bases.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-ESS1-2 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **5c** Computational Thinker		☐ **Computational Thinking** ☐ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

7.SP.G Use random sampling to draw inferences about a population.	Mathematical Practices
7.SP.G.1 Solve real-world and mathematical problems involving: **A.** Understand that a sample is a subset of a population. **B.** Differentiate between random and non-random sampling. **C.** Understand that generalizations from a sample are valid only if the sample is representative of the population. **D.** Understand that random sampling is used to gather a representative sample and tends to support valid inferences about the population.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

ELA

RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3a,b,c,d** Knowledge Constructor **5b** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

7th

Statistics and Probability

7.SP.G Use random sampling to draw inferences about a population.

Mathematical Practices

Example

Estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.

7.SP.G.2 Draw inferences about a population by collecting multiple random samples of the same size to investigate variability in estimates of the characteristic of interest.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Modeling

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

ELA

RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Social Studies

SS8.6.1 Use and evaluate multiple sources of information in diverse formats and media in order to address a question or solve a problem.

Health

HE8.2.5 Analyze how peers, culture, and media can influence decisions students make about health practices and risk behaviors (e.g., time, fiscal, etc.). SEXUALITY, ATOD, ME

Cross-Disciplinary Connections

ISTE

1c Empowered Learner
3a,b,c,d Knowledge Constructor
5b Computational Thinker

Computer Science

2-DA-08 Collect data using computational tools and transform the data to make it more useful and reliable.

- [x] **Computational Thinking**
- [ ] **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

7.SP.H Draw informal comparative inferences about two populations.

7.SP.H.3
Visually compare the centers, spreads, and overlap of two displays of data (e.g., back-to-back stem and leaf plots, dot plots, histograms, box plots) that are graphed on the same scale and draw inferences about this data.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

https://drive.google.com/drive/folders/0B4tmm987k4xER0EwMTcya3hfaW8

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

ELA

RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Social Studies

SS8.6.1 Use and evaluate multiple sources of information in diverse formats and media in order to address a question or solve a problem.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner
3b,d Knowledge Constructor
5b Computational Thinker

Computer Science

2-DA-07 Represent data using multiple encoding schemes.
2-DA-09 Refine computational models based on the data they have generated.

- [x] **Computational Thinking**
- [ ] **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

7.SP.H Draw informal comparative inferences about two populations.

7.SP.H.4 Given measures of center and variability (mean, median and/or mode; range, interquartile range, and/or standard deviation), for numerical data from random samples, draw appropriate informal comparative inferences about two populations.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

ELA

RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Social Studies

SS8.6.1 Use and evaluate multiple sources of information in diverse formats and media in order to address a question or solve a problem.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner
3b,d Knowledge Constructor
5b Computational Thinker

Computer Science

2-DA-07 Represent data using multiple encoding schemes.
2-DA-09 Refine computational models based on the data they have generated.

☑ **Computational Thinking**
☐ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

7.SP.I Investigate chance processes and develop, use, and evaluate probability models.	Mathematical Practices	Example
7.SP.I.5 Find and interpret the probability of a random event. Understand that the probability of a random event is a number between, and including, 0 and 1 that expresses the likelihood of the event occurring.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Modeling

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.

ELA

RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner

Computer Science

2-DA-07 Represent data using multiple encoding schemes.
2-DA-09 Refine computational models based on the data they have generated.

- [ ] **Computational Thinking**
- [ ] **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

7.SP.I Investigate chance processes and develop, use, and evaluate probability models.

7.SP.I.6 Collect multiple samples to compare the relationship between theoretical and experimental probabilities for simple events.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: When rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.

ELA

RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner
5b Computational Thinker

Computer Science

2-DA-08 Collect data using computational tools and transform the data to make it more useful and reliable.

- ☑ **Computational Thinking**
- ☐ **Financial Literacy**

7th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

7.SP.I Investigate chance processes and develop, use, and evaluate probability models.

Mathematical Practices

7.SP.I.7 Apply the concepts of theoretical and experimental probabilities for simple events.

A. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.

B. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.

C. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancies.

Modeling

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Example

Example: If a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.

Example: Find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.

ELA

RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.

W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☐ Financial Literacy

7th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

7.SP.I Investigate chance processes and develop, use, and evaluate probability models.

7.SP.I.8 Find probabilities of compound events using organized lists, tables, and tree diagrams.

A. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.

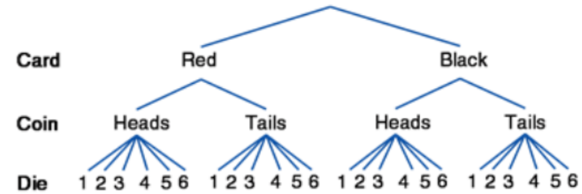
B. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example:



Source: https://www.shmoop.com/basic-statistics-probability/compound-events-exercises.html

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.

ELA

RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Modeling

Grade 7 Resources

Standard/Page Number	Resource/Link/Example(s)
7.RP.A.2 on page 204.	https://www.engageny.org/resource/released-2017-3-8-ela-and-mathematics-state-test-questions
Grade Level Math Practices on page 202.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | Grade 8

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

(1) Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation. Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

(2) Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

(3) Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students continue their work on volume by solving problems involving cylinders .

Standards for Mathematical Practice at Grade Level

1. Make sense of problems and persevere in solving them.

In grade 8, students solve real world problems through the application of algebraic and geometric concepts and discuss (verbally or in writing) how they solve them. Students analyze the problem (including what is given, not given, and what is being asked), identify what strategies are needed, choose the most efficient pathway, then make an initial attempt to solve the problem. Students analyze the result for validity and refine strategies if necessary.

2. Reason abstractly and quantitatively.

Students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students examine patterns in data and assess the degree of linearity of functions. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.

3. Construct viable arguments and critique the reasoning of others.

Students construct arguments using verbal or written explanations that involve solving problems with real numbers. They make conjectures, explore validity, reason mathematically, justify, evaluate their own thinking and analytically critique the reasoning of other students.

4. Model with mathematics.

Students can clearly show their work by using diagrams, words, symbols or pictures. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results of problems involving real numbers in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Students consider available tools (including estimation, concrete models, and technology as appropriate), and decide when certain tools might be helpful. Students can interpret results provided by technology. They choose the representation (table, graph, equation, words) that best suits the problem. Students use concrete models to develop insight into linear equations and other concepts. Students then extend this insight to more abstract representations, including pictures and symbols. Students understand the limitations of each tool. Tools might include: integer tiles, algebra tiles, geometric nets, number lines, graphing technology, scientific calculator, paper and pencil, and others.

6. Attend to precision.

Students continue to refine their mathematical communication skills by using clear and precise mathematical language in their discussions with others and in their own reasoning. Students define variables, including their relationship, specify units of measure, and label each axis accurately. Students use appropriate terminology when referring to the number system, functions, geometric figures, and data displays. Students use appropriate symbols, labels, and units of measure when solving problems with calculations that are accurate and efficient. Answer to the problem matches what was asked in the problem.

7. Look for and make use of structure.

Students routinely seek patterns or structure to model and solve problems. They apply properties to solve problems based upon patterns they have identified. Students examine patterns to generate equations and describe relationships. Students simplify complicated expressions into simple terms. Students recognize the effects of transformations and describe them in terms of congruence and similarity.

8. Look for and express regularity in repeated reasoning.

Students use repeated reasoning to understand algorithms and make generalizations about patterns. They develop efficient strategies for solving problems and check for reasonableness of answers. Students ask questions such as, "What evidence supports that conclusion?"

8th

Wyoming 2018 Mathematics Content and Performance Standards

The Number System

8.NS.A Know that there are numbers that are not rational, and approximate them by rational numbers.

8.NS.A.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. Explore the real number system and its appropriate usage in real-world situations.

A. Make comparisons between rational and irrational numbers.
B. Understand that all real numbers have a decimal expansion.
C. Model the hierarchy of the real number system, including natural, whole, integer, rational, and irrational numbers.
D. Convert repeating decimals to fractions.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 **Look for and make use of structure.**
MP.8 **Look for and express regularity in repeated reasoning.**

Example

Example: 2.3 is a decimal that terminates and is less than 2 and 1/3, which is a decimal that repeats and both are greater than the square root ($\sqrt{5}$) which is a decimal that neither repeats nor terminates:

$\sqrt{5} < 2.3 < 2\ 1/3$

Example: Converting a repeating decimal to a fraction:

- Set your repeating decimal equal to x
- Start with your repeating decimal and **multiply both sides** by $10^{\text{factor length}}$.
  - In the example to the right 12 repeats itself so we have a factor length of 2 since 12 has 2 units in it and we multiply by 10^2 =**100**.
- Now we can subtract the two equations to **eliminate the repeating portion** of the decimal.
- Solve for x and simplify the fraction!

$0.\overline{12}1212 = x$

$0.\overline{12}1212 \cdot 100 = x \cdot 100$

$12.\overline{12}12 = 100x$

$12.\overline{12}12 = 100x$

$-0.\overline{12}1212 = x$

$\left(\frac{1}{99}\right)12 = 99x\left(\frac{1}{99}\right)$

$\frac{12 \div 3}{99 \div 3} = \frac{4}{33} = x$

Source: https://www.google.com/url sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwis5NmezaDXAhUr9IMKHT4GBfwQjRwIBw&url=http%3A%2F%2Fwww.showme.com%2Fsearch%2F%3Fq%3Drepeating%2520and%2520terminating%2520decimals&psig=AOvVaw2r8oaaVjrxqQRyNy8uP2IM&ust=1509736515940671

Wyoming Cross-Disciplinary Connections

Science	ELA	Social Studies
MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	**L.8.5.b** Use the relationship between particular words to better understand each of the words.	**SS8.4.2** Describe how tools and technology in different historical periods impacted the way people lived, made decisions, and saw the world.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

The Number System	8.NS.A Know that there are numbers that are not rational, and approximate them by rational numbers.	Mathematical Practices
	8.NS.A.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: Estimating a Square Root

Estimate $\sqrt{27}$ to the nearest tenth.

$\sqrt{25} < \sqrt{27} < \sqrt{36}$ *Find the two perfect squares that 27 lies between.*

$5 < \sqrt{27} < 6$ *Find the two integers that lies between $\sqrt{27}$.*

Because 27 is closer to 25 than to 36, $\sqrt{27}$ is close to 5 than to 6.

Try 5.2: $5.2^2 = 27.04$ *Too high, try 5.1.*

$5.1^2 = 26.01$ *Too low*

Because 27 is closer to 27.04 than 26.01, $\sqrt{27}$ is closer to 5.2 than to 5.1.

Check On a calculator $\sqrt{27} \approx 5.1961524 \approx 5.2$ rounded to the nearest tenth. ✓

Source: https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwibqsn5zaDXAhUl0oMKHf1BBnwQjRwIBw&url=http%3A%2F%2Fslideplayer.com%2Fslide%2F7819310%2F&psig=AOvVaw1gMwKqVtUDB4pG0_-797EC&ust=1509736758310295

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☐ Financial Literacy

8th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

8.EE.B Work with radicals and integer exponents.	Mathematical Practices
8.EE.B.1 Understand and apply the laws of exponents (i.e. product rule, quotient rule, power to a power, product to a power, quotient to a power, zero power property, negative exponents) to generate equivalent numerical expressions limited to integer exponents.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example: $3^2 \text{x } 3^{-5} = 3^{-3} = 1/(3^3) = 1/27$

Example:

Law	Example
$x^1 = x$	$6^1 = 6$
$x^0 = 1$	$7^0 = 1$
$x^{-1} = 1/x$	$4^{-1} = 1/4$
$x^m x^n = x^{m+n}$	$x^2 x^3 = x^{2+3} = x^5$
$x^m/x^n = x^{m-n}$	$x^6/x^2 = x^{6-2} = x^4$
$(x^m)^n = x^{mn}$	$(x^2)^3 = x^{2\times 3} = x^6$
$(xy)^n = x^n y^n$	$(xy)^3 = x^3 y^3$
$(x/y)^n = x^n/y^n$	$(x/y)^2 = x^2 / y^2$
$x^{-n} = 1/x^n$	$x^{-3} = 1/x^3$

Wyoming Cross-Disciplinary Connections

Science

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

8th

Expressions and Equations

8.EE.B Work with radicals and integer exponents.	Mathematical Practices	Example
8.EE.B.2 Investigate concepts of square and cube roots. A. Use radical notation, if applicable, to represent the exact solutions to equations of the form $x^2 = p$ and $x^3 = q$ where p is a positive rational number and q is any rational number. B. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. C. Recognize that square roots of non-perfect squares and the cube roots of non-perfect cubes are irrational. Assessment Boundary: Include perfect squares up to 144 and perfect cubes up to 125.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**	**Examples:** • $3^2 = 9$ and $\sqrt{9} = \pm 3$ • $\left(\frac{1}{3}\right)^3 = \left(\frac{1^3}{3^3}\right) = \frac{1}{27}$ and $\sqrt[3]{\frac{1}{27}} = \frac{\sqrt[3]{1}}{\sqrt[3]{27}} = \frac{1}{3}$ • Solve $x^2 = 9$ • Solution: $x^2 = 9$ • $\sqrt{x^2} = \pm\sqrt{9}$ • $x = \pm 3$ • Solve $x^3 = 8$ • Solution: $x^3 = 8$ • $\sqrt[3]{x^3} = \sqrt[3]{8}$ • $x = 2$ Source: https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566

Wyoming Cross-Disciplinary Connections

Science

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
MS-ESS1-2 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

8.EE.B Work with radicals and integer exponents.	Mathematical Practices
8.EE.B.3 Explore the relationship between quantities in decimal and scientific notation. A. Express very large and very small quantities, p, in scientific notation in the form $a \times 10^b = p$ where $1 \le a < 10$ and b is an integer. B. Translate between decimal notation and scientific notation. C. Estimate and compare the relative size of two quantities in scientific notation.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.

Example: $9.296 \times 10^7 = 92{,}960{,}000$ $7.03 \times 10^{-6} = 0.00000703$

Wyoming Cross-Disciplinary Connections

Science

MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures.

MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

MS-ESS1-4 Construct a scientific explanation based on evidence from rocks and rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-ESS3-4 Construct an argument supported by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

8.EE.B Work with radicals and integer exponents.	Mathematical Practices
8.EE.B.4 Apply the concepts of decimal and scientific notation to real-world and mathematical problems. A. Select appropriate units of measure when representing answers in scientific notation. B. Interpret scientific notation that has been generated by a variety of technologies.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Modeling

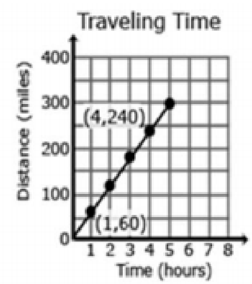
Example

Using graphs of experiences that are familiar to students increases accessibility and supports understanding and interpretation of proportional relationship. Students are expected to both sketch and interpret graphs.

Example:

- Compare the scenarios to determine which represents a greater speed. Include a description of each scenario including the unit rates in your explanation.

Scenario 1:



Scenario 2:

$y = 50x$

x is time in hours

y is distance in miles

Source: https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566

Example: When measuring long distances, such as, between planets, use miles rather than inches. A larger unit of measure is more appropriate.

Wyoming Cross-Disciplinary Connections

Science

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.
evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
MS-ESS3-4 Construct an argument supported by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

8.EE.C Understand the connections between proportional relationships, lines, and linear equations.

8.EE.C.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

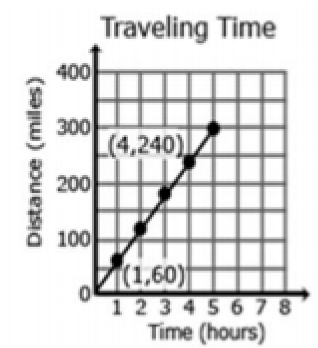
Example

Using graphs of experiences that are familiar to students increases accessibility and supports understanding and interpretation of proportional relationship. Students are expected to both sketch and interpret graphs.

Example:

- Compare the scenarios to determine which represents a greater speed. Include a description of each scenario including the unit rates in your explanation.

Scenario 1:



Scenario 2:

$y = 50x$

x is time in hours

y is distance in miles

Source: https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566

Wyoming Cross-Disciplinary Connections

Science

MS-ESS3-4 Construct an argument supported by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☐ Financial Literacy

8th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations	8.EE.C Understand the connections between proportional relationships, lines, and linear equations.	Mathematical Practices
	8.EE.C.6 Explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y =mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at (0,b).	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Example

Example: Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Wyoming Cross-Disciplinary Connections

Science

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**2-AP-14** Create procedures with parameters to organize code and make it easier to reuse.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations	8.EE.D Analyze and solve linear equations and pairs of simultaneous linear equations.	Mathematical Practices
	8.EE.D.7 Extend concepts of linear equations and inequalities in one variable to more complex multi-step equations and inequalities in real-world and mathematical situations. A. Solve linear equations and inequalities with rational number coefficients that include the use of the distributive property, combining like terms, and variable terms on both sides. B. Recognize the three types of solutions to linear equations: one solution, infinitely many solutions, or no solutions. C. Generate linear equations with the three types of solutions. D. Justify why linear equations have a specific type of solution.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example: One solution: only one value of x will make it true; No solution: there is no value of x that could ever make the equation true; Infinite solutions: there are infinite values of x that can make the equation true.

Wyoming Cross-Disciplinary Connections

Science

MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

MS-PS4-1 Use mathematical representations to describe a simple model for waves, which includes how the amplitude of a wave is related to the energy in a wave.

MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-ESS3-4 Construct an argument supported by evidence for how changes in human population and per-capita consumption of natural resources impact Earth's systems.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **5a** Computational Thinker	**2-AP-10** Use flowcharts and/or pseudocode to address complex problems as algorithms.	☑ **Computational Thinking** ☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Expressions and Equations

8.EE.D Analyze and solve linear equations and pairs of simultaneous linear equations.	Mathematical Practices
8.EE.D.8 Analyze and solve pairs of simultaneous linear equations. A. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. B. Solve systems of two linear equations in two variables with integer solutions by graphing the equations. C. Solve simple real-world and mathematical problems leading to two linear equations in two variables given y = mx + b form with integer solutions.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5** Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example: 3x+2y=5 and 3x+2y=6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.

Example: Given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Wyoming Cross-Disciplinary Connections

Science	Social Studies
MS-LS1-2 Develop and use models to describe the parts, functions, and basic processes of cells. **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. **MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services. **MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	**SS8.3.1** Identify and apply basic economic concepts (e.g., supply, demand, production, exchange and consumption, labor, wages, scarcity, prices, incentives, competition, and profits).

Cross-Disciplinary Connections

ISTE	Computer Science	
1c,d Empowered Learner **5a** Computational Thinker	**2-AP-10** Use flowcharts and/or pseudocode to address complex problems as algorithms.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Functions

8.F.E Define, evaluate, and compare functions.	Mathematical Practices
8.F.E.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.)	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: A person's distance ran in a direction is a direct result of the (constant) speed they've run and the time they've spent running.

Wyoming Cross-Disciplinary Connections

CVE

CVE8.3.1 Career-aware students identify real-world problems and efficiently locate & effectively use various sources of information for informed decision making.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Functions	8.F.E Define, evaluate, and compare functions.	Mathematical Practices
	8.F.E.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Example: Given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

Wyoming Cross-Disciplinary Connections

CVE

CVE8.3.1 Career-aware students identify real-world problems and efficiently locate & effectively use various sources of information for informed decision making.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Functions

8.F.E Define, evaluate, and compare functions.	Mathematical Practices
8.F.E.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example: The function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

Wyoming Cross-Disciplinary Connections

Science	FPA
MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. **MS-PS3-5** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. **MS-PS4-1** Use mathematical representations to describe a simple model for waves, which includes how the amplitude of a wave is related to the energy in a wave.	**FPA8.4.M.2** Students describe ways in which other disciplines are interrelated with music.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Functions

8.F.F Use functions to model relationships between quantities.

8.F.F.4 Apply the concepts of linear functions to real-world and mathematical situations.

A. Understand that the slope is the constant rate of change and the *y*-intercept is the point where *x* = 0.
B. Determine the slope and the *y*-intercept of a linear function given multiple representations, including two points, tables, graphs, equations, and verbal descriptions.
C. Construct a function in slope-intercept form that models a linear relationship between two quantities.
D. Interpret the meaning of the slope and the *y*-intercept of a linear function in the context of the situation.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: For the function y = 3x - 5; slope = 3, as an increase of one unit in x will cause a 3 unit increase in y; y-intercept = -5, as 3*0-5 = -5.

Example: For the points (2,6) and (1,2): slope = (change in y)/(change in x) = (6-2)/(2-1) = 4. We can find the y-intercept using point-slope form: y-2=4(x-1) => y=4x-2, so the y-intercept is -2.

Example: A driver's distance from home (y) as a function of time driven (x): starting the day 1000 miles from home and driving towards it at 75 miles per hour. y= -75x +1000.

Example: A car mechanic's pay (y) is a function of the number of repairs she does in a day (x); y=2x+5. Here, the slope of 2 represents her increase in pay for each hour worked. The y-intercept 5 represents how much money she will make having repaired 0 cars.

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-2 Develop and use models to describe the parts, functions, and basic processes of cells.
MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

CVE

CVE8.3.1 Career-aware students identify real-world problems and efficiently locate & effectively use various sources of information for informed decision making.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner
5a Computational Thinker

Computer Science

2-DA-08 Collect data using computational tools and transform the data to make it more useful and reliable.
2-AP-10 Use flowcharts and/or pseudocode to address complex problems as algorithms.

☑ **Computational Thinking**
☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Functions

8.F.F Use functions to model relationships between quantities.	Mathematical Practices
8.F.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph where the function is increasing, decreasing, constant, linear, or nonlinear. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Wyoming Cross-Disciplinary Connections

ELA

RI.8.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.

W.8.2.b Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

W.8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

W.8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**2-DA-08** Collect data using computational tools and transform the data to make it more useful and reliable.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	8.G.G Understand congruence and similarity using physical models, transparencies, or geometry software.	Mathematical Practices
	8.G.G.1 Verify experimentally the properties of rotations, reflections, and translations. A. Lines are taken to lines, and line segments to line segments of the same length. B. Angles are taken to angles of the same measure. C. Parallel lines are taken to parallel lines.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3** **Construct viable arguments and critique the reasoning of others.** **MP.4** **Model with mathematics.** **MP.5** **Use appropriate tools strategically.** **MP.6** **Attend to precision.** **MP.7** **Look for and make use of structure.** **MP.8** **Look for and express regularity in repeated reasoning.**

Example

Wyoming Cross-Disciplinary Connections

Science

MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c,d Empowered Learner	**2AP-14** Create procedures with parameters to organize code and make it easier to reuse.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	8.G.G Understand congruence and similarity using physical models, transparencies, or geometry software.	Mathematical Practices	Example
	8.G.G.2 Recognize through visual comparison that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Science

MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c,d Empowered Learner	**2AP-14** Create procedures with parameters to organize code and make it easier to reuse.	☑ **Computational Thinking** ☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	8.G.G Understand congruence and similarity using physical models, transparencies, or geometry software.	Mathematical Practices
	8.G.G.3 Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	**Computer Science**	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	8.G.G Understand congruence and similarity using physical models, transparencies, or geometry software.	Mathematical Practices
	8.G.G.4 Recognize through visual comparison that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	8.G.G Understand congruence and similarity using physical models, transparencies, or geometry software.	Mathematical Practices	Example
	8.G.G.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	**Example:** Arrange three copies of the same triangle so that the three angles appear to form a line, and give an argument in terms of transversals why this is so.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	8.G.H Understand and apply the Pythagorean Theorem.	Mathematical Practices	Example
	8.G.H.6 Use models or diagrams to explain the Pythagorean Theorem and its converse.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

8th

Geometry	8.G.H Understand and apply the Pythagorean Theorem.	Mathematical Practices
	8.G.H.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking
1c Empowered Learner		☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry	8.G.H Understand and apply the Pythagorean Theorem.	Mathematical Practices
	8.G.H.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

8.G.I Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.	Mathematical Practices
8.G.I.9 Given the formulas, solve real-world and mathematical problems involving volume and surface area of cylinders. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ Computational Thinking ☐ Financial Literacy

8th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

8.SP.J Investigate patterns of association in bivariate data.	Mathematical Practices
8.SP.J.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe the association by form (linear / nonlinear), direction (positive / negative), strength (correlation), and unusual features.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Modeling

Example

Example: shown on resource page.

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ETS2-2 Develop a model defining and prioritizing the impacts of human activity on a particular aspect of the environment, identifying positive and negative consequences of the activity, both short and long-term, and investigate and explain how the ethics and integrity of scientists and engineers and respect for individual property rights might constrain future development.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4 Develop a model for a proposed object, tool or process and then use an iterative process to test the model, collect data, and generate modification ideas trending toward an optimal design.

ELA

RI.8.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
W.8.2.b Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
W.8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
W.8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Social Studies

SS8.6.3 Use digital tools to research, design, and present social studies concepts (e.g., understand how individual responsibility applies in usage of digital media). https://www.iste.org/standards/nets-for-student

PE

PE8.2.5 Students explain valid characteristics of fitness-related products, technology, and resources related to fitness literacy.

CVE

CV8.3.3 Career-aware students demonstrate an ability to explain and interpret solutions to problems using data and information compiled from a variety of reputable sources.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner
3b,c,d Knowledge Constructor
4a Innovative Designer
6a,c,d Creative Communicator

Computer Science

2-DA-07 Represent data using multiple encoding schemes.
2-DA-09 Refine computational models based on the data they have generated.

☑ **Computational Thinking**
☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

8.SP.J Investigate patterns of association in bivariate data.	Mathematical Practices
8.SP.J.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example: shown on resource page.

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ETS2-2 Develop a model defining and prioritizing the impacts of human activity on a particular aspect of the environment, identifying positive and negative consequences of the activity, both short and long-term, and investigate and explain how the ethics and integrity of scientists and engineers and respect for individual property rights might constrain future development.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4 Develop a model for a proposed object, tool or process and then use an iterative process to test the model, collect data, and generate modification ideas trending toward an optimal design.

ELA

RI.8.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
W.8.2.b Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
W.8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
W.8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **6a,c,d** Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

8th

Statistics and Probability

8.SP.J Investigate patterns of association in bivariate data.

8.SP.J.3 Use an equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Example

Example: In a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an predicted additional 1.5 cm in mature plant height.

Wyoming Cross-Disciplinary Connections

Science

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ETS2-2 Develop a model defining and prioritizing the impacts of human activity on a particular aspect of the environment, identifying positive and negative consequences of the activity, both short and long-term, and investigate and explain how the ethics and integrity of scientists and engineers and respect for individual property rights might constrain future development.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-4 Develop a model for a proposed object, tool or process and then use an iterative process to test the model, collect data, and generate modification ideas trending toward an optimal design.

ELA

RI.8.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.

W.8.2.b Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

W.8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

W.8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner

3b,c,d Knowledge Constructor

4a Innovative Designer

5a Computational Thinker

Computer Science

2-AP-10 Use flowcharts and/or pseudocode to address complex problems as algorithms.

☑ **Computational Thinking**

☐ **Financial Literacy**

8th

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

8.SP.J Investigate patterns of association in bivariate data.

8.SP.J.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.

A. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.

B. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Example

Source: https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566 Folder

Wyoming Cross-Disciplinary Connections

Science

MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.
MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.
MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population affects individuals' probability of surviving and reproducing in a specific environment.
MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ETS2-2 Develop a model defining and prioritizing the impacts of human activity on a particular aspect of the environment, identifying positive and negative consequences of the activity, both short and long-term, and investigate and explain how the ethics and integrity of scientists and engineers and respect for individual property rights might constrain future development.
MS-ESS3-3 Apply scientific principles to design a method for monitoring, evaluating, and managing a human impact on the environment.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4 Develop a model for a proposed object, tool or process and then use an iterative process to test the model, collect data, and generate modification ideas trending toward an optimal design.

ELA

RI.8.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
W.8.2.b Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
W.8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
W.8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

CVE

CV8.3.3 Career-aware students demonstrate an ability to explain and interpret solutions to problems using data and information compiled from a variety of reputable sources.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner
3b,c,d Knowledge Constructor
4a Innovative Designer
6a,c,d Creative Communicator

Computer Science

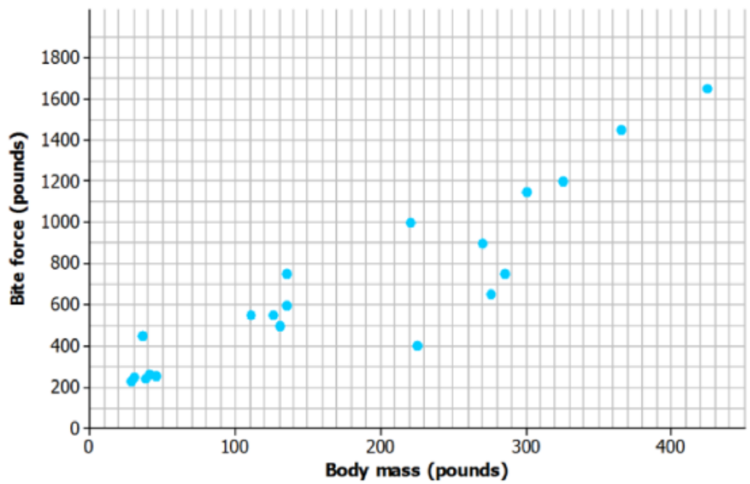
☐ **Computational Thinking**

☐ **Financial Literacy**

Grade 8 Resources

Standard/Page Number	Resource/Link/Example(s)
Grade Level Math Practices on page 228.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
8.NS.A.1 on page 229.	**Example:** 2/3 can be rewritten as 0.666 repeating (use proper symbology)
8.NS.A.1D on page 229.	https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwis5NmezaDXAhUr9IMKHT4GBfwQjRwIBw&url=http%3A%2F%2Fwww.showme.com%2Fsearch%2F%3Fq%3Drepeating%2520and%2520terminating%2520decimals&psig=AOvVaw2r8oaaVjrxqQRyNy8uP2IM&ust=1509736515940671
8.NS.A.2 on page 230.	https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwibqsn5zaDXAhUl0oMKHf1BBnwQjRwIBw&url=http%3A%2F%2Fslideplayer.com%2Fslide%2F7819310%2F&psig=AOvVaw1gMwKqVtUDB4pG0_-797EC&ust=1509736758310295
8.EE.B.2 on page 232.	https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566 https://drive.google.com/open?id=1FgyXWYxIMi9LzN1joq2uNDyyTNER_ecb1Sl0Goo_UWQ https://drive.google.com/open?id=1bw-ft1r0iAfXqDuo8HxBYqejgXnlxQD5hQZrVfXmsbE
8.EE.B.4 on page 234.	https://www.montereyinstitute.org/courses/DevelopmentalMath/TEXTGROUP-9-14_RESOURCE/U11_L1_T4_text_final.html https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566
8.EE.C.5 on page 235.	https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566
8.EE.D.7 on page 237.	http://www.montereyinstitute.org/courses/DevelopmentalMath/COURSE_TEXT2_RESOURCE/U10_L1_T2_text_final.html http://www.charleston.k12.il.us/cms/Teachers/math/PreAlgebra/paunit5/L5-4.PDF

Grade 8 Resources

Standard/Page Number	Resource/Link/Example(s)
8.SP.J.1 on page 252.	https://www.engageny.org/  **4.** **Do you think that there is a statistical relationship between body mass and bite force? If so, describe the nature of the relationship.** ***Sample response: Yes, because it looks like there is an upward pattern in the scatter plot. It appears that alligators with larger body mass also tend to have greater bite force.*** **5.** **Based on the scatter plot, can you conclude that increased body mass causes increased bite force? Explain.** ***Sample response: No. Just because there is a statistical relationship between body mass and bite force does not mean that there is a cause-and-effect relationship.***

Grade 8 Resources

Standard/Page Number	Resource/Link/Example(s)

8.SP.J.2 on page 253.

https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566

The capacity of the fuel tank in a car is 13.5 gallons. The table below shows the number of miles traveled and how many gallons of gas have been used. Describe the relationship between the variables. If the data is linear, determine a line of best fit. Do you think the line represents a good fit for the data set? Why or why not? What is the average fuel efficiency of the car in miles per gallon?

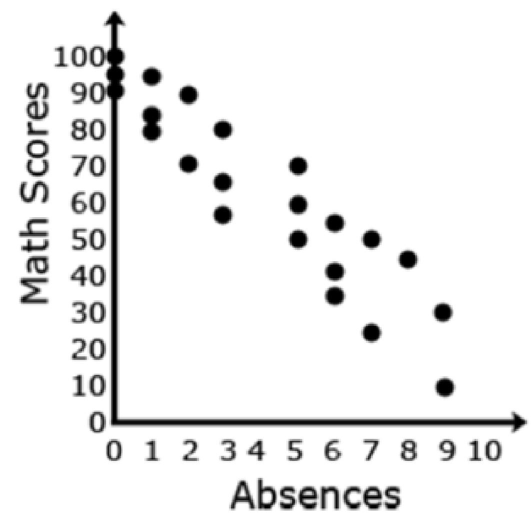
Miles Traveled	0	75	120	160	250	300
Gallons Used	0	2.3	4.5	5.7	9.7	10.7

8.SP.J.3 on page 254.

https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566

Given data from students' math scores and absences, make a scatterplot.

Absences	Math Scores
3	65
5	50
1	95
1	85
3	80
6	34
5	70
3	56
0	100
7	24
8	45
2	71
9	30
0	95
6	55
6	42
2	90
0	92
5	60
7	50
9	10
1	80



Grade 8 Resources

<table>
<tr><th>Standard/Page Number</th><th>Resource/Link/Example(s)</th></tr>
<tr><td>8.SP.J.4 on page 255.</td><td>https://cms.azed.gov/home/GetDocumentFile?id=555281e1aadebe0f94591566

The table illustrates the results when 100 students were asked the survey questions: “Do you have a curfew?” and “Do you have assigned chores?” Is there evidence that those who have a curfew also tend to have chores?

<table>
<tr><th></th><th></th><th colspan="2">Curfew</th></tr>
<tr><th></th><th></th><th>Yes</th><th>No</th></tr>
<tr><th rowspan="2">Chores</th><th>Yes</th><td>40</td><td>10</td></tr>
<tr><th>No</th><td>10</td><td>40</td></tr>
</table>

Solution: Of the students who answered that they had a curfew, 40 had chores and 10 did not. Of the students who answered they did not have a curfew, 10 had chores and 40 did not. From this sample, there appears to be a positive correlation between having a curfew and having chores.</td></tr>
<tr><td>CSTA Standards</td><td>https://www.csteachers.org/page/standards</td></tr>
<tr><td>ISTE Standards</td><td>https://www.iste.org/standards/for-educators</td></tr>
</table>

High School Standards for Mathematical Practices

1. Make sense of problems and persevere in solving them.
Students start to examine problems by explaining to themselves the meaning of a problem and restating the problem in their own words. These students analyze the given information in the problem, including constraints, relationships, and goals. Students make conjectures about the form and meaning of the solution, devise a plan, and solve. They will consider both similar problems, and simpler forms of the original problem, in order to gain insight and efficiency in problem solving. Students monitor and evaluate their progress and change course if necessary. Students may utilize algebraic methods or technology. Students explain relationships between equations and the following: descriptions/situations, tables, and graphs. Students produce diagrams of important features and relationships, graph data, and search for patterns or trends. They check answers to problems and continually ask if the solution makes sense in context. They understand different approaches to solving complex problems and identify correspondences between different approaches.

2. Reason abstractly and quantitatively.
Students seek to make sense of quantities and explore relationships in problem situations. Students represent a given situation by defining and manipulating variables. Students consider the units involved and attend to the meaning of quantities in addition to computational reasoning -- knowing and using the different properties of operations.

3. Construct viable arguments and critique the reasoning of others.
Students understand and use stated assumptions, definitions, and previously established results in constructing arguments. Students make conjectures and build logical progressions of statements to explore the truth of their conjectures. They are able to analyze situations through decomposition and produce counterexample(s) if necessary. Students justify their conclusions, communicate these conclusions, and respond to arguments of others. Students make plausible arguments by reasoning inductively about the data and take into account the context from which the data arose. Students are able to compare the effectiveness of two plausible arguments, and distinguish correct logic from flawed logic. If there is a flaw in an argument, then they explain why the logic is flawed. Students determine a general process and/or domain to which an argument applies. The students listen or read the arguments of others, decide whether the argument makes sense, and ask useful questions to clarify or improve the arguments.

4. Model with mathematics.
Students apply their mathematical knowledge to solve problems arising in everyday life, society, and the workplace. Students may use geometry to solve a design problem or they may use a function to describe how one quantity of interest depends on another. Students may use assumptions and approximations to simplify a complicated situation and realize these may need revision later. Students identify important relationships between quantities in a practical situation and map these relationships using tools such as: diagrams, two-way tables, graphs, flowcharts, and formulas. Students analyze those relationships mathematically to draw conclusions and interpret the results in the context of the situation. Students are reflective of the results and may improve the model if it has not served the purpose.

5. Use appropriate tools strategically.
Students consider appropriate tools when solving a mathematical problem, including but not limited to: a) pencil and paper, b) concrete models, c) ruler, d) protractor, e) calculator, f) spreadsheet, and g) analytical software applications. Students familiar with mathematical tools make sound decisions about when each of these tools may be helpful and recognize both the insight to be gained and the limitations of the tool. Students may use a graphing calculator to analyze graphs of functions knowing that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Students may identify relevant external mathematical resources, such as digital content located on a website, and use those resources to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.
Students communicate using mathematically correct definitions in their own reasoning and in discussions with others. They state the meaning of symbols they choose, specify units of measure, and label axes in order to clarify the correspondence with quantities in a problem. Students accurately and efficiently calculate. They express numerical answers with the degree of precision appropriate for the problem context.

7. Look for and make use of structure.
Students look closely to discern a pattern or structure and holistically consider the overview. Students may shift perspectives if needed to gain understanding of the pattern or structure. Students in algebra may use patterns to create equivalent expressions, factor and solve equations, compose functions, and transform figures. They may consider certain algebraic expressions as single objects or as being composed of several objects. Students in geometry recognize the significance of an existing line in a geometric figure and may use the strategy of drawing an auxiliary line for solving problems

8. Look for and express regularity in repeated reasoning.
Students notice repeated calculations, look for general expressions to annotate the calculation, and consider potential shortcuts. Students maintain oversight of a process as they work to solve problems, derive formulas, or make generalizations, while attending to details. They assess the reasonableness of their intermediate results.

Mathematics | High School
Number and Quantity

Numbers and Number Systems. During the years from kindergarten to eighth grade, students must repeatedly extend their conception of number. At first, “number” means “counting number”: 1, 2, 3... Soon after that, 0 is used to represent “none” and the whole numbers are formed by the counting numbers together with zero. The next extension is fractions. At first, fractions are barely numbers and tied strongly to pictorial representations. Yet by the time students understand division of fractions, they have a strong concept of fractions as numbers and have connected them, via their decimal representations, with the base-ten system used to represent the whole numbers. During middle school, fractions are augmented by negative fractions to form the rational numbers. In Grade 8, students extend this system once more, augmenting the rational numbers with the irrational numbers to form the real numbers. In high school, students will be exposed to yet another extension of number, when the real numbers are augmented by the imaginary numbers to form the complex numbers.

With each extension of number, the meanings of addition, subtraction, multiplication, and division are extended. In each new number system—integers, rational numbers, real numbers, and complex numbers—the four operations stay the same in two important ways: They have the commutative, associative, and distributive properties and their new meanings are consistent with their previous meanings.

Extending the properties of whole-number exponents leads to new and productive notation. For example, properties of whole-number exponents suggest that (5^1/3)^3 should be 5^(1/3)^3 = 5^1 = 5 and that 5^1/3 should be the cube root of 5.

Calculators, spreadsheets, and computer algebra systems can provide ways for students to become better acquainted with these new number systems and their notation. They can be used to generate data for numerical experiments, to help understand the workings of matrix, vector, and complex number algebra, and to experiment with non-integer exponents.

Quantities. In real world problems, the answers are usually not numbers but quantities: numbers with units, involving measurement. In their work in measurement up through Grade 8, students primarily measure commonly used attributes such as length, area, and volume. In high school, students encounter a wider variety of units in modeling, for example, acceleration, currency conversions, derived quantities such as person-hours and heating degree days, social science rates such as per-capita income, and rates in everyday life such as points scored per game or batting averages. They also encounter novel situations in which they themselves must conceive the attributes of interest. For example, to find a good measure of overall highway safety, they might propose measures such as accidents per year, accidents per year per driver, or accidents per vehicle-mile traveled. Such a conceptual process is sometimes called quantification. Quantification is important for science, as when surface area suddenly “stands out” as an important variable in evaporation. Quantification is also important for companies, which must conceptualize relevant attributes and create or choose suitable measures for them.

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Real Number System

N.RN.A Extend the properties of exponents to rational exponents.	Mathematical Practices
N.RN.A.1 Explain how the meaning of the definition of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: $5^{1/3}$ is defined to be the cube root of 5, in order for $[5^{1/3}]^3 = 5^{[1/3x3]}$ to hold so that $[5^{1/3}]^3$ equals 5.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Number and Quantity
The Real Number System

N.RN.A Extend the properties of exponents to rational exponents.	Mathematical Practices
N.RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Examples:

- $\sqrt[3]{5^2} = 5^{\frac{2}{3}}$; $5^{\frac{2}{3}} = \sqrt[3]{5^2}$
- Rewrite using fractional exponents: $\sqrt[5]{16} = \sqrt[5]{2^4} = 2^{\frac{4}{5}}$
- Rewrite $\frac{\sqrt{x}}{x^2}$ in at least three alternate forms.

  Solution: $x^{-\frac{3}{2}} = \frac{1}{x^{\frac{3}{2}}} = \frac{1}{\sqrt{x^3}} = \frac{1}{x\sqrt{x}}$
- Rewrite $\sqrt[4]{2^{-4}}$ .using only rational exponents.
- Rewrite $\sqrt[3]{x^3+3x^2+3x+1}$ in simplest form.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Real Number System

N.RN.B Use properties of rational and irrational numbers.	Mathematical Practices
N.RN.B.3 Explain why the sum or product of rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Since every difference is a sum and every quotient is a product, this includes differences and quotients as well. Explaining why the four operations on rational numbers produce rational results can be a review of students understanding of fractions and negative numbers. Explaining why the sum of a rational number and an irrational number is irrational, or why the product is irrational, includes reasoning about the inverse relationship between addition and subtraction (or between multiplication and addition).

Example: Explain why the number 2π must be irrational, given that π is irrational. Answer: If 2π were rational, then half of 2π would also be rational, so π would have to be rational as well.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ Computational Thinking ☑ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
Quantities

N.Q.C Reason quantitatively and use units to solve problems.	Mathematical Practices
N.Q.C.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Modeling	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Two objects are moving at different rates. One is moving 12 feet per second and the other at 5 miles per hour. Which is moving faster? Answer: In one possible solution to compare speeds, students convert 12 feet per second to miles per hour.

(12 ft/sec)x(60sec/min)x(60min/hr)x(1mi/5280ft) equals approximately 8.182 miles per hour which is greater than 5 mph.

Graphical representations and data displays include, but are not limited to line graphs, circle graphs, histograms, multi-line graphs, scatterplots, and multi-bar graphs, utilizing appropriate scales for the axes.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer **5c** Computational Thinker		☑ **Computational Thinking** ☑ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
Quantities

N.Q.C Reason quantitatively and use units to solve problems.	Mathematical Practices
N.Q.C.2 Define appropriate quantities for the purpose of descriptive modeling.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Advanced Standards (+)/ STEM Pathway

Example

Example: What quantities would be used to determine monthly income and expenses?

Example: What quantities and measurements could be used to express the number of accidents in Wyoming?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer **5a** Computational Thinker **6b** Creative Communicator		☑ Computational Thinking ☑ Financial Literacy

Number and Quantity
Quantities

N.Q.C Reason quantitatively and use units to solve problems.	Mathematical Practices
N.Q.C.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Modeling	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

The margin of error and tolerance limit varies according to the measure, tool used, and context.

Example: Determining the price of gas by estimating to the nearest cent is appropriate because you will not pay a fraction of a cent but the cost of gas is $2.599/gallon.

Adapted from: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer **5a** Computational Thinker **6b** Creative Communicator		☑ **Computational Thinking** ☑ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Complex Number System

N.CN.D Perform arithmetic operations with complex numbers.	Mathematical Practices
N.CN.D.1 Know there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi with a and b real.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Complex numbers are made up of real and an imaginary numbers, a+b*i* , *a* and *b* are real numbers.

The imaginary number is *i.*

$i = \sqrt{-1} \qquad i^2 = (\sqrt{-1})^2$

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
6c Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity

The Complex Number System

N.CN.D Perform arithmetic operations with complex numbers.	Mathematical Practices
N.CN.D.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Simplify the following expression. Justify each step using the commutative, associative and distributive properties.

$(3-2i)(-7+4i)$

Solutions may vary: one solution follows:

$(3-2i)(-7+4i)$

$3(-7+4i)-2i(-7+4i)$	*Distributive Property*
$-21+12i+14i-8i^2$	*Distributive Property*
$-21+(12i+14i)-8i^2$	*Associative Property*
$-21+i(12+14)-8i^2$	*Distributive Property*
$-21+26i-8i^2$	*Computation*
$-21+26i-8(-1)$	$i^2=-1$
$-21+26i+8$	*Computation*
$-21+8+26i$	*Commutative Property*
$-13+26i$	*Computation*

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Complex Number System

N.CN.D Perform arithmetic operations with complex numbers.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway
N.CN.D.3 Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity

The Complex Number System

N.CN.E Represent complex numbers and their operations on the complex plane.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	

Advanced Standards (+)/ STEM Pathway

N.CN.E.4 Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Complex Number System

N.CN.E Represent complex numbers and their operations on the complex plane.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.CN.E.6 Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Complex Number System

N.CN.E Represent complex numbers and their operations on the complex plane.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.CN.E.5 Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + \sqrt{3}i)^3 = 8$ because $(-1 + \sqrt{3}i)$ has modulus 2 and argument 120°.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Complex Number System

N.CN.F Use complex numbers in polynomial identities and equations.	Mathematical Practices
N.CN.F.7 Solve quadratic equations with real coefficients that have complex solutions.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Within which number system can $x^2= -2$ be solved? Explain how you know.
Example: Solve $x^2+2x+2=0$ over the complex numbers.
Example: Find all solutions of $2x^2+5=2x$ and express them in the form *a+bi.*

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
6d Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Complex Number System

N.CN.F Use complex numbers in polynomial identities and equations.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.CN.F.8 Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
The Complex Number System

N.CN.F Use complex numbers in polynomial identities and equations.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.CN.F.9 Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
Vector and Matrix Quantities

N.VM.G Represent and model with vector quantities.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.VM.G.1 Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., **v** ,|**v**|, ||**v**||, v).

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
Vector and Matrix Quantities

N.VM.G Represent and model with vector quantities.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.VM.G.2 Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
Vector and Matrix Quantities

N.VM.G Represent and model with vector quantities.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Advanced Standards (+)/ STEM Pathway
N.VM.G.3 Solve problems involving velocity and other quantities that can be represented by vectors.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
Vector and Matrix Quantities

N.VM.H Perform operations on vectors.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.VM.H.4 Add and subtract vectors.

A. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.
B. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.
C. Understand vector subtraction v – w as v + (–w), where (–w) is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
Vector and Matrix Quantities

N.VM.H Perform operations on vectors.

Mathematical Practices

MP.1 **Make sense of problems and persevere in solving them.**
MP.2 **Reason abstractly and quantitatively.**
MP.3 **Construct viable arguments and critique the reasoning of others.**
MP.4 **Model with mathematics.**
MP.5 **Use appropriate tools strategically.**
MP.6 **Attend to precision.**
MP.7 **Look for and make use of structure.**
MP.8 **Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

N.VM.H.5 Multiply a vector by a scalar.

A. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise.
B. Compute the magnitude of a scalar multiple c**v** using ||c**v**|| = |c|v. Compute the direction of c**v** knowing that when |c|v ≠ 0, the direction of c**v** is either along **v** (for c > 0) or against **v** (for c < 0).

Example

Example: $c(v_x, v_y) = (cv_1, cv_y)$

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity

Vector and Matrix Quantities

N.VM.I Perform operations on matrices and use matrices in applications.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.VM.I.6 Use matrices to represent and manipulate data.

Example

Example: Represent payoffs or incidence relationships in a network.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity
Vector and Matrix Quantities

N.VM.I Perform operations on matrices and use matrices in applications.

Mathematical Practices

MP.1 **Make sense of problems and persevere in solving them.**
MP.2 **Reason abstractly and quantitatively.**
MP.3 **Construct viable arguments and critique the reasoning of others.**
MP.4 **Model with mathematics.**
MP.5 **Use appropriate tools strategically.**
MP.6 **Attend to precision.**
MP.7 **Look for and make use of structure.**
MP.8 **Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway
N.VM.I.7 Multiply matrices by scalars to produce new matrices.

Example

Example: When all of the payoffs in a game are doubled.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Number and Quantity
Vector and Matrix Quantities

N.VM.I Perform operations on matrices and use matrices in applications.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway
N.VM.I.8 Add, subtract, and multiply matrices of appropriate dimensions.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Number and Quantity

Vector and Matrix Quantities

N.VM.I Perform operations on matrices and use matrices in applications.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.VM.I.9 Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Number and Quantity
Vector and Matrix Quantities

N.VM.I Perform operations on matrices and use matrices in applications.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.VM.I.10 Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Number and Quantity
Vector and Matrix Quantities

N.VM.I Perform operations on matrices and use matrices in applications.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

N.VM.I.11 Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Number and Quantity
Vector and Matrix Quantities

N.VM.I Perform operations on matrices and use matrices in applications.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

N.VM.I.12 Work with 2 X 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS - Number and Quantity Resources

Standard/Page Number	Resource/Link
N.RN.A.2 on page 264.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
N.RN.B.3 on page 265.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
N.Q.C.2 on page 266.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
N.Q.C.2 on page 267.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
N.Q.C.3 on page 268.	Adapted from: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
N.CN.D.2 on page 270.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
N.CN.F.7 on page 275.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
Grade Level Math Practices on page 261.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | High School

Algebra

Expressions. An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances.

Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, p + 0.05p can be interpreted as the addition of a 5% tax to a price p. Rewriting p + 0.05p as 1.05p shows that adding a tax is the same as multiplying the price by a constant factor.

Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, p + 0.05p is the sum of the simpler expressions p and 0.05p. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure.

A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave.

Equations and inequalities. An equation is a statement of equality between two expressions. Other than formulas, an equation with one or more variables seeks the value(s) of the variable that makes the expressions equal. The value(s) is the solution to the equation. An identity or formula, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form.

The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system.
An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions.

Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of x + 1 = 0 is an integer, not a whole number; the solution of 2x + 1 = 0 is a rational number, not an integer; the solutions of x^2 – 2 = 0 are real numbers, not rational numbers; and the solutions of x^2 + 2 = 0 are complex numbers, not real numbers.

The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, A = ((b1+b2)/2)*h, can be solved for h using the same deductive process.
Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them.

Connections to Functions and Modeling. Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling.

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra

Seeing Structure in Expressions

A.SSE.A Interpret the structure of expressions.	Mathematical Practices
A.SSE.A.1 Interpret expressions that represent a quantity in terms of its context. **A.** Interpret parts of an expression, such as terms, factors, and coefficients. **B.** Interpret complicated expressions by viewing one or more of their parts as a single entity. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7** Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Students should understand the vocabulary for the parts that make up the whole expression and be able to identify those parts and interpret their meaning in terms of a context.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Science	ELA
HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. **HS-ESS1-2.** Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. **HS-PS2-4.** Use mathematical representations to predict the gravitational and/or electrostatic forces between objects using Newton's Law of Gravitation and/or Coulomb's Law, respectively. **HS-ESS1-1.** Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation. **HS-PS2-1.** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. **HS-ESS1-4.** Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.	**W.9-10.2.d** Use precise language and domain-specific vocabulary to manage the complexity of the topic. **W.11-12.2.d** Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ **Computational Thinking** ☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Seeing Structure in Expressions

A.SSE.A Interpret the structure of expressions.	Mathematical Practices
A.SSE.A.2 Use the structure of an expression to identify ways to rewrite it.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students should extract the greatest common factor (whether a constant, a variable, or a combination of each). If the remaining expression is quadratic, students should factor the expression further.

Example:

Factor:

$3x^3 + 9x^2 - 30x$

$3x(x^2 + 3x - 10)$

$3x(x - 2)(x + 5)$

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra

Seeing Structure in Expressions

A.SSE.B Write expressions in equivalent forms to solve problems.	Mathematical Practices
A.SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. A. Factor a quadratic expression to reveal the zeros of the function it defines. B. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. C. Use the properties of exponents to transform expressions for exponential functions. Apply the concepts of decimal and scientific notation to solve real-world and mathematical problems. i. Multiply and divide numbers expressed in both decimal and scientific notation. ii. Add and subtract numbers in scientific notation with the same integer exponent. Modeling	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students will use the properties of operations to create equivalent expressions.

Example: Express $2(x^2 – 2x – 3) – (x – 3)(x + 4)$ in factored form and use your answer to say for what values of x the expression is zero.

$2(x – 3)(x + 1) – (x – 3) (x + 4)$
$(x – 3)[2(x + 1) – (x + 4)$
$(x – 3) (2x + 2 – x – 4)$
$(x – 3) (x – 2)$
X = 2 or 3 when the expression's value is zero.

Example: Write the expression below as constant times a power of x and use your answer to decide whether the expression gets larger or smaller as x gets larger.

$(3x^4)(2x^3)^2/(x^2)^3$, $x \neq 0$ $(3x^4)(4x^6) / x^6$ is $12x^4$, which gets larger as *x* gets larger.

Example:
$2x^2 – 4x – 6$
$2(x^2 – 2x – 3)$
$2(x^2 – 2x + 1) – 3 – 1$
$2(x – 1)^2 – 4$
The function has a minimum at (1, -4).
Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Science

HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS2-4. Use mathematical representations to predict the gravitational and/or electrostatic forces between objects using Newton's Law of Gravitation and/or Coulomb's Law, respectively.

HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

Cross-Disciplinary Connections

ISTE	Computer Science	
5c Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

Algebra

Seeing Structure in Expressions

A.SSE.B Write expressions in equivalent forms to solve problems.	Mathematical Practices
A.SSE.B.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Modeling

Advanced Standards (+)/ STEM Pathway

Example

Example: Calculate mortgage payments or saving for a vacation trip:

- In January, the Sanderlin family starts saving for a trip to Austria in August. The Sanderlin's expect their vacation to cost $5750. They start with $425. Each month they plan to deposit 25% more than the previous month. Will they have enough money for their trip?

Adapted from: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
5c Computational Thinker		☑ **Computational Thinking** ☑ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra

Arithmetic with Polynomials and Rational Expressions

A.APR.C Perform arithmetic operations on polynomials.	Mathematical Practices
A.APR.C.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Arithmetic with Polynomials and Rational Expressions

A.APR.D Understand the relationship between zeros and factors of polynomials.

Mathematical Practices

A.APR.D.2 Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

The Remainder theorem says that if a polynomial p(x) is divided by x – a, then the remainder is the constant p(a). That is, p(x)=q(x)(x – a)+ p(a). So if p(a) = 0 then p(x) = q(x)(x-a).

Example: · Let $p(x)= x^5 -3x^4 +8x^2- 9x + 30$. Evaluate p(-2).

What does your answer tell you about the factors of p(x)?

Answer: p(-2) = 0 so x+2 is a factor.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra

Arithmetic with Polynomials and Rational Expressions

A.APR.D Understand the relationship between zeros and factors of polynomials.	Mathematical Practices
A.APR.D.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Arithmetic with Polynomials and Rational Expressions

A.APR.E Use polynomial identities to solve problems.	Mathematical Practices
A.APR.E.4 Prove polynomial identities and use them to describe numerical relationships.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Arithmetic with Polynomials and Rational Expressions

A.APR.E Use polynomial identities to solve problems.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

A.APR.E.5 Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Arithmetic with Polynomials and Rational Expressions

A.APR.F Rewrite rational expressions.	Mathematical Practices
A.APR.F.6 Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b (x) using inspection, long division, or, for the more complicated examples, a computer algebra system. (i.e. rewriting a rational expression as the quotient plus the remainder over divisor).	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

The polynomial *q*(*x*) is called the quotient and the polynomial *r*(*x*) is called the remainder. Expressing a rational expression in this form allows one to see different properties of the graph, such as horizontal asymptotes.

Examples:

- Find the quotient and remainder for the rational expression $\frac{x^3-3x^2+x-6}{x^2+2}$ and use them to write the expression in a different form.
- Express $f(x) = \frac{2x+1}{x-1}$ in a form that reveals the horizontal asymptote of its graph.

[Answer: $f(x) = \frac{2x+1}{x-1} = \frac{2(x-1)+3}{x-1} = 2+\frac{3}{x-1}$, so the horizontal asymptote is *y* = 2.]

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Arithmetic with Polynomials and Rational Expressions

A.APR.F Rewrite rational expressions.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

A.APR.F.7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra
Creating Equations

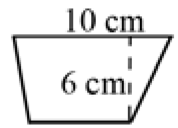
A.CED.G Create equations that describe numbers or relationships.	Mathematical Practices
A.CED.G.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. Modeling	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Equations can represent real world and mathematical problems. Include equations and inequalities that arise when comparing the values of two different functions, such as one describing linear growth and one describing exponential growth.

Example: Given that the following trapezoid has area 54 cm², set up an equation to find the length of the base, and solve the equation.



Example: Lava coming from the eruption of a volcano follows a parabolic path. The height h in feet of a piece of lava t seconds after it is ejected from the volcano is given by $h(t) = -t^2 + 16t + 936$. After how many seconds does the lava reach its maximum height of 1000 feet?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Science

HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Cross-Disciplinary Connections

ISTE	Computer Science	
3d Knowledge Constructor **4d** Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra
Creating Equations

A.CED.G Create equations that describe numbers or relationships.	Mathematical Practices
A.CED.G.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Modeling	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Wyoming Cross-Disciplinary Connections

Science

HS-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.

HS-ESS1-2 Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

HS-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

Cross-Disciplinary Connections

ISTE	Computer Science	
3d Knowledge Constructor **4d** Innovative Designer **5c** Computational Thinker	**3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena.	☑ **Computational Thinking** ☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Algebra
Creating Equations

A.CED.G Create equations that describe numbers or relationships.	Mathematical Practices
A.CED.G.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. Modeling	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example:
A club is selling hats and jackets as a fundraiser. Their budget is $1500 and they want to order a least 250 items. They must buy at least as many hats as they buy jackets. Each hat costs $5 and each jacket costs $8.

- Write a system of inequalities to represent the situation.
- Graph the inequalities.
- If the club buys 150 hats and 100 jackets, will the conditions be satisfied?
- What is the maximum number of jackets they can buy and still meet the conditions?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer **5c** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

HS Wyoming 2018 Mathematics Content and Performance Standards

Algebra
Creating Equations

A.CED.G Create equations that describe numbers or relationships.

Mathematical Practices

A.CED.G.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Modeling

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: The Pythagorean Theorem expresses the relation between the legs a and b of a right triangle and its hypotenuse c with the equation $a^2 + b^2 = c^2$.

- Why might the theorem need to be solved for c?
- Solve the equation for c and write a problem situation where this form of the equation might be useful.
- Solve $V = 4/3\pi r^3$ for radius r.

Example: Motion can be described by the formula below, where t = *time elapsed*, u=initial velocity, a = acceleration, and s = distance traveled $s = ut+½at^2$.

- Why might the equation need to be rewritten in terms of a?
- Rewrite the equation in terms of a.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Science

HS-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.

HS-ESS1-2 Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

HS-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer **5c** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra

Reasoning with Equations and Inequalities

A.REI.H Understand solving equations as a process of reasoning and explain the reasoning.	Mathematical Practices
A.REI.H.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Properties of operations can be used to change expressions on either side of the equation to equivalent expressions. In addition, adding the same term to both sides of an equation or multiplying both sides by a non-zero constant produces an equation with the same solutions. Other operations, such as squaring both sides, may produce equations that have extraneous solutions.

Example:
Explain why the equation $x/2 + 7/3 = 5$ has the same solutions as the equation $3x + 14 = 30$. Does this mean that $x/2 + 7/3$ is equal to $3x + 14$?

Example:
Show that $x = 2$ and $x = -3$ are solutions to the equation $x^2 + x = 6$. Write the equation in a form that shows these are the only solutions, explaining each step in your reasoning.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

CVE

CV12.44 College and career-ready students precisely follow a complex multistep procedure when performing technical tasks.

Cross-Disciplinary Connections

ISTE	Computer Science	
3d Knowledge Constructor **4d** Innovative Designer **5c** Computational Thinker **6a,b,c,d** Creative Communicator		☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra

Reasoning with Equations and Inequalities

A.REI.H Understand solving equations as a process of reasoning and explain the reasoning.

A.REI.H.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Examples:

- $\sqrt{x+2} = 5$
- $\frac{7}{8}\sqrt{2x-5} = 21$
- $\frac{x+2}{x+3} = 2$
- $\sqrt{3x-7} = -4$

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

CVE

CV12.44 College and career-ready students precisely follow a complex multistep procedure when performing technical tasks.

Cross-Disciplinary Connections

ISTE

4d Innovative Designer

Computer Science

☐ **Computational Thinking**

☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Reasoning with Equations and Inequalities

A.REI.I Solve equations and inequalities in one variable.	Mathematical Practices
A.REI.I.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
5a Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra

Reasoning with Equations and Inequalities

A.REI.I Solve equations and inequalities in one variable.

A.REI.I.4 Solve quadratic equations in one variable.

A. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions.

B. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

C. Derive the quadratic formula from the general form of a quadratic equation.

Example

Students should solve by factoring, completing the square, and using the quadratic formula. The zero product property is used to explain why the factors are set equal to zero. Students should relate the value of the discriminant to the type of root to expect. A natural extension would be to relate the type of solutions to $ax^2 + bx + c = 0$ to the behavior of the graph of $y = ax^2 + bx + c$.

Value of Discriminant	Nature of Roots	Nature of Graph
$b^2-4ac = 0$	1 real root	intersects x-axis once
$b^2-4ac > 0$	2 real roots	intersects x-axis twice
$b^2-4ac < 0$	2 complex roots	does not intersect x-axis

Examples: Are the roots of $2x^2 + 5 = 2x$ real or complex? How many roots does it have? Find all solutions of the equation.

Examples: What is the nature of the roots of $x^2 + 6x + 10 = 0$? Solve the equation using the quadratic formula and completing the square. How are the two methods related?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
5a Computational Thinker		☑ **Computational Thinking**
		☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Reasoning with Equations and Inequalities

A.REI.J Solve systems of equations.	Mathematical Practices
A.REI.J.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other, produces a system with the same solutions.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example:

Given that the sum of two numbers is 10 and their difference is 4, what are the numbers?

Explain how your answer can be deduced from the fact that they two numbers, x and y, satisfy the equations $x + y = 10$ and $x – y = 4$.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Reasoning with Equations and Inequalities

A.REI.J Solve systems of equations.	Mathematical Practices
A.REI.J.6 Estimate solutions graphically and determine algebraic solutions to linear systems, focusing on pairs of linear equations in two variables.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

Example

Example:

Two friends are driving to the Grand Canyon in separate cars. Suzette has been there before and knows the way, but Andrea does not. During the trip Andrea gets ahead of Suzette and pulls over to wait for her. Suzette is traveling at a constant rate of 65 miles per hour. Andrea sees Suzette drive past. To catch up, Andrea accelerates at a constant rate. The distance in miles (d) that her car travels as a function of time in hours (t) since Suzette's car passed is given by $d = 3500t^2$.

- Write and solve a system of equations to determine how long it takes for Andrea to catch up with Suzette.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Reasoning with Equations and Inequalities

A.REI.J Solve systems of equations.	Mathematical Practices
A.REI.J.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example:

Given that the sum of two numbers is 10 and their difference is 4, what are the numbers?

Explain how your answer can be deduced from the fact that they two numbers, x and y, satisfy the equations $x + y = 10$ and $x – y = 4$.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **4d** Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Algebra

Reasoning with Equations and Inequalities

A.REI.J Solve systems of equations.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

A.REI.J.8 Represent a system of linear equations as a single matrix equation in a vector variable.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Algebra

Reasoning with Equations and Inequalities

A.REI.J Solve systems of equations.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

A.REI.J.9 Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Reasoning with Equations and Inequalities

A.REI.K Represent and solve equations and inequalities graphically.	Mathematical Practices
A.REI.K.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example:

Which of the following points is on the circle with equation $(x - 1)^2 + (y + 2)^2 = 5$?

a. (1, -2)

b. (2, 2)

c. (3, -1)

d. (3, 4)

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Algebra

Reasoning with Equations and Inequalities

A.REI.K Represent and solve equations and inequalities graphically.

Mathematical Practices

A.REI.K.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Modeling

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that can be represented graphically or numerically. Students may use graphing calculators or programs to generate tables of values, graph, or solve a variety of functions.

Example:
Given the following equations determine the x value that results in an equal output for both functions.

$f(x) = 3x - 2$

$g(x) = (x+3)^2 - 1$

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Algebra

Reasoning with Equations and Inequalities

A.REI.K Represent and solve equations and inequalities graphically.

Mathematical Practices

A.REI.K.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Students may use graphing calculators, programs, or applets to model and find solutions for inequalities or systems of inequalities.

Example:

Graph the solution: $y \leq 2x + 3$.

Example:

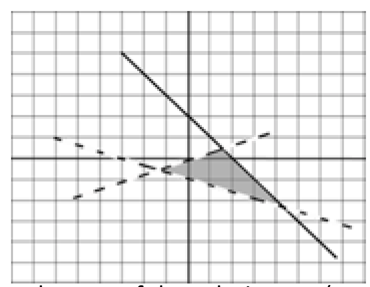
A publishing company publishes a total of no more than 100 magazines every year. At least 30 of these are women's magazines, but the company always publishes at least as many women's magazines as men's magazines. Find a system of inequalities that describes the possible number of men's and women's magazines that the company can produce each year consistent with these policies. Graph the solution set.

Example:

Graph the system of linear inequalities below and determine if (3, 2) is a solution to the system.

$$\begin{cases} x - 3y > 0 \\ x + y \leq 2 \\ x + 3y > -3 \end{cases}$$

Solution:



(3, 2) is not an element of the solution set (graphically or by substitution).

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

HS - Algebra Resources

Standard/Page Number	Resource/Link
A.SSE.A.1 on page 292.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.SSE.A.2 on page 293.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.SSE.B.3 on page 294.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.SSE.B.3 on page 295.	Adapted from: http://www.azed.gov/standards-practices/k-12standards/mathematics-
A.APR.D.2 on page 297.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.APR.F.6 on page 301.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.CED.G.1 on page 303.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.CED.G.3 on page 305.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.CED.G.4 on page 306.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.REI.H.1 on page 307.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.REI.H.2 on page 308.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.REI.I.4 on page 310.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.REI.J.5 on page 311.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

HS - Algebra Resources

Standard/Page Number	Resource/Link
A.REI.J.6 on page 312.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.REI.J.7 on page 313.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.REI.K.10 on page 316.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.REI.K.11 on page 317.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
A.REI.K.12 on page 318.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
Grade Level Math Practices on page 261.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | High School

Functions

Functions describe situations where one quantity determines another. For example, the return on $10,000 invested at an annualized percentage rate of 4.25% is a function of the length of time the money is invested. Because we continually make theories about dependencies between quantities in nature and society, functions are important tools in the construction of mathematical models.

The set of inputs to a function is called its domain. We often infer the domain to be all inputs for which the expression defining a function has a value, or for which the function makes sense in a given context.

In school mathematics, functions usually have numerical inputs from the domain and outputs forming the range that are often defined by an algebraic expression. For functions, each input maps to only one output. For example, the time in hours it takes for a car to drive 100 miles is a function of the car's speed in miles per hour, v; the rule $T(v) = 100/v$ expresses this relationship algebraically and defines a function whose name is T.

A function can be described in various ways, such as by a graph (e.g., the trace of a seismograph); by a verbal rule, as in, "I'll give you a state, you give me the capital city;" by an algebraic expression like $f(x) = a + bx$; or by a recursive rule. The graph of a function is often a useful way of visualizing the relationship of the function models. Manipulating a mathematical expression for a function can further explain the functions properties.

Functions presented as expressions can model many important phenomena. Two important families of functions characterized by laws of growth are linear functions, which grow at a constant rate, and exponential functions, which grow at a constant percent rate. Linear functions with a constant term of zero describe proportional relationships.

A graphing utility or a computer algebra system can be used to experiment with properties of these functions and their graphs and to build computational models of functions, including recursively defined functions.

Connections to Expressions, Equations, Modeling, and Coordinates.

Determining an output value for a particular input involves evaluating an expression; finding inputs that yield a given output involves solving an equation. Questions about when two functions have the same value for the same input lead to equations, whose solutions can be visualized from the intersection of their graphs. Because functions describe relationships between quantities, they are frequently used in modeling. Sometimes functions are defined by a recursive process, which can be displayed effectively using a spreadsheet or other technology.

Wyoming 2018 Mathematics Content and Performance Standards

HS

Functions

Interpreting Functions

F.IF.A Understand the concept of a function and use function notation.	Mathematical Practices
F.IF.A.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: The domain of a function given by an algebraic expression, unless otherwise specified, is the largest possible domain.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Interpreting Functions

F.IF.A Understand the concept of a function and use function notation.

Mathematical Practices

F.IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

The domain of a function given by an algebraic expression, unless otherwise specified, is the largest possible domain.

Example:

If f(x) = x2 + 4x—12, find f(2).

Example:

Let $f(x) = 2(x+3)^2$, find f(3), f(-1/2), f(a), and f(a-h).

If P(*t*) is the population of Tucson *t* years after 2000, interpret the statements

P(0) = 487,000 and P(10)- P(9) = 5,900.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	
4a Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Interpreting Functions

F.IF.A Understand the concept of a function and use function notation.

Mathematical Practices

F.IF.A.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 **Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

Example

Example: The Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	
4a Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Functions

Interpreting Functions

F.IF.B Interpret functions that arise in application in terms of the context.

F.IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Example

Students may be given graphs to interpret or produce graphs given an expression or table for the function, by hand or using technology.

Example: A rocket is launched from 180 feet above the ground at time $t = 0$. *The function that models this situation is given by* $h = -16t^2 + 96t + 180$, *where t is measured in seconds and h is height above the ground measured in feet.*

- What is a reasonable domain restriction for *t in this context?*
- Determine the height of the rocket two seconds after it was launched.
- Determine the maximum height obtained by the rocket.
- Determine the time when the rocket is 100 feet above the ground.
- Determine the time at which the rocket hits the ground.
- How would you refine your answer to the first question based on your response to the second and fifth questions?

Example: Compare the graphs of $y = 3x^2$ *and* $y = 3x^3$.

Example: Let $R(x) = \frac{2}{\sqrt{x-2}}$. Find the domain of *R(x). Also find the range, zeros, and asymptotes of R(x).*

Example: Let $f(x) = 5x^3 - x^2 - 5x + 1$. Graph the function and identify end behavior and any intervals of constancy, increase, and decrease.

Example: Rain fell lightly at 3pm, then became heavier at 6pm. By 8pm the storm ended, with a total rainfall of 4 inches. No further rain fell for the rest of the day. Sketch a possible graph for the number of inches of rain as a function of time, from midday to midnight.

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
3d Knowledge Constructor **4a,d** Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Interpreting Functions

F.IF.B Interpret functions that arise in application in terms of the context.	Mathematical Practices
F.IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Modeling	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may explain orally, or in written format, the existing relationships. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

Wyoming Cross-Disciplinary Connections

Science

HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

Cross-Disciplinary Connections

ISTE	Computer Science	
4a Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Interpreting Functions

F.IF.B Interpret functions that arise in application in terms of the context.

Mathematical Practices

F.IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Modeling

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

The average rate of change of a function y = f(x) over an interval [a,b] is f(b) - f(a)/b — a

In addition to finding average rates of change from functions given symbolically, graphically, or in a table, Students may collect data from experiments or simulations (ex. falling ball, velocity of a car, etc.) and find average rates of change for the function modeling the situation.

Example: Use Table 1 to find the average rate of change of g over the intervals [-2, -1] and [0,2]:

x	*g(x)*
-2	2
-1	-1
0	-4
2	-10

Table 1

	Car 1	Car 2
D	t	t
10	4.472	1.742
20	6.3225	2.899
30	7.746	3.831
40	8.944	4.633
50	10	5.348

Table 2

Example: Table 2 shows the elapsed time when two different cars pass a 10, 20, 30, 40 and 50 meter mark on a test track.

- For car 1, what is the average velocity (change in distance divided by change in time) between the 0 and 10 meter mark? Between the 0 and 50 meter mark? Between the 20 and 30 meter mark? Analyze the data to describe the motion of car 1.
- How does the velocity of car 1 compare to that of car 2?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	Computational Thinking / Financial Literacy
4a,d Innovative Designer		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Interpreting Functions

F.IF.C Analyze functions using different representations.

F.IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

A. Graph linear and quadratic functions and show intercepts, maxima, and minima.

B. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

C. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

E. Graph exponential and logarithmic functions, showing intercepts and end behavior.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

D. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

F. Graph trigonometric functions, showing period, midline, and amplitude.

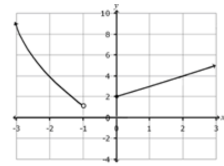
Example

Key characteristics include but are not limited to maxima, minima, intercepts, symmetry, end behavior, and asymptotes. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions.

Example:

- Describe key characteristics of the graph of f(x) = |x – 3| + 5.
- Sketch the graph and identify the key characteristics of the function described below.

$$F(x) = \begin{cases} x + 2 \text{ for } x \geq 0 \\ -x^2 \text{ for } x < -1 \end{cases}$$



- Graph the function f(x) = 2^x by creating a table of values. Identify the key characteristics of the graph.
- Graph f(x) = 2 tan x – 1. Describe its domain, range, intercepts, and asymptotes.

Draw the graph of f(x) = sin x and f(x) = cos x. What are the similarities and differences between the two graphs?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Science

HS-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-6 Construct explanations and revise, as needed, based on evidence for: 1) how carbon, hydrogen, and oxygen may combine with other elements to form amino acids and/or other large carbon-based molecules, and 2) how other hydrocarbons may also combine to form large carbon-based molecules.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **4a,d** Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Functions

Interpreting Functions

F.IF.C Analyze functions using different representations.	Mathematical Practices
F.IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. A. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. **B.** Use the properties of exponents to interpret expressions for exponential functions.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
4a Innovative Designer		☐ **Computational Thinking** ☑ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Functions

Interpreting Functions

F.IF.C Analyze functions using different representations.	Mathematical Practices
F.IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

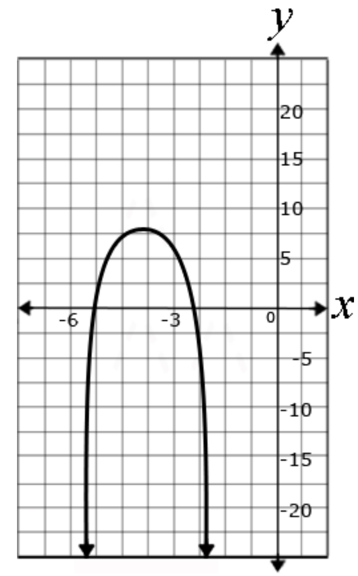
Example

For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Example:

- Examine the functions below. Which function has the larger maximum? How do you know?

$F(x) = -2x^2 — 8x + 20$



Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Building Functions

F.BF.D Build a function that models a relationship between two quantities.	Mathematical Practices
F.BF.D.1 Write a function that describes a relationship between two quantities. A. Determine an explicit expression, a recursive process, or steps for calculation from a context. B. Combine standard function types using arithmetic operations. Modeling	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

C. Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.

Example

Students will analyze a given problem to determine the function expressed by identifying patterns in the function's rate of change. They will specify intervals of increase, decrease, constancy, and, if possible, relate them to the function's description in words or graphically. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions .

Example:

- You buy a $20,000 car with an annual interest rate of 5 percent compounded annually and make monthly payments of $550. Express the amount remaining to be paid off as a function of the number of months, using a recursion equation.
- A cup of coffee is initially at a temperature of 97º F. The difference between its temperature and the room temperature of 70° F decreases by 8% each minute. Write a function describing the temperature of the coffee as a function of time.
- The radius of a circular oil slick after t hours is given in feet by $r = 10t^2 — 0.5t$, for $0 \le t \le 10$. Find the area of the oil slick as a function of time.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Science	ELA
HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. **HS-LS1-4** Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.	**W.9-10.2.d** Use precise language and domain-specific vocabulary to manage the complexity of the topic. **W.9-10.2.e** Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. **W.11-12.1.d** Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. **W.11-12.2.d** Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
4a Innovative Designer **5a,c** Computational Thinker		☑ **Computational Thinking** ☑ **Financial Literacy**

HS

Functions
Building Functions

F.BF.D Build a function that models a relationship between two quantities.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

F.BF.D.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Functions
Building Functions

F.BF.E Build new functions from existing functions.

F.BF.E.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

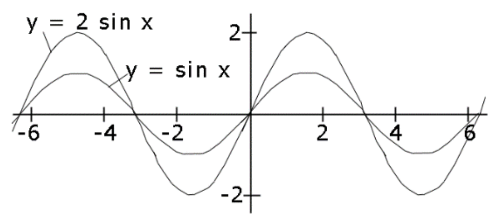
Students will apply transformations to functions and recognize functions as even and odd. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions.

Example: Is $f(x) = x^3 - 3x^2 + 2x + 1$ even, odd, or neither? Explain your answer orally or in written format.

Example: Describe effect of varying the parameters a, h, and k have on the shape and position of the graph of $f(x) = a(x-h)^2 + k$

Example: Describe the effect of varying the parameters a, h, and k on the shape and position of the graph $f(x) = ab^{(x + h)} + k$, orally or in written format. What effect do values between 0 and 1 have? What effect do negative values have?

Example: Compare the shape and position of the graphs of y = sin x to y = 2 sin x.



Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
4a Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Building Functions

F.BF.E Build new functions from existing functions.	Mathematical Practices
F.BF.E.4 Find inverse functions. A. Write an expression for the inverse of a simple, invertible function f(x). Understand that an inverse function can be obtained by expressing the dependent variable of one function as the independent variable of another, as f and g are inverse functions, if and only if, f(x) = y and g(y) = x, for all values of x in the domain of f and all values of y in the domain of g.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

B. Verify by composition that one function is the inverse of another.
C. Read values of an inverse function from a graph or a table, given that the function has an inverse.
D. Produce an invertible function from a non-invertible function by restricting the domain.

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model functions.

Examples:

- For the function $h(x) = (x - 2)^3$, defined on the domain of all real numbers, find the inverse function if it exists or explain why it doesn't exist.
- Graph h(x) and $h^{-1}(x)$ and explain how they relate to each other graphically.

Example: Find a domain for $f(x) = 3x^2 + 12x - 8$ on which it has an inverse. Explain why it is necessary to restrict the domain of the function.

Example: $f(x) = 2x^3$ or $f(x) = (x + 1) / (x - 1)$ for $x \neq 1$.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Building Functions

F.BF.E Build new functions from existing functions.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

F.BF.E.5 Build new functions from existing functions. Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Functions

Linear, Quadratic, and Exponential Models

F.LE.F Construct and compare linear, quadratic, and exponential models and solve problems.

F.LE.F.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

A. Verify that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.

B. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

C. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and compare linear and exponential functions.

Example:

A cell phone company has three plans. Graph the equation for each plan, and analyze the change as the number of minutes used increases. When is it beneficial to enroll in Plan 1? Plan 2? Plan 3?

1. $59.95/month for 700 minutes and $0.25 for each additional minute.

2. $39.95/month for 400 minutes and $0.15 for each additional minute, and 3. $89.95/month for 1,400 minutes and $0.05 for each additional minute. A computer store sells about 200 computers at the price of $1,000 per computer. For each $50 increase in price, about ten fewer computers are sold. How much should the computer store charge per computer in order to maximize their profit?

Example: Students can investigate functions and graphs modeling different situations involving simple and compound interest.

Example: Students can compare interest rates with different periods of compounding (monthly, daily) and compare them with the corresponding annual percentage rate.

Example: Spreadsheets and applets can be used to explore and model different interest rates and loan terms.

Example: Students can use graphing calculators or programs, spreadsheets, or computer algebra systems to construct linear and exponential functions.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3d** Knowledge Constructor **5a** Computational Thinker **6a,b,c,d** Creative Communicator		☑ **Computational Thinking** ☑ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Linear, Quadratic, and Exponential Models

F.LE.F Construct and compare linear, quadratic, and exponential models and solve problems.

F.LE.F.2 Construct linear and exponential functions using a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to construct linear and exponential functions.

Examples:

Determine an exponential function of the form $f(x) = ab^x$ using data points from the table. Graph the function and identify the key characteristics of the graph.

x	*f(x)*
0	1
1	3
3	27

Sara's starting salary is $32,500. Each year she receives a $700 raise. Write a sequence in explicit form to describe the situation.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

.

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
4a,d Innovative Designer		☑ **Computational Thinking**
5c Computational Thinker		☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Linear, Quadratic, and Exponential Models

F.LE.F Construct and compare linear, quadratic, and exponential models and solve problems.	Mathematical Practices
F.LE.F.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. Modeling	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example:

- Contrast the growth of the $f(x)=x^3$ and $f(x)=3^x$.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Functions

Linear, Quadratic, and Exponential Models

F.LE.F Construct and compare linear, quadratic, and exponential models and solve problems.	Mathematical Practices
F.LE.F.4 For exponential models, express as a logarithm the solution to $ab^{(ct)} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to analyze exponential models and evaluate logarithms.

Example:

Solve 200 $e.^{0.04t} = 450$ for t.

Solution:

We first isolate the exponential part by dividing both sides of the equation by 200.

$e^{0.04t} = 2.25$

Now we take the natural logarithm of both sides.

$\ln e^{0.04t} = \mathit{ln}\ 2.25$

The left hand side simplifies to 0.04t, by logarithmic identity 1.

$0.04t = \mathit{ln}\ 2.25$

Lastly, divide both sides by 0.04.

$t = \mathit{ln}\ (2.25) / 0.04$

$t \approx 20.3$

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Linear, Quadratic, and Exponential Models

F.LE.F Interpret expressions for functions in terms of the situation they model.	Mathematical Practices
F.LE.F.5 Interpret the parameters in a linear or exponential function in terms of a context.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Advanced Standards (+)/ STEM Pathway

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and interpret parameters in linear, quadratic or exponential functions.

Example:
A function of the form $f(n) = P(1+r)^n$ is used to model the amount of money in a savings account that earns 3% interest, compounded annually, where n is the number of years since the initial deposit. What is the value of r? What is the meaning of the constant P in terms of the savings account? Explain either orally or in written format.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
4a,d Innovative Designer	**3B-DA-05** Use data analysis tools and techniques to identify patterns in data representing	☑ **Computational Thinking** ☐ **Financial Literacy**

Functions

Trigonometric Functions

F.TF.H Extend the domain of trigonometric functions using the unit circle.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

F.TF.H.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Trigonometric Functions

F.TF.H Extend the domain of trigonometric functions using the unit circle.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

F.TF.H.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Trigonometric Functions

F.TF.H Extend the domain of trigonometric functions using the unit circle.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Advanced Standards (+)/ STEM Pathway

F.TF.H.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosine, and tangent for π - x, π + x, and 2π - x in terms of their values for x, where x is any real number.

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Trigonometric Functions

F.TF.H Extend the domain of trigonometric functions using the unit circle.	Mathematical Practices	Example
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.	

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

F.TF.H.4 Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Trigonometric Functions

F.TF.I Model periodic phenomena with trigonometric functions.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

F.TF.I.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Functions

Trigonometric Functions

F.TF.I Model periodic phenomena with trigonometric functions.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

F.TF.I.6 Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Functions

Trigonometric Functions

F.TF.I Model periodic phenomena with trigonometric functions.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

F.TF.I.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Trigonometric Functions

F.TF.J Prove and apply trigonometric identities.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

F.TF.J.8 Prove the Pythagorean identity $(\sin A)^2 + (\cos A)^2 = 1$ and use it to find sin A, cos A, or tan A, given sin A, cos A, or tan A, and the quadrant of the angle.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Functions

Trigonometric Functions

F.TF.J Prove and apply trigonometric identities.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

F.TF.J.9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

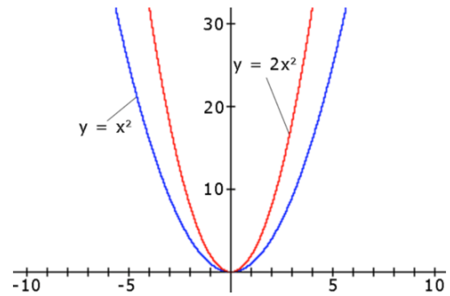
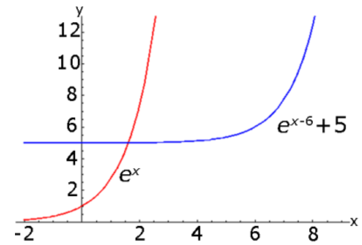
Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS - Functions Resources

Standard/Page Number	Resource/Link
F.IF.A.1 on page 322.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.IF.A.2 on page 323.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.IF.B.4 on page 325.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.IF.B.6 on page 327.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.IF.C.7 on page 328.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.IF.C.9 on page 330.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.BF.D.1 on page 331.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.BF.E.3 on page 333.	**Example:** Compare the shape and position of the graphs of $f(x) = x^2$ and $g(x) = 2x^2$, and explain the differences in terms of the algebraic expressions for the functions.  **Example:** Compare the shape and position of the graphs of $f(x) = e^x$ to $g(x) = e^{x-6}$, and explain the differences, orally or in written format, in terms of the algebraic expressions for the functions.  http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

HS - Functions Resources

Standard/Page Number	Resource/Link
F.BF.E.4 on page 334.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.LE.F.1 on page 336.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.LE.F.2 on page 337.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.LE.F.3 on page 338.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.LE.F.4 on page 339.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
F.LE.F.5 on page 340.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
Grade Level Math Practices on page 261.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | High School

Geometry

An understanding of the attributes and relationships of geometric objects can be applied in diverse contexts—interpreting a schematic drawing, estimating the amount of wood needed to frame a sloping roof, rendering computer graphics, or designing a sewing pattern for the most efficient use of material.

Although there are many types of geometry, school mathematics is devoted primarily to plane Euclidean geometry, studied both synthetically (without coordinates) and analytically (with coordinates). Euclidean geometry is characterized most importantly by the Parallel Postulate, that through a point not on a given line there is exactly one parallel line. (Spherical geometry, in contrast, has no parallel lines.)

During high school, students begin to formalize their geometry experiences from elementary and middle school, using more precise definitions and developing careful proofs. Later in college some students develop Euclidean and other geometries carefully from a small set of axioms.

The concepts of congruence, similarity, and symmetry can be understood from the perspective of geometric transformation. Fundamental are the rigid motions: translations, rotations, reflections, and combinations of these, all of which are here assumed to preserve distance and angles (and therefore shapes generally). Reflections and rotations each explain a particular type of symmetry, and the symmetries of an object offer insight into its attributes—as when the reflective symmetry of an isosceles triangle assures that its base angles are congruent.

In the approach taken here, two geometric figures are defined to be congruent if there is a sequence of rigid motions that carries one onto the other. This is the principle of superposition. For triangles, congruence means the equality of all corresponding pairs of sides and all corresponding pairs of angles. Through experiences of drawing triangles from given conditions, students notice ways to specify enough measures in a triangle to ensure that all triangles drawn with those measures are congruent. Once these triangle congruence criteria (ASA, SAS, and SSS) are established using rigid motions, they can be used to prove theorems about triangles, quadrilaterals, and other geometric figures.

Similarity transformations (rigid motions followed by dilations) define similarity in the same way that rigid motions define congruence, thereby formalizing the similarity ideas of "same shape" and "scale factor" developed in the middle grades. These transformations lead to the criterion for triangle similarity that two pairs of corresponding angles are congruent.

The definitions of sine, cosine, and tangent for acute angles are founded on right triangles and similarity, and, with the Pythagorean Theorem, are fundamental in many real-world and theoretical situations. The Pythagorean Theorem is generalized to non-right triangles by the Law of Cosines. Together, the Laws of Sines and Cosines embody the triangle congruence criteria for the cases where three pieces of information suffice to completely solve a triangle. Furthermore, these laws yield two possible solutions in the ambiguous case, illustrating that Side-Side-Angle is not a congruence criterion.

Analytic geometry connects algebra and geometry, resulting in powerful methods of analysis and problem solving. A number line associates numbers with locations in one dimension while a pair of perpendicular axes associates pairs of numbers with locations in two dimensions.

Dynamic geometry environments provide students with experimental and modeling tools that allow them to investigate geometric phenomena in much the same way as computer algebra systems allow them to experiment with algebraic phenomena.

Connections to Equations. The correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof. Geometric transformations of the graphs of equations correspond to algebraic changes in their equations.

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry
Congruence

G.CO.A Experiment with transformations in the plane.	Mathematical Practices
G.CO.A.1 Apply precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Angle: the intersection of two non-collinear rays at a common endpoint.
Circle: the locus of all points in a plane equidistant from a given point at the center.
Perpendicular Line: lines that form right angles.
Parallel Line: lines that do not intersect.
Line Segment: a measurable part of a line that consists of 2 points and all the points between them.
Point: a location.
Line: is made up of points, it has no thickness or width.
Plane: flat surface made up of points that has no depth and extends indefinitely.

Source: https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry Congruence

G.CO.A Experiment with transformations in the plane.	Mathematical Practices
G.CO A.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Transformations: an operation that creates an image from an original figure or preimage
Rigid Motion: a transformation that creates an image that is congruent to the original figure

Example: Create various polygons that can be transformed using the properties of transformations with explanations. Students may use geometry software and/or manipulatives to model and compare transformations.

Source: https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **4a** Innovative Designer	**3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ **Computational Thinking** ☐ **Financial Literacy**

Geometry
Congruence

G.CO.A Experiment with transformations in the plane.

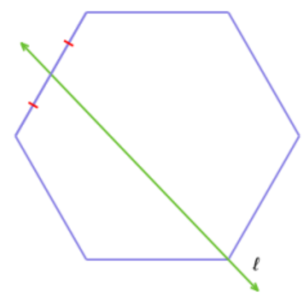
G.CO.A.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Describe which transformations would and would not carry this regular polygon onto itself. (i.e. reflection across line l, rotation of 30° counterclockwise, rotation of 72° counterclockwise, rotation of 60° counterclockwise, etc.).



Source: https://www.ixl.com/math/geometry/transformations-that-carry-a-polygon-onto-itself

Wyoming Cross-Disciplinary Connections

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Congruence

G.CO.A Experiment with transformations in the plane.	Mathematical Practices
G.CO.A.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Transformations: an operation that creates an image from an original figure or preimage.
Rigid Motion: a transformation that creates an image that is congruent to the original figure.

Example: Explore effects of various transformations on angles, circles, perpendicular lines, parallel lines, and line segments. Students may use geometry software and/or manipulatives to model and compare transformations.

Source: https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry
Congruence

G.CO.A Experiment with transformations in the plane.	Mathematical Practices
G.CO.A.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Students may use geometry software and/or manipulatives to model and compare transformations.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☑ **Computational Thinking**
5c Computational Thinker		☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Congruence

G.CO.B Understand congruence in terms of rigid motions.	Mathematical Practices
G.CO.B.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Is ΔBCD congruent to ΔEFG? If so, describe a series of rigid motions that would transform ΔBCD to ΔEFG.

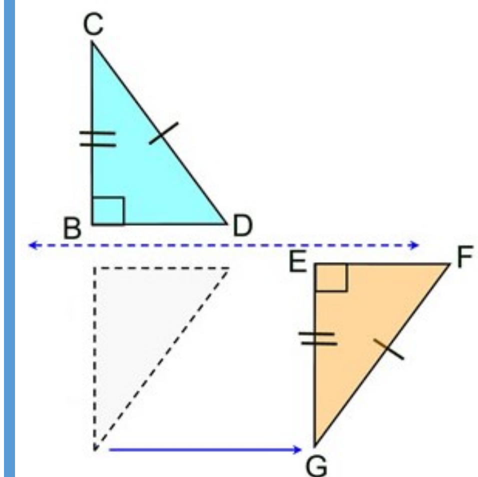


Image by MathBits.com

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Geometry

Congruence

G.CO.B Understand congruence in terms of rigid motions.	Mathematical Practices
G.CO.B.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

A **rigid motion** is a transformation of points in space consisting of a sequence of one or more translations, reflections, and/or rotations. Rigid motions are assumed to preserve distances and angle measures.

Congruence of triangles: two triangles are said to be congruent if one can be exactly superimposed on the other by a rigid motion, and the congruence theorems specify the conditions under which this can occur.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Congruence

G.CO.B Understand congruence in terms of rigid motions.	Mathematical Practices
G.CO.B.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Congruence:
ASA: Angle Side Angle Triangle Congruence
SAS: Side Angle Side Triangle Congruence
SSS: Side Side Side Triangle Congruence

Source: https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner	**3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ **Computational Thinking** ☐ **Financial Literacy**

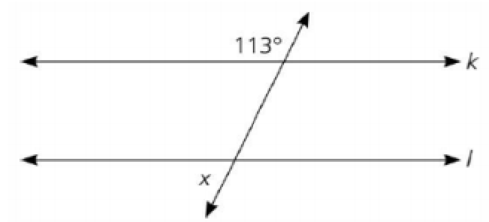
Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Congruence

G.CO.C Prove geometric theorems.	Mathematical Practices
G.CO.C.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Use parallel lines cut by a transversal to find all the various type of angles with one angle is given. This can be done multiple ways without using algebraic expression.



Source: https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Congruence

G.CO.C Prove geometric theorems.	Mathematical Practices
G.CO.C.10 Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Identify and describe all types of triangles.
Example: Construct angle bisectors of triangles.
Example: Find area and perimeter of triangles in real world context.
Example: Prove similarity exists between two triangles.
Example: Use the Triangle Theorems.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry
Congruence

G.CO.C Prove geometric theorems.	Mathematical Practices
G.CO.C.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Describe, classify and determine the relationships that exist between all parallelograms.
Example: Solve problems of real world nature and not for area and perimeter.
Example: Use coordinate geometry to find lengths.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry Congruence

G.CO.D Make geometric constructions.	Mathematical Practices
G.CO.D.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Construct a triangle given the lengths of two sides and the measure of the angle between the two sides.

Example: Construct the circumcenter of a given triangle.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
	3A-DA-12 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry Congruence

G.CO.D Make geometric constructions.	Mathematical Practices
G.CO.D.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may use geometry software and/or manipulatives to model and compare transformations.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
	3A-DA-12 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.E Understand similarity in terms of similarity transformations.	Mathematical Practices
G.SRT.E.1 Verify heuristically the properties of dilations given by a center and a scale factor. A. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. B. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Dilation is a transformation that moves each point along the ray through the point emanating from a fixed center, and multiplies distances from the center by a common scale factor.

Students may use geometric simulation software to model transformations. Students may observe patterns and verify "experimentally" the properties of dilations.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.E Understand similarity in terms of similarity transformations.

G.SRT.E.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

A **similarity transformation** is a rigid motion followed by dilation.

Students may use geometric simulation software to model transformations and demonstrate a sequence of transformations to show congruence or similarity of figures.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.E Understand similarity in terms of similarity transformations.	Mathematical Practices
G.SRT.E.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Similarity: the ratio of the lengths of corresponding sides.
Proportionality: having equivalent ratios.
AA: Angle Angle Triangle Congruence.

Source: https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.F Prove Theorems involving similarity.	Mathematical Practices
G.SRT.F.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.F Prove theorems involving similarity.	Mathematical Practices
G.SRT.F.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Similarity postulates include SSS, SAS, and AA.

Congruence postulates include SSS, SAS, ASA, AAS, and H-L.

Students may use geometric simulation software to model transformations and demonstrate a sequence of transformations to show congruence or similarity of figures.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
4a Innovative Designer		☐ Computational Thinking ☐ Financial Literacy

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.G Define trigonometric ratios and solve problems involving right triangles.

G.SRT.G.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

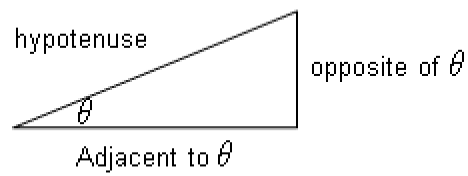
Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may use applets to explore the range of values of the trigonometric ratios as θ ranges from 0 to 90 degrees.



$$\sin\theta=\frac{\text{opp.}}{\text{hyp.}}\quad \cos\theta=\frac{\text{adj.}}{\text{hyp.}}\quad \tan\theta=\frac{\text{opp.}}{\text{adj.}}$$

$$\csc\theta=\frac{\text{hyp.}}{\text{opp.}}\quad \sec\theta=\frac{\text{hyp.}}{\text{adj.}}\quad \cot\theta=\frac{\text{adj.}}{\text{opp.}}$$

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Source: http://www.pstcc.edu/facstaff/jwlamb/1910/unitcircletrigreview.pdf

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer **6a,b,c,d** Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

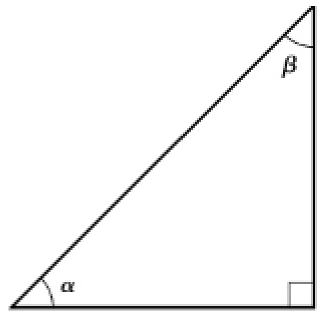
Similarity, Right Triangles, and Trigonometry

G.SRT.G Define trigonometric ratios and solve problems involving right triangles.	Mathematical Practices
G.SRT.G.7 Explain and use the relationship between the sine and cosine of complementary angles.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Explore the relationship between angles α and β as well as the relationship between sine and cosine of these angles.



$\sin\alpha = \cos\beta$
$\sin\beta = \cos\alpha$

Image: http://philschatz.com/algebra-trigonometry-book/contents/m51284.html

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer **6a,b,c,d** Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.G Define trigonometric ratios and solve problems involving right triangles.

Mathematical Practices

G.SRT.G.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

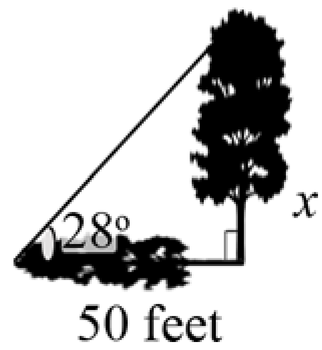
Modeling

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Find the height of a tree to the nearest tenth if the angle of elevation of the sun is 28° and the shadow of the tree is 50 ft.



Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
4d Innovative Designer		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.H Apply trigonometry to general triangles.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

G.SRT.H.9 Derive the formula A = (1/2)ab(sinC) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.H Apply trigonometry to general triangles.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3** Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. **MP.7** Look for and make use of structure. **MP.8** Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

G.SRT.H.10 Prove the Laws of Sines and Cosines and use them to solve problems.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry

Similarity, Right Triangles, and Trigonometry

G.SRT.H Apply trigonometry to general triangles.

Mathematical Practices

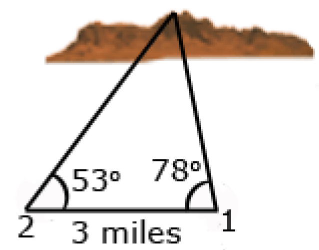
MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

G.SRT.H.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Example

Example: Tara wants to fix the location of a mountain by taking measurements from two positions 3 miles apart. From the first position, the angle between the mountain and the second position is 78°. From the second position, the angle between the mountain and the first position is 53°. How can Tara determine the distance of the mountain from each position, and what is the distance from each position?



Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry
Circles

G.C.I Understand and apply theorems and circles.	Mathematical Practices
G.C.I.1 Prove that all circles are similar.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Circles

G.C.I Understand and apply theorems and circles.

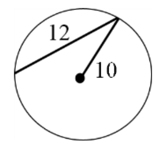
Mathematical Practices

G.C.I.2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

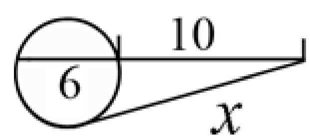
MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Example

Example: Given the circle below with radius of 10 and chord length of 12, find the distance from the chord to the center of the circle.



Example: Find the unknown length in the picture below.



Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Advanced Standards (+)/ STEM Pathway

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Circles

G.C.I Understand and apply theorems and circles.

Mathematical Practices

G.C.I.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

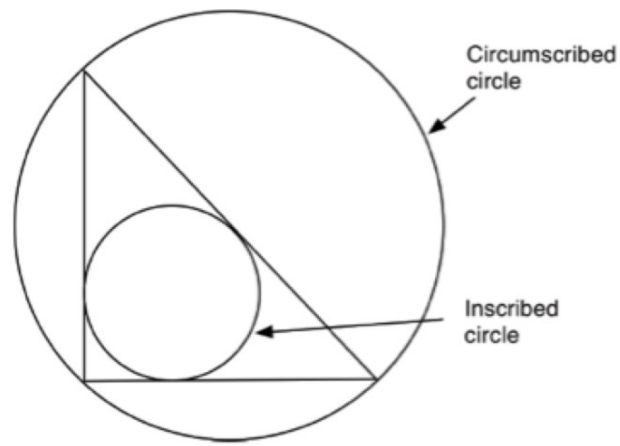
MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Inscribed: a figure whose vertices are part of another figure.
Circle inscribed in a triangle: the circle touches each side of the triangle at exactly one point.
Quadrilateral inscribed in a circle: each vertex of the quadrilateral lies on the circle.

Example: Construct inscribed angles and other vocabulary terms for circle theorems.



Source: https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

Image: https://easingthehurrysyndrome.wordpress.com/2014/03/14/inscribed-circumscribed-right-triangles/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Circles

G.C.I Understand and apply theorems and circles.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway
G.C.I.4 Construct a tangent line from a point outside a given circle to the circle.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry
Circles

G.C.J Find arc lengths and areas of sectors of circles.	Mathematical Practices
G.C.J.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Area of a Sector: the region bounded by two radii of the circle and that arc they intercept.
Arc Length: the length of an arc or a portion of the circle.

Example: Find the measures of angles, arcs, and arc lengths in given circle diagrams.

Source: https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry

Expressing Geometric Properties with Equations

G.GPE.K Translate between the geometric description and the equation for a conic section.	Mathematical Practices
G.GPE.K.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. **MP.7 Look for and make use of structure.** **MP.8 Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

Example

Students may use geometric simulation software to explore the connection between circles and the Pythagorean Theorem.

Example: Write an equation for a circle with a radius of 2 units and center at (1, 3).

Example: Write an equation for a circle given that the endpoints of the diameter are (-2, 7) and (4, -8).

Example: Find the center and radius of the circle $4x^2 + 4y^2 - 4x + 2y - 1 = 0$.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Expressing Geometric Properties with Equations

G.GPE.K Translate between the geometric description and the equation for a conic section.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

G.GPE.K.2 Derive the equation of a parabola given a focus and directrix.

Example

Example: Write and graph an equation for a parabola with focus (2, 3) and directrix $y = 1$.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Expressing Geometric Properties with Equations

G.GPE.K Translate between the geometric description and the equation for a conic section.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

G.GPE.K.3 Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

Example

Example: Write an equation in standard form for an ellipse with foci at (0, 5) and (2, 0) and a center at the origin.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Expressing Geometric Properties with Equations

G.GPE.L Use coordinates to prove simple geometric theorems algebraically.	Mathematical Practices
G.GPE.L.4 Use coordinates to prove simple geometric theorems algebraically.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may use geometric simulation software to model figures and prove simple geometric theorems.

Example:

Use slope and distance formula to verify the polygon formed by connecting the points (-3, -2), (5, 3), (9, 9), (1, 4) is a parallelogram.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Expressing Geometric Properties with Equations

G.GPE.L Use coordinates to prove simple geometric theorems algebraically.	Mathematical Practices
G.GPE.L.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

Example

Lines can be horizontal, vertical, or neither.

Students may use a variety of different methods to construct a parallel or perpendicular line to a given line and calculate the slopes to compare the relationships.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Expressing Geometric Properties with Equations

G.GPE.L Use coordinates to prove simple geometric theorems algebraically.	Mathematical Practices
G.GPE.L.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

Example

Students may use geometric simulation software to model figures or line segments.

Example:

Given A(3, 2) and B(6, 11),

- Find the point that divides the line segment AB two-thirds of the way from A to B. The point two-thirds of the way from A to B has *x-coordinate two-thirds of the way from 3 to 6 and y coordinate two-thirds of the way from 2 to 11.* So, (5, 8) is the point that is two-thirds from point A to point B.

Example:

Find the midpoint of line segment AB.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Geometry

Expressing Geometric Properties with Equations

G.GPE.L Use coordinates to prove simple geometric theorems algebraically.	Mathematical Practices
G.GPE.L.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, (e.g., using the distance formula.) Modeling	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. **MP.5 Use appropriate tools strategically.** **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Find the area and perimeter of the triangle with vertices A (-1,2), B (4,-3), and C (-2,-1).

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Geometric Measurement and Dimension

G.GMD.M Explain volume formulas and use them to solve problems.	Mathematical Practices
G.GMD.M.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Cavalieri's Principle: If two solids have the same height and the same cross-sectional area at every level, then they have the same volume.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Geometric Measurement and Dimension

G.GMD.M Explain volume formulas and use them to solve problems.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

G.GMD.M.2 Give an informal argument using Cavalieri's Principle for the formulas for the volume of a sphere and other solid figures.

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Geometric Measurement and Dimension

G.GMD.M Explain volume formulas and use them to solve problems.	Mathematical Practices
G.GMD.M.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. (Modeling)	**MP.1 Make sense of problems and persevere in solving them.** **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: Missing measures can include but are not limited to slant height, altitude, height, diagonal of a prism, edge length, and radius.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Geometric Measurement and Dimension

G.GMD.N Visualize relationships between two-dimensional and three-dimensional objects.

G.GMD.N.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional object.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may use geometric simulation software to model figures and create cross sectional views.

Example:

Identify the shape of the vertical, horizontal, and other cross sections of a cylinder.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
	3A-DA-12 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Modeling with Geometry

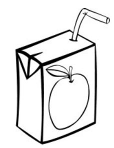
G.MG.O Apply geometric concepts in modeling situations.	Mathematical Practices
G.MG.O.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Modeling

Advanced Standards (+)/ STEM Pathway

Example

Example: Use measures of various shapes to find volume, height, or radius of various objects. For example compare the volumes of a can and box.



Images: Clipart

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
	3A-DA-12 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Modeling with Geometry

G.MG.O Apply geometric concepts in modeling situations.	Mathematical Practices
G.MG.O.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Modeling

Advanced Standards (+)/ STEM Pathway

Example

Example: If one city has a population of 20.7 million people and an area of 16,400 km^2 and another city has 23.7 million people and an area of 6,300 km^2, how many times as great is the population density of the first city to the second?

Adapted from: https://www.khanacademy.org/math/geometry/hs-geo-solids/hs-geo-density/e/surface-and-volume-density-word-problem

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Geometry

Modeling with Geometry

G.MG.O Apply geometric concepts in modeling situations.

G.MG.O.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Modeling

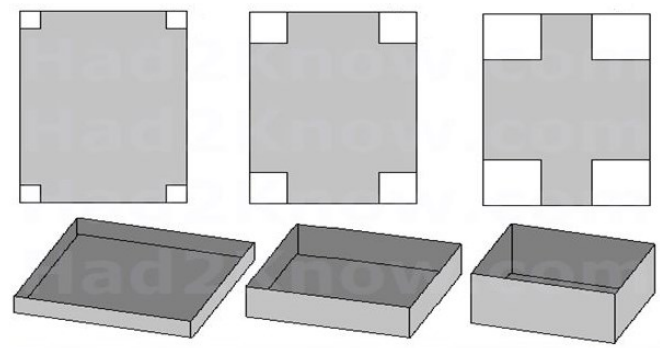
Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Example: An open-top box is to be made by cutting small squares from the corners of a 12-in. by 12-in. sheet of tin and bending the sides up. How large should the squares cut from the corners be to maximize the volume of the box?



Adapted from: http://slideplayer.com/slide/10086523/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
5a Computational Thinker	**3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ **Computational Thinking** ☐ **Financial Literacy**

HS - Geometry Resources

Standard/Page Number	Resource/Link
G.CO .A.1 on page 353.	https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf
G.CO .A.2 on page 354.	https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf
G.CO .A.3 on page 355.	https://www.ixl.com/math/geometry/transformations-that-carry-a-polygon-onto-itself
G.CO.A.4 on page 356.	https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf
G.CO.A.5 on page 357.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.CO.B.6 on page 358.	Image by: MathBits.com
G.CO.B.7 on page 359.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.CO.B.8 on page 360.	https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf
G.CO.C.9 on page 361.	https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf
G.CO.C.10 on page 362.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.CO.C.11 on page 363.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.CO.D.12 on page 364.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.CO.D.13 on page 365.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.SRT.E.1 on page 366.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.SRT.E.2 on page 367.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.SRT.E.3 on page 368.	https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf

HS - Geometry Resources

Standard/Page Number	Resource/Link
G.SRT.F.5 on page 370.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.SRT.G.6 on page 371.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/ http://www.pstcc.edu/facstaff/jwlamb/1910/unitcircletrigreview.pdf
G.SRT.G.7 on page 372.	Image: http://philschatz.com/algebra-trigonometry-book/contents/m51284.html
G.SRT.G.8 on page 373.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.SRT.H.11 on page 376.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.C.I.2 on page 378.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.C.I.3 on page 379.	https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf Image: https://easingthehurrysyndrome.wordpress.com/2014/03/14/inscribed-circumscribed-right-triangles/
G.C.J.5 on page 381.	https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-resource-guide.pdf
G.GPE.K.1 on page 382.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.GPE.K.2 on page 383.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.GPE.K.3 on page 384.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.GPE.L.4 on page 385.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.GPE.L.5 on page 386.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.GPE.L.6 on page 387.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.GPE.L.7 on page 388.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

HS - Geometry Resources

Standard/Page Number	Resource/Link
G.GMD.M.1 on page 389.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.GMD.M.3 on page 391.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.GMD.N.4 on page 392.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
G.MG.O.1 on page 393.	Images: Clipart
G.MG.O.2 on page 394.	Adapted from: https://www.khanacademy.org/math/geometry/hs-geo-solids/hs-geo-density/e/surface-and-volume-density-word-problem
G.MG.O.3 on page 395.	Adapted from: http://slideplayer.com/slide/10086523/
Grade Level Math Practices on page 261.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

Mathematics | High School

Statistics and Probability

Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take data into account.

Data are gathered, displayed, summarized, examined, and interpreted to discover patterns and deviations from patterns. Quantitative data can be described in terms of key characteristics: measures of shape, center, and spread. The shape of a data distribution might be described as symmetric, skewed, flat (uniform, or bell shaped), and it might be summarized by a statistic measuring center (such as mean or median) and a statistic measuring spread (such as standard deviation or interquartile range). Different distributions can be compared numerically using these statistics or compared visually using plots. Knowledge of center and spread are not enough to describe a distribution. Which statistics to compare, which plots to use, and what the results of a comparison might mean, depend on the question to be investigated and the real-life actions to be taken.

Randomization has two important uses in drawing statistical conclusions. First, collecting data from a random sample of a population makes it possible to draw valid conclusions about the whole population, taking variability into account. Second, randomly assigning individuals to different treatments allows a fair comparison of the effectiveness of those treatments. A statistically significant outcome is one that is unlikely to be due to chance alone, and this can be evaluated only under the condition of randomness. The conditions under which data are collected are important in drawing conclusions from the data. In critically reviewing uses of statistics in public media and other reports, consideration is important for the study design, how the data were gathered, and the analyses employed as well as the data summaries and the conclusions drawn.

Random processes can be described mathematically by using a probability model: a list or description of the possible outcomes (the sample space), each of which is assigned a probability. In situations such as flipping a coin, rolling a number cube, or drawing a card, it might be reasonable to assume various outcomes are equally likely. In other situations, the probability of outcomes may be different. In a probability model, sample points represent outcomes and combine to make up events; probabilities of events can be computed by applying the Addition and Multiplication Rules. Interpreting these probabilities relies on an understanding of independence and conditional probability, which can be approached through the analysis of two-way tables.

Technology plays an important role in statistics and probability by making it possible to generate plots, linear regression models, correlation coefficients, and to simulate many possible outcomes, in a short amount of time.

Connections to Functions and Modeling. Functions may be used to describe data; if the data suggest a linear relationship, the relationship can be modeled with a regression line and its strength and direction can be expressed through a correlation coefficient.

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.A Summarize, represent, and interpret data on a single count or measurement variable.

S.ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots) by hand or using technology.

Modeling

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Wyoming Cross-Disciplinary Connections

Science

HS-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex biotic and abiotic interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a modified ecosystem.

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner

4a Innovative Designer

5a,b Computational Thinker

Computer Science

3A-DA-12 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.

- [x] Computational Thinking
- [x] Financial Literacy

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.A Summarize, represent, and interpret data on a single count or measurement variable.

Mathematical Practices

S.ID.A.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

Modeling

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may use spreadsheets, graphing calculators and statistical software for calculations, summaries, and comparisons of data sets.

Example: The two data sets below depict the housing prices sold in the King River area and Toby Ranch areas of Pinal County, Arizona. Based on the prices below which price range can be expected for a home purchased in Toby Ranch? In the King River area? In Pinal County?

- King River area {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000}
- Toby Ranch homes {5 million, 154000, 250000, 250000, 200000, 160000, 190000}

Example: Given a set of test scores {99, 96, 94, 93, 90, 88, 86, 77, 70, 68}, find the mean, median and standard deviation. Explain how the values vary about the mean and median. What information does this give the teacher?

Example: Collect gas receipts and compare the distributions to grocery receipts.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **5a,b,c** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.A Summarize, represent, and interpret data on a single count or measurement variable.

Mathematical Practices

S.ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Modeling

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Students may use spreadsheets, graphing calculators and statistical software to statistically identify outliers and analyze data sets with and without outliers as appropriate.

Example:

Hunting in Wyoming: The number of licenses available and number who applied for different game species for several years and is listed by hunting area. (Resident deer licenses in 2017: Antlered deer licenses by area (75, 142, 141, 80, …). Use this type of data to determine descriptive statistics (mean, median, standard deviation, range, …) number of antlered deer (or any deer, …) licenses available in an area. Could graph the data to discuss shape, etc.

*Reference graph on resource page.

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
3d Knowledge Constructor		☑ **Computational Thinking**
5b Computational Thinker		☐ **Financial Literacy**
6a,b,c,d Creative Communicator		

HS

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.A Summarize, represent, and interpret data on a single count or measurement variable.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.ID.A.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use the Empirical Rule, calculators, spreadsheets, and/or tables to estimate areas under the normal curve.

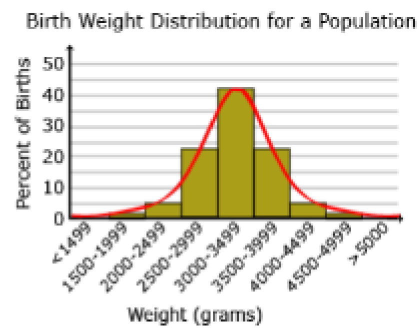
Modeling

Example

Students may use spreadsheets, graphing calculators, statistical software and tables to analyze the fit between a data set and normal distributions and estimate areas under the curve.

Example:

The bar graph below gives the birth weight of a population of 100 chimpanzees. The line shows how the weights are normally distributed about the mean, 3250 grams. Estimate the percent of baby chimps weighing 3000-3999 grams.



Example:

Determine which situation(s) is best modeled by a normal distribution. Explain your reasoning. o Annual income of a household in the U.S. o Weight of babies born in one year in the U.S.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **4d** Innovative Designer **5a,b,c** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.B Summarize, represent, and interpret data on two categorical and quantitative variables.

Mathematical Practices

MP.1 **Make sense of problems and persevere in solving them.**
MP.2 **Reason abstractly and quantitatively.**
MP.3 **Construct viable arguments and critique the reasoning of others.**
MP.4 **Model with mathematics.**
MP.5 **Use appropriate tools strategically.**
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 **Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

S.ID.B.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations in the data, and use inferential statistical techniques to show association.

Modeling

Example

Students may use spreadsheets, graphing calculators, and statistical software to create frequency tables and determine associations or trends in the data.

Example:

A two-way frequency table is shown below displaying the relationship between age and baldness. We took a sample of 100 male subjects, and determined who is or is not bald. We also recorded the age of the male subjects by categories.

Two-way Frequency Table			
Bald	Age		Total
	Younger than 45	45 or older	
No	35	11	46
Yes	24	30	54
Total	59	41	100

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner

5a,b,c Computational Thinker

Computer Science

☑ **Computational Thinking**

☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.B Summarize, represent, and interpret data on two categorical and quantitative variables.

S.ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

A. Use a function to describe data trends to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.

C. Using technology, fit a least squares linear regression function for a scatter plot that suggests a linear association.

Advanced Standards (+)/ STEM Pathway

B. Informally assess the fit of a function by plotting and analyzing residuals.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Example

The residual in a regression model is the difference between the observed and the predicted y for some *x* (*y* the dependent variable and *x* the independent variable). So if we have a model $y = ax + b$ and a data point (x_i, y_i) the residual is for this point is $r_i = y_i - (ax_i + b)$. Students may use spreadsheets, graphing calculators, and statistical software to represent data, describe how the variables are related, fit functions to data, perform regressions, and calculate residuals.

Example:

Measure the wrist and neck size of each person in your class and make a scatterplot. Find the least squares regression line. Calculate and interpret the correlation coefficient for this linear regression model. Graph the residuals and evaluate the fit of the linear equations.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Example:

Collect Grocery receipts and number of people in the family. Develop a scatterplot. Would you expect to find a correlation/relation? What factors may account for variability of the data? (Ex: people who shop daily vs. weekly or monthly)

Wyoming Cross-Disciplinary Connections

Science	ELA
HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.	**W.9-10.2.d** Use precise language and domain-specific vocabulary to manage the complexity of the topic. **W.11-12.2.d** Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3d** Knowledge Constructor **4a,d** Innovative Designer **5a,b** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

HS

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.C Interpret linear models.	Mathematical Practices
S.ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	**MP.1** Make sense of problems and persevere in solving them. **MP.2** Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4** Model with mathematics. **MP.5** Use appropriate tools strategically. **MP.6** Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Advanced Standards (+)/ STEM Pathway

Example

Students may use spreadsheets or graphing calculators to create representations of data sets and create linear models.

Example:

Lisa lights a candle and records its height in inches every hour. The results recorded as (time, height) are (0, 20), (1, 18.3), (2, 16.6), (3, 14.9), (4, 13.2), (5, 11.5), (7, 8.1), (9, 4.7), and (10, 3). Express the candle's height (h) as a function of time (t) and state the meaning of the slope and the intercept in terms of the burning candle.

Solution: h = -1.7t + 20, Slope: The candle's height decreases by 1.7 inches for each hour it is burning.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
3c Knowledge Constructor **5c** Computational Thinker **6a,b,c,d** Creative Communicator		☑ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.C Interpret linear models.	Mathematical Practices
S.ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** **MP.5 Use appropriate tools strategically.** MP.6 Attend to precision. MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

Example

Students may use spreadsheets, graphing calculators, and statistical software to represent data, describe how the variables are related, fit functions to data, perform regressions, and calculate residuals and correlation coefficients.

Example:

Collect height, shoe-size, and wrist circumference data for each student. Determine the best way to display the data.

Answer the following questions:

- Is there a correlation between any two of the three indicators?
- Is there a correlation between all three indicators?
- What patterns and trends are apparent in the data?
- What inferences can be made from the data?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3c** Knowledge Constructor **5a,c** Computational Thinker		☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Interpreting Categorical and Quantitative Data

S.ID.C Interpret linear models.	Mathematical Practices
S.ID.C.9 Distinguish between correlation and causation.	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. **MP.3 Construct viable arguments and critique the reasoning of others.** **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Modeling

Advanced Standards (+)/ STEM Pathway

Example

Some data leads observers to believe that there is a cause and effect relationship when a strong relationship is observed. Students should be careful not to assume that correlation implies causation. The determination that one thing causes another requires a controlled randomized experiment.

Example:

Diane did a study for a health class about the effects of a student's end-of-year math test scores on height. Based on a graph of her data, she found that there was a direct relationship between students' math scores and height. She concluded that "doing well on your end-of-course math tests makes you tall." Is this conclusion justified? Explain any flaws in Diane's reasoning.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

Cross-Disciplinary Connections

ISTE	Computer Science	
3d Knowledge Constructor **6a,b,c,d** Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Making Inferences and Justifying Conclusions

S.IC.D Understand and evaluate random processes underlying statistical experiments.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.IC.D.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
	3B-DA-06 Select data collection tools and techniques to generate data sets that support a claim or communicate information. **3B-DA-07** Evaluate the ability of models and simulations to test and support the refinement of hypotheses. **3B-AP-10** Use and adapt classic algorithms to solve computational problems.	☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Making Inferences and Justifying Conclusions

S.IC.D Understand and evaluate random processes underlying statistical experiments.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.IC.D.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.

Modeling

Example

Data--generating processes include (but are not limited to): flipping coins, spinning spinners, rolling a number cube, and simulations using the random number generators. Students may use graphing calculators, spreadsheet programs, or applets to conduct simulations and quickly perform large numbers of trials. The law of large numbers states that as the sample size increases, the experimental probability will approach the theoretical probability. Comparison of data from repetitions of the same experiment is part of the model building verification process.

Example:

Have multiple groups flip coins. One group flips a coin 5 times, one group flips a coin 20 times, and one group flips a coin 100 times.

- Which group's results will most likely approach the theoretical probability?
- A model says a spinning coin will fall heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

W.9-10.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Cross-Disciplinary Connections

ISTE	Computer Science	
3d Knowledge Constructor **4d** Innovative Designer **5a,b** Computational Thinker	**3B-DA-07** Evaluate the ability of models and simulations to test and support the refinement of hypotheses.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Making Inferences and Justifying Conclusions

S.IC.E Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.IC.E.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

Modeling

Example

Students should be able to explain techniques/applications for randomly selecting study subjects from a population and how those techniques/applications differ from those used to randomly assign existing subjects to control groups or experimental groups in a statistical experiment. In statistics, an observational study draws inferences about the possible effect of a treatment on subjects, where the assignment of subjects into a treated group versus a control group is outside the control of the investigator (for example, observing data on academic achievement and socio-economic status to see if there is a relationship between them). This is in contrast to controlled experiments, such as randomized controlled trials, where each subject is randomly assigned to a treated group or a control group before the start of the treatment.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

.

Cross-Disciplinary Connections

ISTE	Computer Science	
3a,d Knowledge Constructor		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Statistics and Probability

Making Inferences and Justifying Conclusions

S.IC .E Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.IC.E.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

Modeling

Example

Students may use computer generated simulation models based upon sample surveys results to estimate population statistics and margins of error.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

W.9-10.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3a,d** Knowledge Constructor **5a,b** Computational Thinker **7b,c,d** Global Collaborator	**3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Statistics and Probability

Making Inferences and Justifying Conclusions

S.IC.E Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.IC.E.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

Modeling

Example

Students may use computer generated simulation models to decide how likely it is that observed differences in a randomized experiment are due to chance. Treatment is a term used in the context of an experimental design to refer to any prescribed combination of values of explanatory variables.

Example: One wants to determine the effectiveness of weed killer. Two equal parcels of land in a neighborhood are treated; one with a placebo and one with weed killer to determine whether there is a significant difference in effectiveness in eliminating weeds.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.2.e Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

W.9-10.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

W.11-12.1.d Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner

3d Knowledge Constructor

5a,b,c Computational Thinker

Computer Science

3A-DA-12 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.

☑ **Computational Thinking**

☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Statistics and Probability

Making Inferences and Justifying Conclusions

S.IC.E Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.IC.E.6 Evaluate reports based on data.

Modeling

Example

Explanations can include but are not limited to sample size, biased survey sample, interval scale, unlabeled scale, uneven scale, and outliers that distort the line-of-best-fit. In a pictogram the symbol scale used can also be a source of distortion. As a strategy, collect reports published in the media and ask students to consider the source of the data, the design of the study, and the way the data are analyzed and displayed.

Example: A reporter used the two data sets below to calculate the mean housing price in Arizona as $629,000. Why is this calculation not representative of the typical housing price in Arizona? King River area {1.2 million, 242000, 265500, 140000, 281000, 265000, 211000} , Toby Ranch homes {5 million, 154000, 250000, 250000, 200000, 160000, 190000}.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

RI.9-10.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

RI.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RI.9-10.8 Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

W.9-10.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

SL.9-10.2 Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

RI.11-12.7 Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

CVE

CV12.3.2 College and career-ready students identify trends, forecast possibilities, and explore complex systems and issues.

Cross-Disciplinary Connections

ISTE

1c Empowered Learner
3a,b,c,d Knowledge Constructor
4a,d Innovative Designer
5a,b,c Computational Thinker
6a,b,c,d Creative Communicator
7b,c,d Global Collaborator

Computer Science

3B-DA-07 Evaluate the ability of models and simulations to test and support the refinement of hypotheses.

- [x] **Computational Thinking**
- [ ] **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.F Understand independence and conditional probability and use them to interpret data.	Mathematical Practices
S.CP.F.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

Example

Intersection: The intersection of two sets A and B is the set of elements that are common to both set A and set B. It is denoted by A ∩ B and is read 'A intersection B.'

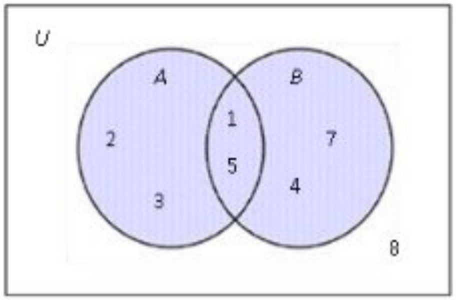
- A ∩ B in the diagram is {1, 5}, ∩ means BOTH/AND.

Union: The union of two sets A and B is the set of elements, which are in A or in B or in both. It is denoted by A u B and is read 'A union B.'

- A u B in the diagram is {1, 2, 3, 4, 5, 7} , u means: EITHER/OR/ANY, u could be both.

Complement: The complement of the set A u B is the set of elements that are members of the universal set U but are not in A u B. It is denoted by (A u B)'.

- (A u B)' in the diagram is {8}.



Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
6a,b,c,d Creative Communicator		☐ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

HS

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.F Understand independence and conditional probability and use them to interpret data.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.CP.F.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.F Understand independence and conditional probability and use them to interpret data.	Mathematical Practices
	MP.1 Make sense of problems and persevere in solving them. **MP.2 Reason abstractly and quantitatively.** MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** **MP.7 Look for and make use of structure.** MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.CP.F.3 Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

Modeling

Example

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.F Understand independence and conditional probability and use them to interpret data.

Mathematical Practices

MP.1 **Make sense of problems and persevere in solving them.**
MP.2 **Reason abstractly and quantitatively.**
MP.3 **Construct viable arguments and critique the reasoning of others.**
MP.4 **Model with mathematics.**
MP.5 **Use appropriate tools strategically.**
MP.6 **Attend to precision.**
MP.7 **Look for and make use of structure.**
MP.8 **Look for and express regularity in repeated reasoning.**

Advanced Standards (+)/ STEM Pathway

S.CP.F.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

Example

Students may use spreadsheets, graphing calculators, and simulations to create frequency tables and conduct analyses to determine if events are independent or determine approximate conditional probabilities.

Example:

Collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner		☑ **Computational Thinking**
3d Knowledge Constructor		☐ **Financial Literacy**
5b,c Computational Thinker		

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.F Understand independence and conditional probability and use them to interpret data.	Mathematical Practices
S.CP.F.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	**MP.1 Make sense of problems and persevere in solving them.** MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. **MP.4 Model with mathematics.** MP.5 Use appropriate tools strategically. **MP.6 Attend to precision.** MP.7 Look for and make use of structure. **MP.8 Look for and express regularity in repeated reasoning.**

Modeling

Advanced Standards (+)/ STEM Pathway

Example

Example:

- What is the probability of drawing a heart from a standard deck of cards on a second draw, given that a heart was drawn on the first draw and not replaced? Are these events independent or dependent?
- At Johnson Middle School, the probability that a student takes computer science and French is 0.062. The probability that a student takes computer science is 0.43. What is the probability that a student takes French given that the student is taking computer science.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

ELA

W.9-10.2.d Use precise language and domain-specific vocabulary to manage the complexity of the topic.

W.11-12.2.d Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

Cross-Disciplinary Connections

ISTE	Computer Science	
1c Empowered Learner **3d** Knowledge Constructor **5b** Computational Thinker **6a,b,c,d** Creative Communicator		☑ **Computational Thinking** ☐ **Financial Literacy**

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.G Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Mathematical Practices

MP.1 **Make sense of problems and persevere in solving them.**
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 **Model with mathematics.**
MP.5 **Use appropriate tools strategically.**
MP.6 Attend to precision.
MP.7 **Look for and make use of structure.**
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.CP.G.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

Modeling

Example

Students could use graphing calculators, simulations, or applets to model probability experiments and interpret the outcomes.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Science

HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex biotic and abiotic interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a modified ecosystem.

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.G Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.CP.G.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.

Modeling

Example

Students could use graphing calculators, simulations, or applets to model probability experiments and interpret the outcomes.

Example:

In a math class of 32 students, 18 are boys and 14 are girls. On a unit test, 5 boys and 7 girls made an A grade. If a student is chosen at random from the class, what is the probability of choosing a girl or an A student?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.G Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.CP.G.8 Apply the general Multiplication Rule in a uniform probability model, P(A and B) = [P(A)]x [P(B|A)] =[P(B)]x[P(A|B)], and interpret the answer in terms of the model.

Modeling

Example

Students could use graphing calculators, simulations, or applets to model probability experiments and interpret the outcomes.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Conditional Probability and the Rules of Probability

S.CP.G Use the rules of probability to compute probabilities of compound events in a uniform probability model.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.CP.G.9 Use permutations and combinations to compute probabilities of compound events and solve problems.

Modeling

Example

Students may use calculators or computers to determine sample spaces and probabilities.

Example:

You and two friends go to the grocery store and each buys a soda. If there are five different kinds of soda, and each friend is equally likely to buy each variety, what is the probability that no one buys the same kind?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability
Using probability to Make Decisions

S.MD.H Calculate expected values and use them to solve problems.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.MD.H.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

Modeling

Example

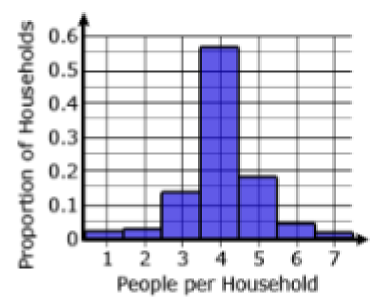
Students may use spreadsheets, graphing calculators and statistical software to represent data in multiple forms.

Example:

Suppose you are working for a contractor who is designing new homes. She wants to ensure that the home models match the demographics for the area. She asks you to research the size of households in the region in order to better inform the floor plans of the home.

Solution: A possible solution could be the result of research organized in a variety of forms. In this case, the results of the research are shown in a table and graph. The student has defined their variable as x as the number of people per household.

People per Household	Proportion of Households
1	0.026
2	0.031
3	0.132
4	0.567
5	0.181
6	0.048
7	0.015



Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability
Using probability to Make Decisions

S.MD.H Calculate expected values and use them to solve problems.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway
S.MD.H.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

Modeling

Example

Students may use spreadsheets or graphing calculators to complete calculations or create probability models. The expected value of an uncertain event is the sum of the possible points earned multiplied by each point's chance of occurring.

Example: In a game, you roll a six sided number cube numbered with 1, 2, 3, 4, 5 and 6. You earn 3 points if a 6 comes up, 6 points if a 2, 4 or 5 come up and nothing otherwise. Since there is a 1/6 chance of each number coming up, the outcomes, probabilities and payoffs look like this:

Outcome	Probability	Points
1	1/6	0 points
2	1/6	6 points
3	1/6	0 points
4	1/6	6 points
5	1/6	6 points
6	1/6	3 points

The expected value is the sum of the products of the probability and points earned for each outcome (the entries in the last two columns multiplied together):

$$\left(\frac{1}{6}\right)\bullet 0+\left(\frac{1}{6}\right)\bullet 6+\left(\frac{1}{6}\right)\bullet 0+\left(\frac{1}{6}\right)\bullet 6+\left(\frac{1}{6}\right)\bullet 6+\left(\frac{1}{6}\right)\bullet 3=3.50\text{points}$$

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

HS

Statistics and Probability

Using probability to Make Decisions

S.MD.H Calculate expected values and use them to solve problems.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.MD.H.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.

Modeling

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and interpret parameters in linear, quadratic or exponential functions.

Example: For the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Using probability to Make Decisions

S.MD.H Calculate expected values and use them to solve problems.

Mathematical Practices

MP.1 **Make sense of problems and persevere in solving them.**
MP.2 Reason abstractly and quantitatively.
MP.3 **Construct viable arguments and critique the reasoning of others.**
MP.4 **Model with mathematics.**
MP.5 **Use appropriate tools strategically.**
MP.6 Attend to precision.
MP.7 **Look for and make use of structure.**
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.MD.H.4 Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

Modeling

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and interpret parameters in linear, quadratic or exponential functions.

Example: Find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	
		☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability
Using probability to Make Decisions

S.MD.I Use probability to evaluate outcomes of decisions.

Mathematical Practices

MP.1 **Make sense of problems and persevere in solving them.**
MP.2 **Reason abstractly and quantitatively.**
MP.3 **Construct viable arguments and critique the reasoning of others.**
MP.4 **Model with mathematics.**
MP.5 **Use appropriate tools strategically.**
MP.6 Attend to precision.
MP.7 **Look for and make use of structure.**
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.MD.I.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

A. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.
B. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.

Modeling

Example

Different types of insurance to be discussed include but are not limited to: health, automobile, property, rental, and life insurance. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and interpret parameters in linear, quadratic or exponential functions.

Example: Find the expected winnings from a state lottery ticket or a game at a fast food restaurant.

Example: Compare a high deductible versus a low deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability

Using probability to Make Decisions

S.MD.I Calculate expected values and use them to solve problems.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway

S.MD.I.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

Modeling

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and interpret parameters in linear, quadratic or exponential functions.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS

Wyoming 2018 Mathematics Content and Performance Standards

Statistics and Probability
Using probability to Make Decisions

S.MD.I Calculate expected values and use them to solve problems.

Mathematical Practices

MP.1 Make sense of problems and persevere in solving them.
MP.2 Reason abstractly and quantitatively.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.4 Model with mathematics.
MP.5 Use appropriate tools strategically.
MP.6 Attend to precision.
MP.7 Look for and make use of structure.
MP.8 Look for and express regularity in repeated reasoning.

Advanced Standards (+)/ STEM Pathway
S.MD.I.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Modeling

Example

Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and interpret parameters in linear, quadratic or exponential functions.

Source: http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

Wyoming Cross-Disciplinary Connections

Cross-Disciplinary Connections

ISTE	Computer Science	☐ Computational Thinking ☐ Financial Literacy

HS - Statistics and Probability Resources

<table>
<tr><th>Standard/Page Number</th><th>Resource/Link</th></tr>
<tr><td>S.ID.A.2 on page 401.</td><td>http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/</td></tr>
<tr><td>S.ID.A.3 on page 402.</td><td>Hunting in Wyoming:
<table>
<tr><th>Hunt Area</th><th>Hunt Type</th><th>Description</th><th>Total Quota</th></tr>
<tr><td>----</td><td>----</td><td>-----------------------</td><td>-----</td></tr>
<tr><td>010</td><td>1</td><td>ANTLERED DEER</td><td>75</td></tr>
<tr><td>010</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>239</td></tr>
<tr><td>015</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>320</td></tr>
<tr><td>022</td><td>1</td><td>ANTLERED MULE DEER O</td><td>234</td></tr>
<tr><td>022</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>57</td></tr>
<tr><td>023</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>120</td></tr>
<tr><td>024</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>240</td></tr>
<tr><td>034</td><td>1</td><td>ANTLERED DEER</td><td>142</td></tr>
<tr><td>034</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>18</td></tr>
<tr><td>036</td><td>1</td><td>ANTLERED MULE DEER O</td><td>250</td></tr>
<tr><td>037</td><td>1</td><td>ANTLERED DEER</td><td>141</td></tr>
<tr><td>037</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>18</td></tr>
<tr><td>041</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>60</td></tr>
<tr><td>047</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>60</td></tr>
<tr><td>059</td><td>3</td><td>ANY WHITE-TAILED DEE</td><td>120</td></tr>
<tr><td>060</td><td>1</td><td>ANTLERED DEER</td><td>80</td></tr>
<tr><td>060</td><td>2</td><td>ANY DEER</td><td>156</td></tr>
</table>
https://wgfd.wyo.gov/Hunting/Drawing-Odds</td></tr>
<tr><td>S.ID.A.4 on page 403.</td><td>http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/</td></tr>
<tr><td>S.ID.B.5 on page 404.</td><td>http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/</td></tr>
<tr><td>S.ID.B.6 on page 405.</td><td>http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/</td></tr>
<tr><td>S.ID.C.7 on page 406.</td><td>http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/</td></tr>
<tr><td>S.ID.C.8 on page 407.</td><td>http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/</td></tr>
<tr><td>S.ID.C.9 on page 408.</td><td>http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/</td></tr>
</table>

HS - Statistics and Probability Resources

Standard/Page Number	Resource/Link
S.IC.D.2 on page 410.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.IC.D.3 on page 411.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.IC.D.4 on page 412.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.IC.D.5 on page 413.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.IC.D.6 on page 414.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.CP.F.1 on page 415.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.CP.F.4 on page 418.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.CP.F.5 on page 419.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.CP.G.6 on page 420.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.CP.G.7 on page 421.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.CP.G.8 on page 422.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.CP.G.9 on page 423.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.MD.H.1 on page 424.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.MD.H.2 on page 425.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.MD.H.3 on page 426.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/

HS - Statistics and Probability Resources

Standard/Page Number	Resource/Link
S.MD.H.4 on page 427.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.MD.I.5 on page 428.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.MD.I.6 on page 429.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
S.MD.I.7 on page 430.	http://www.azed.gov/standards-practices/k-12standards/mathematics-standards/
Grade Level Math Practices on page 261.	Source: www.k12.wa.us/corestandards/pubdocs/mpbygradelevel.pdf Adapted from Arizona Department of Education Mathematics Standards—2010
CSTA Standards	https://www.csteachers.org/page/standards
ISTE Standards	https://www.iste.org/standards/for-educators

2018 Wyoming Grades K – 5 Math Standards Glossary

These definitions were compiled by the Standards Review Committee to help readers understand the terminology.

Addends: Two or more quantities added together to form a sum.

Algorithm: A process or set of rules to be followed in calculations. The standard algorithm for addition is just one example of an algorithm.

Area models: An arrangement of items defined by columns and rows.

Arithmetic Sequence: A sequence that changes from one term to the next by always adding (or subtracting) the same value.

Array: A set of objects or numbers arranged in order, often in rows and columns.

Associative Property of Multiplication: Changing the grouping of addends does not change the sum.

$a+b+c=a+b+c$

$a+(b+c)=(a+b)+c$

Associative Property of Multiplication: Changing the grouping of factors does not change the product.

$a\times b\times c=a\times b\times c$

$a\times(b\times c)=(a\times b)\times c$

Automaticity (From Memory): The ability to do things without occupying the mind with the low-level details required, allowing it to become an automatic response pattern or habit. It is usually the result of learning, repetition, and practice.

Benchmark Fraction: Common fractions that you can use to judge other numbers against. These fractions are commonly known fractions that serve as a relevant reference point for measurement comparison. Common benchmark fractions include 1/3, 1/4, 1/2, 2/3 and 3/4.

Cardinality: The number of elements in a set or group.

Commutative Property of Addition: Changing the order of addends does not change the sum. a + b = b + a.

Compose: When a number or shape is made by putting together other existing numbers or shapes.

Decompose: Separate numbers or shapes into their components (smaller parts).

Defining Attributes: Characteristics, properties or features which allow items to be sorted and classified as belonging to a set or group.

Dividend: A quantity to be divided. For example: 21 ÷ 3 = 7, 21 is the dividend.

Divisor: The quantity by which another quantity, the dividend, is to be divided. For example: 21 ÷ 3 = 7, 3 is the divisor.

Factor: Two or more quantities multiplied together to form a product.

Fluently/Fluency: Fluency is defined as using strategies and/or procedures that are efficient, flexible, accurate, and generalizable, that lead students to habituation. This habituation is the foundation of memory and automaticity.

From Memory (Automaticity): The power or process of reproducing or recalling what has been learned, practiced, and retained.

Function: A function is a special relationship where each input has a single output.

Greatest Common Factor (GCF) or Greatest Common Divisor (GCD): The greatest common factor of two integers *a* and *b* is the largest divisor common to *a* and *b*.

Improper Fraction: A fraction whose numerator is greater than its denominator.

Least Common Multiple (LCM): The least common multiple of two numbers *a* and *b* is the smallest positive integer *m* divisible by both *a* and *b*.

Line Plot (Dot Plot): A line plot is a graphical display of data along a number line with X's or dots recorded above the responses to indicate the number of occurrences a response appears in the data set.

Mean (Average): A statistical average found by taking the sum of a set of data and dividing by the number of data points.

Median: The median of a set of numbers is the value for which half the numbers are larger and half are smaller. If there are two middle numbers, the median is the arithmetic mean of the two middle numbers.

Mode: The value(s) which appears most often in a set of data.

Natural Numbers (Counting Numbers): The positive integers excluding zero. {1, 2, 3, 4, ...} [Note that in some instances we consider zero to also be a natural number, though this ambiguity does not normally appear until college.]

Number Line Diagram: A line representing the set of all real numbers. The number line is typically marked showing integer values.

Part/Part/Whole: Two smaller parts that combine to equal a whole.

Proper Fraction: A fraction whose numerator is less than the denominator.

Properties of Addition: See Commutative, Associative, Identity, Inverse and Distributive properties.

Quotient: The result of division. For example: 21 ÷ 3 = 7, 7 is the quotient.

Range (Statistical): Statistically, the range is the value calculated as the maximum value minus the minimum value in a data set.

Regular Polygon: A polygon is regular when all angles are congruent and all sides are congruent (have the same measure).

Right Prism: A right prism is a solid (or 3D) object with two parallel bases that are the same shape and several rectangular faces depending upon the shape of the bases. They are called right prisms because where the bases and rectangular faces meet are perpendicular.

Square unit: The area of a square each of whose sides measures 1 unit. It is used to measure area.

Standard Units of Measurement: Systems of Measurement: there are two main systems of measurement in the world: the Metric (decimal, SI) system and the US standard system (English). In each system, there are different units for measuring things like volumes, distances, temperature and mass.

Unit Cube: A cube whose side lengths are one unit.

Unit Square: A square whose side lengths are one unit.

Unknown: A symbol or letter whose value is unknown.

Vertex (Geometry): A point where two or more line segments meet. For example: a corner of a shape.

Whole Number System: All natural (counting) numbers including zero: {0, 1, 2, 3, 4, ...}

2018 Wyoming Grades 6-12 Math Standards Glossary

These definitions were compiled by the Standards Review Committee to help readers understand the terminology.

Absolute Value: The magnitude of a real number without regard to its sign. The distance a real number is from zero on a number line or the distance a complex number is from the origin in the complex number plane.

Addends: Two or more quantities added together to form a sum.

Additive Identity: For any real number a, a + 0 = 0 + a = a. Therefore, for the set of real numbers, zero is the additive identity.

Additive Inverse: The number in the set of real numbers that when added to a given number will yield zero.

Adjacent Angles: Two angles are adjacent when they share a common vertex, a common side but do not share interior space.

Algorithm: A process or set of rules to be followed in calculations. The standard algorithm for addition is just one example of an algorithm.

Angle: A geometric figure formed wherever two rays share a common point (the vertex).

Angle-Angle criterion (similarity theorem): If two angles of one triangle are congruent to two angles of another triangle, then the triangles are similar.

Area models: An arrangement of items defined by columns and rows.

Arithmetic Sequence: A sequence that changes from one term to the next by always adding (or subtracting) the same value.

Array: A set of objects or numbers arranged in order, often in rows and columns.

Associative Property of Addition: Changing the grouping of addends does not change the sum. $a+b+c=a+b+c$ $a+(b+c)=(a+b)+c$

Associative Property of Multiplication: Changing the grouping of factors does not change the product. $a\times b\times c=a\times b\times c$ $a\times(b\times c)=(a\times b)\times c$

Automaticity (From Memory): The ability to do things without occupying the mind with the low-level details required, allowing it to become an automatic response pattern or habit. It is usually the result of learning, repetition, and practice.

B (as in V=Bh): Area of the base.

Back-to-Back Plots: An option to split the categorical data into two. The back-to-back stemplot is an example of a back-to-back plot.

Benchmark Fraction: Common fractions that you can use to judge other numbers against. These fractions are commonly known fractions that serve as a relevant reference point for measurement comparison. Common benchmark fractions include 1/3, 1/4, 1/2, 2/3 and 3/4.

Box Plots: A box plot is a graphical rendition of statistical data based on the minimum, first quartile, median, third quartile, and maximum. Also referred to as a Box and Whisker Plot.

Clusters: When data seems to be "gathered" around a particular value.

Coefficient: A numerical or constant quantity placed before and multiplying the variable in an algebraic expression.

Combination: A collection of things, in which the order doesn't matter.

Commutative Property of Addition: Changing the order of addends does not change the sum. a + b = b + a.

Commutative Property of Multiplication: Changing the order of factors does not change the product. a* b = b * a.

Complementary Angles: Two angles whose sum is 90 degrees.

Complex Fraction: A fraction which has, as part of its numerator and/or denominator, at least one other fraction or mixed number.

Complex Number: Any number that can be written in the form: *a* + *bi* where *a* and *b* are real numbers.

Compose: When a number or shape is made by putting together other existing numbers or shapes.

Compound Events: An event where more than one outcome is possible.

Conditional Probability: The probability that event A occurs, given event B has already occurred.

$P(A|B) = P(A \text{ and } B)/P(B)$

Constant Rate of Change: Graphically, this is described with a straight line, where the ratio of 'rise' (vertical change) to 'run' (horizontal change) is a constant number.

Coordinate Plane (System): A two-dimensional number line where the vertical line is called the y-axis and the horizontal is called the x-axis. These lines are perpendicular and intersect at their zero points. This point is called the origin. The axes divide the plane into four quadrants. A coordinate system is three-dimensional.

Decompose: Separate numbers or shapes into their components (smaller parts).

Defining Attributes: Characteristics, properties or features which allow items to be sorted and classified as belonging to a set or group.

Dependent Events: Two events are dependent if the outcome or occurrence of the first affects the outcome or occurrence of the second so that the probability is changed.

Dilations: A dilation changes the size of the object without changing its interior angle measures. A dilation that creates a larger image is called an enlargement. A dilation that creates a smaller image is called a reduction. A description of a dilation includes the scale factor (or ratio) and the center of the dilation. The center of dilation is a fixed point in the plane.

Directrix: A line perpendicular to the axis of symmetry used in the definition of a parabola.

Distribution (Statistical): The distribution of a variable is a description of the relative numbers of times each possible outcome will occur in a number of trials.

Distributive Property: The product of a sum is the same as the sum of the products. $3(2 + 5) = 3 \times 2 + 3 \times 5$ or $5(2 - 7) = 5 \times 2 - 5 \times 7$.

Dividend: A quantity to be divided. For example: $21 \div 3 = 7$, 21 is the dividend.

Divisor: The quantity by which another quantity, the dividend, is to be divided. For example: $21 \div 3 = 7$, 3 is the divisor.

Domain: Algebraically, the domain is the set of inputs for a function.

Dot Plot/Dot Chart (Line Plot): A dot plot, also called a dot chart, is a type of simple histogram-like chart used in statistics for relatively small data sets where values fall into a number of discrete bins.

Ellipse: A regular oval shape, traced by a point moving in a plane so that the sum of its distances from two other points (the foci) is constant, or resulting when a cone is cut by an oblique plane that does not intersect the base.

Empirical Rule: The rule that gives benchmarks for understanding how probability is distributed under a normal distribution curve; in the normal distribution, 68% of the observations are within one standard deviation of the mean, 95% is within two standard deviations of the mean, and 99.7% is within three standard deviations of the mean.

Experimental Probability: The ratio of the number of times an outcome occurs to the total number of times the activity is performed.

Exponent: A number that tells how many times a given number, the base, is used as a factor.

Factor: Two or more quantities multiplied together to form a product.

Fit of a Function: How well an approximation function `fits' a data set. Calculating `fit' can be done many ways, but amounts to how much error is involved (a perfect fit would have zero error).

Fluently/Fluency: Fluency is defined as using strategies and/or procedures that are efficient, flexible, accurate, and generalizable, that lead students to habituation. This habituation is the foundation of memory and automaticity.

Frequencies (in data): The number of times a data point occurs.

From Memory (Automaticity): The power or process of reproducing or recalling what has been learned, practiced, and retained.

Function: A function is a special relationship where each input has a single output.

Geometric Net: A 2-dimensional shape that can be folded to form a 3-dimensional shape or a solid.

Greatest Common Factor (GCF) or Greatest Common Divisor (GCD): The greatest common factor of two integers *a* and *b* is the largest divisor common to *a* and *b*.

Histogram: The grouping of data into bins (spaced apart by the class interval) plotting the number of members in each bin versus the bin number.

Hyperbola: A hyperbola is a conic section defined as the locus of all points P in the plane, the difference of whose distances $r_1=F_1 \times P$ and $r_2=F_2 \times P$ from two fixed points (the foci F_1 and F_2) separated by a distance $2c$ is a given positive constant k, $r_2-r_1=k$.

The number *i*: The imaginary quantity equal to the square root of negative one.

$i=\sqrt{-1}$

Identity Property of Addition: The sum of any number and 0 is the original number. Let *a* be any number; $a + 0 = 0 + a = a$.

Identity Property of Multiplication: The product of any number and 1 is the original number. Let *a* be any number; $a * 1 = 1 * a = a$.

Improper Fraction: A fraction whose numerator is greater than its denominator.

Independent Events: Two events in which the outcome of the second is not affected by the outcome of the first.

Inferential Statistical Techniques: Inferential statistics makes inferences about populations using data drawn from the population. Confidence Intervals and Hypothesis Testing are two statistical techniques used to make these inferences.

Interquartile Range: The difference between the upper and lower quartile values in a set of data; it is commonly referred to as IQR and is used as a measure of spread and variability in a data set.

Integers: The set of whole numbers, their opposites, and zero. {... , -3, -2, -1, 0, 1, 2, 3, ...}.

Interval Notation: An interval is a connected portion of the real line. If the endpoints *a* and *b* are finite and are included, the interval is called closed and is denoted [*a,b*]. If the endpoints are not included, the interval is called open and denoted (*a,b*). If one endpoint is included but not the other, the interval is denoted [*a,b*) or (*a,b*] and is called a half-closed (or half-open interval). An infinite interval has -∞ on the left and/or ∞ on the right; since ∞ is not a real number, it is never included as an endpoint.

Inverse Property of Addition: The sum of a number and its inverse (opposite) is 0. Let *a* be any number; $a + (-a) = (-a) + a = 0$.

Inverse Property of Multiplication: The product of a number and its inverse (reciprocal) is 1. Let a be any number; $a \times (1/a) = (1/a) \times a = 1$.

Irrational Number: A decimal number that neither terminates, nor repeats.

Isometry: A transformation that is invariant with respect to distance. That is, the distance between any two points in the pre-image must be the same as the distance between the images of the two points. Isometries: Reflections, rotations, translations, glide reflections.

Joint Frequencies: Frequencies for each cell in a two-way table relative to the total number of data.

Least Common Multiple (LCM): The least common multiple of two numbers *a* and *b* is the smallest positive integer *m* divisible by both *a* and *b*.

Least-Squares Linear Regression: The "best-fit" line that is calculated by minimizing the sum of the squares of the differences between the observed and predicted values of the line.

Linear Regression Function: The most common form of linear regression is using least squares, but higher order than squares is possible.

Margin of Error: A range of values to the left and right of a point estimate.

Marginal Frequencies: Row totals and column totals in a two-way table.

Mean (Average): A statistical average found by taking the sum of a set of data and dividing by the number of data points.

Median: The median of a set of numbers is the value for which half the numbers are larger and half are smaller. If there are two middle numbers, the median is the arithmetic mean of the two middle numbers.

Mode: The value(s) which appears most often in a set of data.

Multiplicative Identity: For real numbers, the number 1 (one) is the multiplicative identity. This has the property that for any real number *a*, $a \times 1 = 1 \times a = a$.

Multiplicative Inverse: See Reciprocal.

Multiplicative Property of Zero: The product of any number and 0 is 0. Let *a* be any number; $a \times 0 = 0 \times a = 0$.

Mutually Exclusive/Exclusivity/Disjoint: Two events are mutually exclusive if they cannot occur at the same time.

Natural Numbers (Counting Numbers): The positive integers excluding zero. {1, 2, 3, 4, ...} [Note that in some instances we consider zero to also be a natural number, though this ambiguity does not normally appear until college.]

Normal Distribution: The mean, median, and mode of a normal distribution are equal. The area under the normal curve is equal to 1.0. Normal distributions are denser in the center and less dense in the tails. Normal distributions are defined by two parameters, the mean (μ) and the standard deviation (σ).

Number Line Diagram: A line representing the set of all real numbers. The number line is typically marked showing integer values.

Outliers: An outlier is an element of a data set that distinctly stands out from the rest of the data.

Percent Error: A measure of the error of an approximation, in percentage form. Absolute value of (approximation - actual value)/(actual value) * 100.

Percent Increase/Decrease: The ratio of the amount of increase/decrease to the initial value expressed as a percent. (Final Value - Initial Value)/Initial Value*100.

Permutations: All possible arrangements of a collection of things, where the order is important.

Pi: Pi is the ratio of the circumference of a circle to its diameter (π =circumference/diameter).

Product: The result of multiplying two or more quantities.

Properties of Addition: See Commutative, Associative, Identity, Inverse and Distributive properties.

Prove: Demonstrate by deductive reasoning which is appropriate for the grade level in which it appears. This could include step-by-step, two-column, picture proof, proof by visual demonstration, or more formal proof methods.

Qualitative/Categorical Data: Qualitative data is the term used to denote information which is descriptive. For example; whether someone has brown hair or blonde hair.

Quantitative data: Quantitative data is the term used to denote information which is numerical. For example; 10 girls have brown hair and 12 girls have blonde hair.

Quotient: The result of division. For example: 21 ÷ 3 = 7, 7 is the quotient.

Random Sampling: A method of sampling where individuals are selected by chance.

Randomization: The process by which treatments are assigned by a chance mechanism to the experimental units.

Range (Statistical): Statistically, the range is the value calculated as the maximum value minus the minimum value in a data set.

Range (Functions): The range of a function is the set of outputs from the domain.

Ratio: A comparison of two quantities.

Rational Number: Any number that can be expressed as a ratio n/d where n and d are integers and $d \neq 0$.

Real Number: Any number that can be represented on a number line. (The set of all rational and irrational numbers).

Reciprocal: The multiplicative inverse of a non-zero number a is the reciprocal ($1/a$). When a number is multiplied by its multiplicative inverse (reciprocal) the product is one. Zero has no multiplicative inverse.

Relative Frequency: The probability of a data value occurring.

Regular Polygon: A polygon is regular when all angles are congruent and all sides are congruent (have the same measure).

Right Prism: A right prism is a solid (or 3D) object with two parallel bases that are the same shape and several rectangular faces depending upon the shape of the bases. They are called right prisms because where the bases and rectangular faces meet are perpendicular.

Sample: A selection of values which have been taken from a larger group of data.

Scale Factor: In two similar figures, the ratio of their corresponding parts is called the scale factor.

Scatter Plot: A plot used to visualize bivariate data; the explanatory (independent) variable is shown on the horizontal axis and the response (dependent) variable is shown on the vertical axis. No lines connect the data points.

Similarity Transformations: A similarity transformation is one or more rigid transformations (reflection, rotation, translation) followed by a dilation. When a figure is transformed by a similarity transformation, an image is created that is similar to the original figure.

Simplify: To use the rules of arithmetic and algebra to rewrite an expression as simply as possible.

Square Root: The square root of a number is another number which produces the first number when it is multiplied by itself. Example: The square root of 49 is 7.

Square unit: The area of a square each of whose sides measures 1 unit. It is used to measure area.

Standard Deviation (σ): Standard deviation is a measure of the variability of a set of data from its mean.

Standard Units of Measurement: Systems of Measurement: there are two main systems of measurement in the world: the Metric (decimal, SI) system and the US standard system (English). In each system, there are different units for measuring things like volumes, distances, temperature and mass.

Stem-and-Leaf Plot or Stemplot: A table where each data value is split into a "stem" (the first digit or digits) and a "leaf" (usually the last digit).

Supplementary Angles: Two angles whose sum is 180°.

Tree Diagram: A diagram that shows all the possible outcomes of an event. Each branch in a tree diagram represents a possible outcome.

Uniform Probability Distribution/Model: A uniform distribution, also called a rectangular distribution, is a probability distribution that has constant probability.

Unknown: A symbol or letter whose value is unknown.

Variability: Variability (also called spread or dispersion) refers to how spread out a set of data is. Variability gives you a way to describe how much data sets vary and allows you to use statistics to compare your data to other sets of data.

Vertex (Geometry): A point where two or more line segments meet. For example: a corner of a shape.

Vertical Angles: The angles opposite each other when two lines intersect.