WDE

2023 Mathematics
Wyoming Content & Performance Standards (WYCPS)
Effective - July 17, 2024
To be Fully Implemented in Districts by the Beginning of School Year 2025-26

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.

Organization of the Standards:
Standard Code = Grade.Math Domain.Standard #
Key: K.G.4 = Grade K.Domain Geometry (G).Standard 4

Domain: The core concepts to be studied in math. The Math Standards usually consist of 5-6 domains in each grade level. The math domains are listed below.
- Kindergarten – Counting & Cardinality (CC)
- K-5   – Operations & Algebraic Thinking (OA)
- K-5   – Number & Operations in Base Ten (NBT)
- K-5   – Measurement & Data (MD)
- K-HS – Geometry (G)
- 3-5   – Number & Operations – Fractions (NF)
- 6-7   – Ratios & Proportional Relationships (RP)
- 8-12 – Functions (F)
- 6-8   – Expressions & Equations (EE)
- 6-8   – The Number System (NS)
- 6-12 – Statistics & Probability (SP)
- 9-12 – Number & Quantity (N)
- 9-12 – Algebra (A)

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.

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.

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, expressing 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 $x2 + 9x + 14$, 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 $(x - 1)(x^3 + x^2 + x + 1)$ 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.

Kindergarten Math Content & Performance Standards

Counting and Cardinality
Know number names and the count sequence.
> **K.CC.1**
>> **K.CC.1a** Count to 100 by ones and by tens.
>> **K.CC.1b** Count backwards by ones from 20.
>>> *The Proficient student* is able to:
>>>> A1. Count to 100 by ones, starting at one.
>>>> A2. Count to 100 by multiples of ten, starting at ten.
>>>> B. Count backwards by ones from 20.
>> **K.CC.3** Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 [with a 0 (zero) representing a count of no objects].
>>> *The Proficient student* is able to:
>>>> A. Write numbers from 0 to 20.
>>>> B. Represent a number of objects with a written numeral 0-20 [with 0 (zero) representing a count of no objects].

Count to tell the number of objects.
> **K.CC.4** Understand the relationship between numbers and quantities; connect counting to cardinality.
>> **K.CC.4a** Use one-to-one correspondence when counting objects.
>> **K.CC.4b** Understand that the last number name said, tells the number of objects counted regardless of their arrangement.
>> **K.CC.4c** 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.
>>> *The Proficient student* is able to count and tell the number of objects in a range from 10 to 39.
>>>> 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.

Operations and Algebraic Thinking

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

> **K.OA.2** Solve word problems using objects and drawings to find sums up to 10 and differences within 10.
>
> *The Proficient student* is able to solve word problems using objects and drawings to find sums up to 10 and differences within 10.
>
> **K.OA.3** Decompose numbers less than or equal to 10 in more than one way.
>
> *The Proficient student* is able to decompose numbers less than or equal to 10 in more than one way.
>
> **K.OA.4** For any number from 1 to 9, find the number that makes 10 when added to the given number.
>
> *The Proficient student* is able to for any number from 1 to 9, find the number that makes 10 when added to the given number.
>
> **K.OA.5** Fluently add and subtract within 5.
>
> *The Proficient student* is able to fluently add and subtract within 5.

Measurement and Data

Classify objects and count the number of objects in each category.

> **K.MD.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.)
>
> *The Proficient student* is able to 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.)

Geometry

Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).

> **K.G.2** Correctly name shapes regardless of their orientations or overall size.
>
> *The Proficient student* is able to correctly name shapes regardless of their orientations or overall size.

Analyze, compare, create, and compose shapes.

> **K.G.4** Analyze and compare two- and three-dimensional shapes, using informal language to describe their similarities, differences, and attributes.
>
> *The Proficient student* is able to analyze and compare two- and three-dimensional shapes, using informal language to describe their similarities, differences, and attributes.
>
> **K.G.6** Use simple shapes to compose squares, rectangles, and hexagons.
>
> *The Proficient student* is able to use simple shapes to compose squares, rectangles, and hexagons.

Grade 1 Math Content & Performance Standards

Counting and Cardinality

Represent and solve problems involving addition and subtraction.

1.OA.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.

The Proficient student is able to 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.

Add and subtract within 20.

1.OA.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.

The Proficient student is able to 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.

Work with addition and subtraction equations.

1.OA.7 Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.

The Proficient student is able to understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.

Number and Operations in Base Ten

Extend the counting sequence.

1.NBT.1 Extend the number sequences to 120. In this range:

1.NBT.1a Count forward and backward, starting at any number less than 120.

1.NBT.1b Read numerals.

1.NBT.1c Write numerals.

1.NBT.1d Represent a number of objects with a written numeral.

The Proficient student is able to extend the number sequences to 120. In this range:

A. Count forward and backward, starting at any number less than 120.

B. Read numerals.

C. Write numerals.

D. Represent a number of objects with a written numeral.

Understand place value.

1.NBT.2 Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:

1.NBT.2a 10 can be thought of as a bundle of ten ones — called a "ten."

1.NBT.2b The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.

1.NBT.2c 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).

The Proficient student is able to 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).

Use place value understanding and properties of operations to add and subtract.

1.NBT.4 Add within 100, using concrete models or drawings and strategies based on place value:

1.NBT.4a Including adding a two-digit number and a one-digit number.

1.NBT.4b Adding a two-digit number and a multiple of 10.

1.NBT.4c Understand that in adding two-digit numbers, adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.

1.NBT.4d Relate the strategy to a written method and explain the reasoning used.

The Proficient student is able to 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.

Measurement and Data

Work with time and money.

1.MD.3a Tell and write time in hours and half-hours using analog and digital clocks.

The Proficient student is able to tell and write time in hours and half-hours using analog and digital clocks.

1.MD.3b Identify U.S. coins by value (pennies, nickels, dimes, quarters).

The Proficient student is able to identify U.S. coins by value (pennies, nickels, dimes, quarters).

Geometry

Reason with shapes and their attributes.

1.G.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.

The Proficient student is able to 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.

1.G.3 Partition circles and rectangles into two and four equal shares and:

1.G.3a Describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of.

1.G.3b Describe the whole as two of, or four of the shares.

1.G.3c Recognize that decomposing into more equal shares creates smaller shares.
The Proficient student is able to 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.

Grade 2 Math Content & Performance Standards

Operations & Algebraic Thinking
Represent and solve problems involving addition and subtraction.
2.OA.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.
The Proficient student is able to use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, and 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.

Add and subtract within 20.
2.OA.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.
The Proficient student is able to 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.

Number and Operations in Base Ten
Understand place value.
2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; and demonstrate that cases: 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).
2.NBT.1a 100 can be thought of as a bundle of ten tens — called a "hundred."
2.NBT.1b 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).
2.NBT.1c 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.)
The Proficient student is able to 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.)

2.NBT.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.
The Proficient student is able to 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.

Use place value understanding and properties of operations to add and subtract.

2.NBT.5 Add and subtract within 100 using strategies based on place value, properties of addition, and/or the relationship between addition and subtraction.
The Proficient student is able to add and subtract within 100 using strategies based on place value, properties of addition, and/or the relationship between addition and subtraction.

2.NBT.7 Add and subtract within 1,000, using concrete models or drawings and strategies based on place value, properties of addition, and/or the relationship between addition and subtraction:

2.NBT.7a Relate the strategy to a written method and explain the reasoning used.

2.NBT.7b Understand that in adding or subtracting three-digit numbers, add or subtract hundreds and hundreds, tens and tens, ones and ones.

2.NBT.7c Understand that sometimes it is necessary to compose or decompose tens or hundreds.
The Proficient student is able to add and subtract within 1,000, 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.

Measurement and Data

Measure and estimate lengths in standard units.

2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
The Proficient student is able to measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

Work with time and money.

2.MD.7 Tell and write time from analog and digital clocks in five minute increments using a.m. and p.m.
The Proficient student is able to tell and write time from analog and digital clocks in five minute increments using a.m. and p.m.

2.MD.8 Solve word problems up to $10 involving dollar bills, quarters, dimes, nickels, and pennies, using $ (dollars) and ¢ (cents) symbols appropriately.
The Proficient student is able to solve word problems up to $10 involving dollar bills, quarters, dimes, nickels, and pennies, using $ (dollars) and ¢ (cents) symbols appropriately.

Geometry

Reason with shapes and their attributes.

2.G.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.

The Proficient student is able to partition a rectangle into rows and columns of same-size squares and count to find the total number of them.

2.G.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

2.G.3a Describing the shares using the words halves, thirds, half of, a third of, etc.

2.G.3b Describing the whole as two halves, three thirds, four fourths.

2.G.3c Recognizing that equal shares of identical wholes need not have the same shape.

The Proficient student is able to 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.

Grade 3 Math Content & Performance Standards

Operations and Algebraic Thinking

Multiply and divide within 100.

3.OA.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.

The Proficient student is able to 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.

Solve problems involving the four operations, and identify and explain patterns in arithmetic.

3.OA.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.

3.OA.8a Represent these problems using equations with a symbol standing for the unknown quantity.

3.OA.8b Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

The Proficient student is able to 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.

Number and Operations in Base Ten

Use place value understanding and properties of operations to perform multi-digit arithmetic (a range of algorithms may be used).

3.NBT.2 Fluently add and subtract within 1,000 using strategies and algorithms based on place value, properties of addition, and/or the relationship between addition and subtraction.
The Proficient student is able to fluently add and subtract within 1,000 using strategies and algorithms based on place value, properties of addition, and/or the relationship between addition and subtraction.

Number and Operations - Fractions

Develop understanding of fractions as numbers (limited to denominators 2, 3, 4, 6, and 8) (use horizontal fractions).

3.NF.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 $1/b$.
The Proficient student is able to 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 $1/b$.

3.NF.2 Understand and represent fractions on a number line diagram.

3.NF.2a 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.

3.NF.2b 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 ab on the number line.
The Proficient student is able to 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.

3.NF.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

3.NF.3a Understand two fractions as equivalent if they are the same size, or the same point on a number line.

3.NF.3b Recognize and generate simple equivalent fractions. Explain why the fractions are equivalent.

3.NF.3c Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.

3.NF.3d 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.

The Proficient student is able to 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.

Measurement and Data
Represent and interpret data.

3.MD.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.

The Proficient student is able to 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.

Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

3.MD.7 Relate area to the operations of multiplication and addition.

3.MD.7a 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.

3.MD.7b 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.

3.MD.7c 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.

The Proficient student is able to 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.

Geometry

Reason with shapes and their attributes.

3.G.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.

The Proficient student is able to 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.

Grade 4 Math Content & Performance Standards

Operations and Algebraic Thinking

Use the four operations with whole numbers to solve problems.

4.OA.3 Solve multi-step word problems posed with whole numbers, including problems in which remainders must be interpreted.

4.OA.3a Represent these problems using equations with a letter standing for the unknown quantity.

4.OA.3b Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

The Proficient student is able to 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.

Number and Operations in Base Ten

Generalize place value understanding for multi-digit whole numbers (limited to numbers less than or equal to 1,000,000).

4.NBT.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.

The Proficient student is able to 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.

4.NBT.3 Use place value understanding to round multi-digit whole numbers to any place.

The Proficient student is able to use place value understanding to round multi-digit whole numbers up to 1,000,000 to any place.

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).

4.NBT.5 Use strategies based on place value and the properties of multiplication.

4.NBT.5a Multiply a whole number of up to four digits by a one-digit whole number.

4.NBT.5b Multiply a pair of two-digit numbers.

4.NBT.5c Use appropriate models to explain the calculation, such as by using equations, rectangular arrays, and/or area models.

The Proficient student is able to 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, ratio tables, or area models.

4.NBT.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.

The Proficient student is able to 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, ratio tables, or area models.

Number and Operations - Fractions

Extend understanding of fraction equivalence and ordering (limited to denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100).

4.NF.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.

The Proficient student is able to 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.

4.NF.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 $1/2$.

4.NF.2a Recognize that comparisons are valid only when the two fractions refer to the same whole.

4.NF.2b Record the results of comparisons with symbols >, =, or <.

4.NF.2c Justify the conclusions by using a visual fraction model.

The Proficient student is able to 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.

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

4.NF.3a Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.

4.NF.3b 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.

4.NF.3c 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.

4.NF.3d Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.

The Proficient student is able to 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.

Understand decimal notation for fractions, and compare decimal fractions.

4.NF.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 <.

The Proficient student is able to 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 <.

Measurement and Data

Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

4.MD.3 Apply the area and perimeter formulas for rectangles in real-world and mathematical problems.

The Proficient student is able to apply the area and perimeter formulas for rectangles in real-world and mathematical problems.

Geometric measurement: understand concepts of angle and measure angles.

4.MD.7 Solve addition and subtraction problems to find unknown angles on a diagram in real-world and mathematical problems.

The Proficient student is able to solve addition and subtraction problems to find unknown angles on a diagram in real-world and mathematical problems.

Geometry

Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

    4.G.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.

    The Proficient student is able to 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.

Grade 5 Math Content & Performance Standards

Operations and Algebraic Thinking

Write, interpret, and/or evaluate numerical expressions.

    5.OA.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

    The Proficient student is able to use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

    5.OA.2 Write simple expressions requiring parentheses that record calculations with numbers, and interpret numerical expressions without evaluating them.

    The Proficient student is able to write simple expressions requiring parentheses that record calculations with numbers, and interpret numerical expressions without evaluating them.

Number and Operations in Base Ten

Understand the place value system.

    5.NBT.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.

    The Proficient student is able to 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.

    5.NBT.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.

    The Proficient student is able to 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.

Perform operations with multi-digit whole numbers and with decimals to hundredths.

    5.NBT.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.

    The Proficient student is able to 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.

Number and Operations - Fractions
Use equivalent fractions as a strategy to add and subtract fractions.

5.NF.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.

The Proficient student is able to 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.

Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

5.NF.3 Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). 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.

The Proficient student is able to interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). 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.

5.NF.6 Solve real-world problems involving multiplication of fractions and mixed numbers by using visual fraction models or equations to represent the problem.

The Proficient student is able to solve real-world problems involving multiplication of fractions and mixed numbers by using visual fraction models or equations to represent the problem.

5.NF.7 Extend the concept of division to divide unit fractions and whole numbers by using visual fraction models and equations.

5.NF.7a Interpret division of a unit fraction by a non-zero whole number and compute the quotient.

5.NF.7b Interpret division of a whole number by a unit fraction and compute the quotient.

5.NF.7c 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.

The Proficient student is able to 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.

Measurement and Data
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

5.MD.5 Relate volume to the operations of multiplication and solve real-world and mathematical problems involving volume.

5.MD.5a 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.

5.MD.5b 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.

The Proficient student is able to 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.

Geometry

Graph points on the coordinate plane to solve real-world and mathematical problems.

5.G.2 Plot and interpret points in the first quadrant of the coordinate plane to represent real-world and mathematical situations.

The Proficient student is able to plot and interpret points in the first quadrant of the coordinate plane to represent real-world and mathematical situations.

Grade 6 Math Content & Performance Standards

Ratios and Proportional Relationships

Understand ratio concepts and use ratio reasoning to solve problems.

6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems.

6.RP.3a 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.

6.RP.3b Solve unit rate problems including those involving unit pricing and constant speed.

6.RP.3c Understand that a percentage is a rate per 100 and use this to solve problems involving wholes, parts, and percentages.

6.RP.3d Use ratio reasoning to convert measurement units; convert units appropriately when multiplying or dividing quantities.

The Proficient student is able to:

    A. Make tables of equivalent ratios relating quantities with whole number measurements and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

    B. Solve unit rate problems with whole number measurements including those involving unit pricing and constant speed.

    C. In mathematical and real-world contexts solve one-step problems involving wholes, parts, and percentages.

    D. Use ratio reasoning to convert measurement units and to transform units appropriately when multiplying or dividing quantities in one-step problems.

The Number System

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

      6.NS.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.

      The Proficient student is able to 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.

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

      6.NS.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.

      The Proficient student is able to add, subtract, multiply, and divide multi-digit decimals using efficient and generalizable procedures including, but not limited to the standard algorithm for each operation.

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

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

        6.NS.7a Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.

        6.NS.7b Write, interpret, and explain statements of order for rational numbers in real-world contexts.

        6.NS.7c 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.

        6.NS.7d Distinguish comparisons of absolute value from statements about order.

        The Proficient student is able to understand ordering and absolute value of rational numbers.

          A. Interpret statements of inequality as statements about the relative position of two numbers on a (vertical or horizontal) number line diagram.

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

          C. Describe 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.

      6.NS.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.

      The Proficient student is able to 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.

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions.

      6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers.

        6.EE.2a Write expressions that record operations with numbers and with letters standing for numbers.

6.EE.2b Identify parts of an expression using mathematical terms (sum, difference, term, product, factor, quotient, coefficient, constant).

6.EE.2c Use Order of Operations to evaluate algebraic expressions using positive rational numbers and whole-number exponents. Include expressions that arise from formulas in real-world problems.
The Proficient student is able to write, read, and evaluate expressions in which letters stand for numbers.
    A. Write two-step algebraic expressions.
    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 using positive rational numbers and whole-number exponents. Include expressions that arise from formulas relative to sixth grade standards in real-world problems.

6.EE.3 Apply the properties of operations to generate equivalent expressions.
The Proficient student is able to apply the properties of operations to generate equivalent expressions (Commutative Property, Associative Property, Distributive Property, Additive Identity Property, Multiplicative Identity Property, and Zero Product Property).

Reason about and solve one-variable equations and inequalities.

6.EE.6 Use variables to represent unknown numbers and write expressions when solving a real-world or mathematical problem.
The Proficient student is able to use variables to represent unknown numbers and write expressions to represent real-world or mathematical problems.

6.EE.7 Write and solve real-world and mathematical problems in the form of one-step, linear equations involving non negative rational numbers.
The Proficient student is able to solve problems in both real-world and mathematical contexts by writing and solving equations in the form of one-step, linear equations involving non negative rational numbers.

6.EE.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.
The Proficient student is able to write an inequality of the form $x > c$ or $x < c$ (with the variable on either side) to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities have infinitely many solutions and represent solutions by graphing on a number line.

Geometry

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

6.G.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.
The Proficient student is able to find the 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.

6.G.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.

The Proficient student is able to represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of right triangular prisms, right rectangular prisms, and right rectangular pyramids (given lateral height) in the context of solving real-world and mathematical problems.

Statistics and Probability

Summarize and describe distributions.

6.SP.4 Display numerical data in plots on a number line, including dot plots, stem-and-leaf plots, histograms, and box plots.

The Proficient student is able to display numerical data in plots on a number line, including dot plots, stem-and-leaf plots, histograms, and box plots.

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

6.SP.5a Report the sample size.

6.SP.5b Describe the context of the data under investigation, including how it was measured and its units of measurement.

6.SP.5c 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.

6.SP.5d 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.

The Proficient student is able to 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.

Grade 7 Math Content & Performance Standards

Ratios and Proportional Relationships

Analyze proportional relationships and use them to solve real-world and mathematical problems.

7.RP.2 Recognize and represent proportional relationships between quantities.

7.RP.2a Decide whether two quantities in a table or graph are in a proportional relationship.

7.RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

7.RP.2c Represent proportional relationships with equations.

7.RP.2d 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.
The Proficient student is able to 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.

7.RP.3 Solve multi-step real-world and mathematical problems involving ratios and percentages.
The Proficient student is able to solve multi-step real-world and mathematical problems involving ratios and percentages (e.g., simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error).

The Number System

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

7.NS.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.)
The Proficient student is able to 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.)

Expressions and Equations

Use properties of operations to generate equivalent expressions.

7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
The Proficient student is able to add, subtract, factor, and expand linear expressions with rational coefficients.

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

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

7.EE.4a 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.

7.EE.4b 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.

7.EE.4c Write and solve two-step linear inequalities. Graph the solution set on a number line and interpret its meaning.

7.EE.4d Identify and justify the steps for solving multi-step linear equations and two-step linear inequalities.
The Proficient student is able to 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.

Geometry

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

7.G.4 Investigate the concept of circles.

7.G.4a Demonstrate an understanding of the proportional relationships between diameter, radius, and circumference of a circle.

7.G.4b Understand that is defined by the constant of proportionality between the circumference and diameter.

7.G.4c Given the formulas for circumference and area of circles, solve real-world and mathematical problems.

The Proficient student is able to investigate the concept of circles.

A. Demonstrate an understanding of the proportional relationships between diameter, radius, and circumference of a circle.

B. Understand that 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.

7.G.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.

The Proficient student is able to 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.

7.G.6 Solve real-world and mathematical problems involving.

7.G.6a Area and surface area of objects composed of triangles and quadrilaterals;

7.G.6b Volume of objects composed only of right prisms having triangular or quadrilateral bases.

The Proficient student is able to 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.

Statistics and Probability

Use random sampling to draw inferences about a population.

7.SP.1 Solve real-world and mathematical problems involving:

7.SP.1a Understand that a sample is a subset of a population.

7.SP.1b Differentiate between random and non-random sampling.

7.SP.1c Understand that generalizations from a sample are valid only if the sample is representative of the population.

7.SP.1d Understand that random sampling is used to gather a representative sample and tends to support valid inferences about the population.

The Proficient student is able to solve real-world and mathematical problems involving:

    A. Describing a sample that is a subset of a population.

    B. Differentiating between random and non-random sampling.

    C. Determining if a generalization is valid by justifying whether or not the sample is representative of the population.

    D. Determining if inferences about the population are valid based on how the given sample was collected.

Draw informal comparative inferences about two populations.

7.SP.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.

The Proficient student is able to 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.

Investigate chance processes and develop, use, and evaluate probability models.

7.SP.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.

The Proficient student is able to 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.

7.SP.6 Collect multiple samples to compare the relationship between theoretical and experimental probabilities for simple events.

The Proficient student is able to collect multiple samples to compare the relationship between theoretical and experimental probabilities for simple events.

Grade 8 Math Content & Performance Standards

The Number System

Know that there are numbers that are not rational, and approximate them by rational numbers.

8.NS.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.

8.NS.1a Make comparisons between rational and irrational numbers.

8.NS.1b Understand that all real numbers have a decimal expansion.

8.NS.1c Model the hierarchy of the real number system, including natural, whole, integer, rational, and irrational numbers.

8.NS.1d Convert repeating decimals to fractions.

The Proficient student is able to know that numbers that are not rational are called irrational. Show 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. Show that real numbers (excluding irrational 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.

Expressions and Equations

Understand the connections between proportional relationships, lines, and linear equations.

8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

The Proficient student is able to graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

Analyze and solve linear equations and pairs of simultaneous linear equations.

8.EE.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.

8.EE.7a 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.

8.EE.7b Recognize the three types of solutions to linear equations: one solution, infinitely many solutions, or no solutions.

The Proficient student is able to 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.

8.EE.8 Analyze and solve pairs of simultaneous linear equations.

8.EE.8a 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.

8.EE.8b Solve systems of two linear equations in two variables with integer solutions by graphing the equations.

8.EE.8c Solve simple real-world and mathematical problems leading to two linear equations in two variables given $y = mx + b$ form with integer solutions.

The Proficient student is able to analyze and solve a system of linear equations.

    A. Show 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, including systems with one, infinitely many, and no solutions.

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.

Functions

Define, evaluate, and compare functions.

8.F.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
The Proficient student is able to compare properties (intercepts, domain, and range) of two linear functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Use functions to model relationships between quantities.

8.F.4 Apply the concepts of linear functions to real-world and mathematical situations.

8.F.4a Understand that the slope is the constant rate of change and the y-intercept is the point where x = 0.

8.F.4b Determine the slope and the y-intercept of a linear function given multiple representations, including two points, tables, graphs, equations, and verbal descriptions.

8.F.4c Construct a function in slope-intercept form that models a linear relationship between two quantities.

8.F.4d Interpret the meaning of the slope and the y-intercept of a linear function in the context of the situation.
The Proficient student is able to apply the concepts of linear functions to real-world and mathematical situations.

A. Recognize that the slope is the constant rate of change and the y-intercept is the point where x = 0 from an equation, graph, table, and verbal description.

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.

Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software.

8.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.
The Proficient student is able to 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 at most two transformations (rotations, reflections, and translations); given two congruent figures, describe a sequence of at most two transformations that exhibits the congruence between them.

8.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.
The Proficient student is able to 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.

Understand and apply the Pythagorean Theorem.

8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems.
The Proficient student is able to apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems.

8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
The Proficient student is able to apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Statistics and Probability

Investigate patterns of association in bivariate data.

8.SP.3 Use an equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
The Proficient student is able to interpret the slope and y-intercept in the context of the bivariate measurement data when given a scatter plot with a line of best fit and an equation.

8.SP.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.

8.SP.4a Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.

8.SP.4b Use relative frequencies calculated for rows or columns to describe possible association between the two variables.
The Proficient student is able to 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.

High School Math Content & Performance Standards

Number and Quantity

The Real Number System

Extend the properties of exponents to rational exponents.

N.RN.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.

The Proficient student is able to explain and use the meaning of rational exponents in terms of properties of integer exponents and use proper notation for radicals in terms of rational exponents.

N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

The Proficient student is able to rewrite expressions involving radicals and rational exponents, using the properties of exponents.

Quantities

Reason quantitatively and use units to solve problems.

N.Q.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; and choose and interpret the scale and the origin in graphs and data displays.

The Proficient student is able to use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; and choose and interpret the scale and the origin in graphs and data displays.

The Complex Number System

Use complex numbers in polynomial identities and equations.

N.CN.7 Solve quadratic equations with real coefficients that have complex solutions.

The Proficient student is able to solve quadratic equations with real coefficients that have complex solutions.

Algebra

Seeing Structure in Expressions

Write expressions in equivalent forms to solve problems.

A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A.SSE.3a Factor a quadratic expression to reveal the zeros of the function it defines.

The Proficient student is able to 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.

Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials.

A.APR.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.

The Proficient student is able to 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.

Understand the relationship between zeros and factors of polynomials.

A.APR.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.
The Proficient student is able to 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.

Creating Equations

Create equations that describe numbers or relationships.

A.CED.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.
The Proficient student is able to 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.

A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
The Proficient student is able to create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A.CED.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.
The Proficient student is able to 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.

Reasoning with Equations and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
The Proficient student is able to solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
The Proficient student is able to solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A.REI.4 Solve quadratic equations in one variable.

A.REI.4b Solve quadratic equations by inspection (e.g., for $x2 = 49$), 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

The Proficient student is able to solve quadratic equations in one variable.

  B. Solve quadratic equations by inspection (e.g., for x2 = 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 ± bi for real numbers a and b.

Solve systems of equations.

A.REI.6 Estimate solutions graphically and determine algebraic solutions to linear systems, focusing on pairs of linear equations in two variables.
The Proficient student is able to estimate solutions graphically and determine algebraic solutions to linear systems, focusing on pairs of linear equations in two variables.

A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
The Proficient student is able to solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

Functions

Interpreting Functions

Understand the concept of a function and use function notation.

F.IF.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).
The Proficient student is able to demonstrate that a function's domain is assigned to exactly one element of the range in equations, tables, graphs, and context.

F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
The Proficient student is able to use function notation, evaluate functions for inputs in their domain, and interpret statements that use function notation in terms of a context.

Interpret functions that arise in applications in terms of the context.

F.IF.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.
The Proficient student is able to, 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.

Analyze functions using different representations.

F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F.IF.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

F.IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior.
The Proficient student is able to graph linear, quadratic, and exponential functions expressed symbolically and show appropriate key features of the graph showing intercepts, maxima, and minima, and end behavior.
    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

F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
The Proficient student is able to compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Building Functions
Build a function that models a relationship between two quantities.
    F.BF.1 Write a function that describes a relationship between two quantities.
    F.BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.
    The Proficient student is able to 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.
Build new functions from existing functions.
    F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.
The Proficient student is able to identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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.

    F.BF.4 Find inverse functions.
    F.BF.4a 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.
The Proficient student is able to 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.

Linear, Quadratic, and Exponential Models

Construct and compare linear, quadratic, and exponential models and solve problems.

F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

F.LE.1a Verify that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.

F.LE.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

F.LE.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

The Proficient student is able to 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.

F.LE.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).

The Proficient student is able to construct linear and exponential functions using a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Geometry

Congruence

Experiment with transformations in the plane.

G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

The Proficient student is able to, given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

Understand congruence in terms of rigid motions.

G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

The Proficient student is able to explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

Prove geometric theorems.

G.CO.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.

The Proficient student is able to prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G.CO.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.

The Proficient student is able to prove theorems about triangles. Theorems include: measure 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.

Similarity, Right Triangles, and Trigonometry
Prove theorems involving similarity.

G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

The Proficient student is able to use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Define trigonometric ratios and solve problems involving right triangles.

G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

The Proficient student is able to use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Circles
Find arc lengths and areas of sectors of circles.

G.C.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.

The Proficient student is able to 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.

Expressing Geometric Properties With Equations
Use coordinates to prove simple geometric theorems algebraically.

G.GPE.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).

The Proficient student is able to 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).

Geometric Measurement and Dimension
Explain volume formulas and use them to solve problems.

G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

The Proficient student is able to use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Statistics And Probability

Interpreting Categorical and Quantitative Data

Summarize, represent, and interpret data on a single count or measurement variable.

S.ID.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.
The Proficient student is able to 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.

Summarize, represent, and interpret data on two categorical and quantitative variables.

S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

S.ID.6a 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.
The Proficient student is able to represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

- 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.

Interpret linear models.

S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
The Proficient student is able to interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S.ID.9 Distinguish between correlation and causation.
The Proficient student is able to distinguish between correlation and causation.

Conditional Probability and the Rules of Probability

Understand independence and conditional probability and use them to interpret data.

S.CP.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").
The Proficient student is able to 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").