

Grade – Eighth

Standard: Number Operations and Concepts

Skill: Understand ways to represent numbers, relationships among numbers, and number systems

Context: Problem solving situations and a variety of models will include representing (such as but not limited to fraction/decimal/percent conversions), ordering, and comparing with rational and integer numbers.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Remind students in all standards, reading for “math” understanding is a part of what they are expected to do.
- Provide opportunities for students to deal with negative rational numbers using number lines, sometimes with a starting place other than 0.
- TI-73 calculators have a number line function that is great (under applications). You can use fractions and decimals on this feature. Use a double set (one with decimals/ one with fractions). Students need to be able to look at both mixed.
- Have practice that allows students to translate from word phrases to mathematical expressions and back again.
- Provide opportunities for students to solve problems with powers of negative numbers.

o Example: $-(5)^2$ and $(-5)^2$

- Use quick class period “openers” to help students strengthen their understanding of division steps, basic multiplication facts, decimal/fraction/percent conversions, exponents, square roots, and rational numbers:

- o Kids use deck of cards to play “War” and multiply products – winner gets the cards, with red and black cards representing positive and negative #'s.
- o Kids create a number line (including positive and negative numbers) on the classroom wall or in their notebooks to scale different representations (e.g., decimals, percents, fractions and square roots all scaled in the same ruler).

Grade – Eighth

Standard: Number Operations and Concepts

Skill: Develop the connection between conceptual understanding and computational proficiency

Context: Problem solving situations will include rational numbers, factors, multiples, and powers up to 5 of a given whole number; estimation and computational fluency (e.g. justification of results by inductive reasoning) to include the order of operations with integers.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Provide students practice with roots.
 - o Example: Between what 2 integers does the square root of 17 lie?
- Solve story problems that require estimation.
 - o Example: CDs are \$15.95. What is the estimated price in whole dollars to purchase 8 CDs?
- Help students understand operations order of is a four-step process; that multiplication and division are inverses of each other; adding and subtracting are inverses as well.
 - o Put on a white board two solutions with the same problem, one displaying the correct order of operations and the other not. Have kids point errors of the incorrect solution, have them explain why.

Grade – Eighth

Standard: Geometry

Skill: Specify locations and describe spatial relationships using coordinate geometry and other representational systems

Context: Problem solving situations will include the Pythagorean Theorem, lines, rays, segments, and angles; and allow students to use spatial reasoning and models to demonstrate perpendicularity and parallelism.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Remind students to use the correct symbols for lines, line segments, rays, etc.
- Students should be able to apply terminology such as perpendicular and parallel to a 3- dimensional shape.
- Provide students with practice applying the Pythagorean Theorem regardless of how the formula is written (what is written first).
 - o Example: $a^2+b^2=c^2$ or $c^2=a^2+b^2$
- Use real life situations (applications) of the Pythagorean Theorem; find all sides of a triangle (accurate measurement and/or by estimating).
- Given parallel lines and a transversal, students need to know which angles prove the lines to be parallel.
- Teachers need to focus use of geometric vocabulary
 - o for angles (acute, obtuse, right, straight, vertical, supplementary, complimentary)

- o for lines (parallel, perpendicular, intersecting, transversal)
- Use a two-column graphic organizer (shapes vocabulary and symbols etc. on one side—definitions on the other) to help students learn the vocabulary. Teacher keeps a master list, and covers two definitions per day with students, drills, etc.
- Visit www.ThatQuiz.org to look at pre-slugged vocabulary test items; or develop and customize a formative geometry vocabulary test using items where students are struggling in their vocabulary.

Grade – Eighth

Standard: Geometry

Skill: Apply transformations and use symmetry to analyze mathematical situations

Context: Problem solving situations include real-world situations requiring communicating with mathematical language to interpret, analyze, and/or illustrate transformations, congruency, and similarity.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Have students reflect objects and coordinates over the x and y axis, and lines not on the axis (i.e. vertical, horizontal and diagonal).
- Given a translated object in a coordinate plane, find the original object's coordinates given one point. Describe how the object was translated.
- Solve for the missing sides in similar polygons using proportions with rationale numbers.
- Review, define and discuss the vocabulary of congruency, similarity and transformations.
- Use patty paper to focus on parallel lines and transversals.
- Use 'Patty Paper' (or transparencies) to model or demonstrate transformation and symmetry properties for students; this technique can also be used to model rotation, reflections translation.
 - o Then, the teacher has students create their own figures and shapes using the patty paper; engage students in a 'Stump the Class' competition, etc.

based on their patty paper figures, for example “this figure is a transformation of _____?”

Grade – Eighth

Standard: Measurement

Skill: Understand measurable attributes of objects and the units, systems, and processes of measurement

Context: Problem solving situations which require use of appropriate methods, tools, units, and proportional reasoning to solve problems involving angle measures (such as the concept of complementary and/or supplementary angle relationships); models and real-world problems including estimation and conversion of weight/mass/capacity/volume within metric and customary units.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Focus on vocabulary: students find missing angles given the complimentary or supplementary angle measurements.
 - o Example: Bobby drew a 30 degree angle. What would be the measurement of its complimentary and supplementary angles?
- Practice unit conversions within metric and customary systems to include mass, weight, capacity and volume.
 - o Example: A soda contained 500ml. What is the liter equivalent to this volume?
- Use a conversion charts; have students create their own conversion charts as graphic organizers, and have them share them with the rest of the class
- Relate a common object with the metric measure, e.g., the weight of a paper clip is about 1 gram. Have students pick their own objects and prove or disprove the object's metric measure

- Review metric system prefixes with students and their specific meanings, e.g., centi-, milli, kilo-, deci-.

Grade – Eighth

Standard: Measurement

Skill: Apply appropriate techniques, tools, and formulas to determine perimeter, area or volume

Context: Problem solving situations will include calculating area and circumference of circles and surface area and volume of rectangular solids in real-world situations.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Use the many children's picture books that are available for math concepts for example "Sir Cumference," "What's Your Angle Pythagoras?," "The Greedy Triangle," "How Much is a Million?," and "Circumference and the Dragons of PI."
- Make radius squares to cover a circle so students can discover a little more than 3 but not quite 4. Use a string to measure diameters on various objects like a soup can. Have a variety of sizes and let them discover with a string that this is not a "fluke."
- For surface area – Around Halloween get boxes of candy and find the surface area of all the candy boxes. Discuss designing the best packages and using the least amount of materials to keep the cost down, while still being able to fit the contents inside. A similar idea is using wrapping paper with grid on the back side; then students open up the package and see/use the grid during the activity.
- Stress the PAWS reference sheet (grades 6-8). Students need to be comfortable utilizing the sheet to calculate area and circumference of circles and surface area and volume of rectangular solids in real world situations (include multistep problems).

Grade – Eighth

Standard: Algebra

Skill: Understand patterns, relations, and functions

Context: Problem solving situations will include 1-step equations with integer coefficients and solutions, and using the order of operations, given integer values for variables, in linear expressions and formulas.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Provide students with hands-on problems and experience with calculators and proper input into calculators to generate the correct answer.
- Have students write story problems, write equations from those problems, and solve them.
- Provide kids with the PAWS formula sheet early in the year to ensure they are comfortable and familiar with using it. Have them practice using all of the formulas on the sheet.
- In solving equations have your students always remember, “you must make a zero before you can make a 1”. Here is how this will work. In the equation $3x-20=10$ students will often take the steps to solve this equation out of order. Some may want to divide by three before adding 20. If they remember they must make a “0” before a “1” this will help prevent them from making this mistake. They must make the -20 a zero before they can make the x a 1, etc... When you divide the $3x$ by 3, be sure to put a line through it and refer to it as a “1”. This “1” can’t happen until “0”.
- Constantly revisit order of operations, review positive and negative integer rules.

- o For positive/negative integers, play 'math football' by using the 50 yard line as zero in a game and move the football's movement to reflect gains or losses on the field. [Essentially a game using a number line].
- Continuously emphasize the steps in solving equations. They will be able to solve some simple problems by "plugging" in numbers/trial and error, but this won't work on more complex problems.
- Always give comprehensive tests so they are constantly reviewing what they have already learned.
- Use the newspaper and magazines to bring in "real-life" examples and applications to what you are studying.
- Have students solve algebraic equations and expressions with variables.
 - o Example: $r = 200 - 60z$ when $z = 10$
 - o Example: $4(n-p) \div 4x$ when $n = 7$, $p = -2$, and $x = 3$

Grade – Eighth

Standard: Algebra

Skill: Use mathematical models to represent and understand quantitative relationships

Context: Problem solving situations will include creating tables and graphing the solutions on a coordinate plane; and using symbolic reasoning to translate word problems involving one or more of the four basic operations into mathematical expressions and equations.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Given a table, a student should create an equation and graph the information within the table. From the table or equation make predictions about past, present, and future events.
- Given a graph or story problem, the student should write an algebraic equation and solve for the answer.
- Given a table, story problem, or word phrase, the student should write a variable expression.
Note: be certain to include opportunities to write quantitative expressions (e.g. Subtract the sum of 6 and p from x).
- Have students participate in “silent” board game where the teacher either makes up a function that only he/she knows or uses one from a previous exercise, and then lists at least one ordered pair satisfying that function in an input/output table. Then the teacher adds additional points in either column, and the students fill in the values that will keep the table accurate. The students should eventually write the function that describes the table.

- Teacher has a set of flash cards of ordered pairs that fit a specific function. Students record the information from the cards either in a table or on a graph and then find the function that fits the information. Can be used as a class contest, and students can make up their own functions with corresponding ordered pairs to challenge the rest of the class.
- Form groups of students and have each group write their own story problem that can be explained by a formula or expression. They then challenge other groups to find that formula or expression.

Grade – Eighth

Standard: Data Analysis and Probability

Skill: Collect, organize, and display relevant data to answer questions, and use appropriate statistical methods to analyze the data

Context: Problem solving situations with mean, median, mode, and range. Contexts will allow students to make observations, inferences, conjectures, and use statistical reasoning to make generalizations about a population from data presented as tables, charts, diagrams, and graphs.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Have students create and conduct their own school survey and make different types of graphs and Venn diagrams. Students should have practice analyzing and comparing data.
- Bring in graphs from USA Today. Have students write their own questions and give four choices for others to answer.
- Give multiple opportunities for students to graph scatter plots, pie charts and stem & leaf plots with appropriate scales, labeling of x and y axes, titles and legends, making predictions and inferences from the graphs.
- Have students find a missing data piece in a set of values.
 - o Example: Jenny's first two bowling scores were 139 and 150. What must her third game total score be to make her bowling average a 156? (Use this as an opportunity to discuss average meaning the same thing as mean.)

Grade – Eighth

Standard: Data Analysis and Probability

Skill: Develop and evaluate inferences and predictions that are based on data

Context: Problem solving situations involving simple probability and communicating the likelihood of events from experiments or simulations.

Instructional suggestions: (Created to be user-friendly, teachers should be able to read these ideas and put them into practice in their classroom.)

- Have a Probability Carnival/Fair. Students circulate to various booths to play probability games.
- Throughout the year pull out various manipulatives (e.g. marbles in a bag, colored M&Ms, combination locks, etc.). Have students determine the probability of what color item will be pulled, what combination of items will be pulled (e.g. a red or a green M&M), what number will be selected for the combination, etc.
- Compare experimental probability of an event to its theoretical probability.
- Using probability, predict the outcome of a series of events.
 - o Example: On an assembly line, 3 of 50 tires have defects. On a particular day, the company produces 5,000 tires. How many of those tires could you predict have defects?
- Introduce the terminology to the above activities by asking students what will “certainly” come up, most likely be chosen, equally likely to occur, least to likely occur, or be impossible.