# WGSD Curriculum – Math 8th Grade

In Grade 8, instructional time will focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships and (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

While the content learning goals describe the mathematics students should be able to understand and do, the first eight learning goals (The Standards for Mathematical Practice) describe how students should engage with these mathematical concepts and skills as they grow in mathematical maturity and expertise. Teachers will connect the mathematical practices to mathematical content in all mathematics instruction. These learning goals merit the most time, resources, innovation, and focus necessary to qualitatively improve the instruction, assessment, and student achievement in mathematics.

# WGSD Curriculum – Math 8th Grade
## *Mathematical Practices*

**High Priority Standards**
CCSS.Math.Practice.MP1

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will be able to make sense of problems and persevere in solving them. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Discussing, explaining, and solving a problem with multiple representations and in multiple ways.<br>● Struggling with various attempts over time.<br>● Learning from previous solution attempts.<br>● Checking answers using a different method or strategy.<br><br>2: Student demonstrates they are nearing proficiency by:<br>● Explaining his/her thought processes when solving a problem and representing it in several ways.<br>● Trying several approaches in find a solution and seeking hints only if stuck.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by:<br>● Explaining their thought processes when solving a problem one way.<br>● Staying with a challenging problem for more than one attempt. |

**Learning Targets**

- Explain the meaning of a problem and look for efficient ways to solve it
- Use concrete objects or pictures to help conceptualize and solve problems
- Checks their thinking by asking themselves, “Does this make sense?”
- Listens to the strategies of others and tries different approaches
- Uses a different strategies to check answers
- Takes time to thoughtfully consider problems

**Learning Design**

- Provides time and facilitates discussion in problem solutions
- Facilitates discourse in the classroom so that students UNDERSTAND the approaches of others
- Provides opportunities for students to explain themselves, the meaning of a problem, etc.
- Provides opportunities for students to connect concepts to “their” world
- Provides students TIME to think and become “patient” problem solvers
- Facilitates and encourages students to check their answers using different methods (not calculators)
- Provides problems that focus on relationships and are “generalizable”

# WGSD Curriculum – Math 8th Grade
## *Mathematical Practices*

**High Priority Standards**
CCSS.Math.Practice.MP2

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will be able to reason abstractly and quantitatively. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Converting situations into symbols to solve problems.<br>● Converting mathematical equations into meaningful situations.<br><br>2: Student demonstrates they are nearing proficiency by translating situations into symbols to solve problems.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by reasoning with models or pictorial representations to solve problems. |

**Learning Targets**

- Recognize that a number represents a specific quantity
- Connect the quantity to written symbols and create a logical representation of the problem at hand
- Consider both the appropriate units involved and the meaning of quantities
- Write simple expressions that record calculations with numbers and symbols
- Represent or round numbers using place value concepts

**Learning Design**

- Provides a range of representations of math problem situations and encourages various solutions
- Provides opportunities for students to make sense of quantities and their relationships in problem situations
- Provides problems that require flexible use of properties of operations and objects
- Emphasizes quantitative reasoning which 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/or rules; and knowing and flexibly using different properties of operations and objects

# WGSD Curriculum – Math 8th Grade
## *Mathematical Practices*

**High Priority Standards**
CCSS.Math.Practice.MP3

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will be able to construct viable arguments and critique the reasoning of others. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Justifying and explaining, with accurate language and vocabulary, why his/her solution is correct.<br>● Comparing his/her strategy to other students' strategies, asking questions, and making connections with his/her own thinking.<br>● Explaining the reasoning of others.<br><br>2: Student demonstrates they are nearing proficiency by:<br>● Explaining his/her thinking and the thinking of others with accurate vocabulary.<br>● Explaining other students' solutions and identifying strengths and weaknesses of the strategy.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by:<br>● Explaining his/her solution.<br>● Discussing other ideas, approaches, and strategies. |

**Learning Targets**

- Construct arguments using concrete referents, such as objects, pictures, and drawings
- Refine their mathematical communication skills by answering questions like "How do you know?" and "Can you show me another way?"
- Refine their mathematical communication skills by asking others questions like "How do you know?" and "How did you get that?"
- Explain their thinking to others and respond to others' thinking

**Learning Design**

- Provides ALL students opportunities to understand and use stated assumptions, definitions, and previously established results in constructing arguments
- Provides ample time for students to make conjectures and build a logical progression of statements to explore the truth of their conjectures
- Provides opportunities for students to construct arguments and critique arguments of peers
- Facilitates and guides students in recognizing and using counterexamples
- Encourages and facilitates students justifying their conclusions, communicating, and responding to the arguments of others
- Asks useful questions to clarify and/or improve students' arguments

# WGSD Curriculum – Math 8th Grade
## *Mathematical Practices*

**High Priority Standards**

CCSS.Math.Practice.MP4, TILS 5.C.a: Recognize that there are a variety of ways to share information, TILS 5.C.c: Effectively share information

**Learning Goal**

Students will be able to model with mathematics.

**Proficiency Scale**

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Recognizing math in everyday situations.
- Using a variety of models, symbolic representations, and technology tools to represent the solution to a problem and accurately explain the solution representation.

2: Student demonstrates they are nearing proficiency by:

- Recognize math in everyday situations, when prompted.
- Using models and symbols to represent and solve a problem.

1: Student demonstrates a limited understanding or skill with the learning goal by using models to represent and solve a problem with teacher support.

**Learning Targets**

- Represents problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc. and use all of these representations as needed
- Connect different representations and explain the connections
- Evaluate results in the context of the situation and reflect on whether the results make sense
- Evaluate the utility of models to determine which models are most useful and efficient to solve problems

**Learning Design**

- Provides problem situations that apply to everyday life
- Provides rich tasks that focus on conceptual understanding, relationships, etc.

# WGSD Curriculum – Math 8th Grade
## *Mathematical Practices*

**High Priority Standards**
CCSS.Math.Practice.MP5

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will be able to use appropriate tools strategically. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by combining various tools to explore and solve a problem as well as justifying his/her tool selection and problem solution.<br><br>2: Student demonstrates they are nearing proficiency by selecting from a variety of provided tools the ones that can be used to solve a problem and explaining his/her reasoning for the selection.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by using the appropriate tool, when provided, to find a solution. |

**Learning Targets**

- Consider the available tools (including, but not limited to estimation, graph paper, manipulatives, table, list, etc.) when solving a mathematical problem and decide when certain tools might be helpful
- For example, they may use unit cubes to fill a rectangular prism and a ruler to measure the dimensions
- Use graph paper to accurately create graphs and solve problems or make predictions from real world data

**Learning Design**

- Provides a variety of tools and technology for students to explore to deepen their understanding of math concepts
- Provides problem solving tasks that require students to consider a variety of tools for solving (Tools might include pencil/paper, concrete models, manipulatives, ruler, protractor, calculator, spreadsheet, computer algebra system, statistical package, or dynamic geometry software, etc.)

# WGSD Curriculum – Math 8th Grade
## *Mathematical Practices*

<table>
<tr><td colspan="2"><u>High Priority Standards</u><br>CCSS.Math.Practice.MP6</td></tr>
<tr><td><u>Learning Goal</u><br><br>Students will be able to attend to precision.</td><td><u>Proficiency Scale</u><br>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by using appropriate symbols, vocabulary, and labeling to communicate effectively and exchange ideas.<br><br>2: Student demonstrates they are nearing proficiency by incorporating appropriate vocabulary and symbols in most mathematical communications.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by communicating his/her reasoning and solution to others, with support.</td></tr>
<tr><td colspan="2"><u>Learning Targets</u><br>● Use clear and precise language in their discussions with others and in their own reasoning<br>● Specify units of measure and state the meaning of the symbols used<br>● Report answers that appropriately address the context of a problem</td></tr>
<tr><td colspan="2"><u>Learning Design</u><br>● Facilitates, encourages and expects precision in communication<br>● Provides opportunities for students to explain and/or write their reasoning to others</td></tr>
</table>

# WGSD Curriculum – Math 8th Grade
## *Mathematical Practices*

**High Priority Standards**
CCSS.Math.Practice.MP7

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will be able to look for and make use of structure. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Noticing mathematical expressions as component parts.<br>● Using mathematical generalizations to identify the most efficient solution to mathematical tasks.<br><br>2: Student demonstrates they are nearing proficiency by composing and decomposing number situations and relationships in order to simplify solutions.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by looking for structure or patterns within mathematics to help him/her solve problems efficiently. |

**Learning Targets**

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

**Learning Design**

- Provides opportunities and time for students to explore patterns and relationships to solve problems
- Provides rich tasks and facilitates pattern seeking and understanding of relationships in numbers rather than following a set of steps and/or procedures

# WGSD Curriculum – Math 8th Grade
## *Mathematical Practices*

**High Priority Standards**
CCSS.Math.Practice.MP8

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will be able to look for and express regularity in repeated reasoning. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Connecting prior knowledge to an unfamiliar mathematical situation.<br>● Creating a model or equation that unifies the various aspects of a problem.<br>● Noticing patterns, making generalizations, and predicting patterns.<br><br>2: Student demonstrates they are nearing proficiency by finding and explaining patterns.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by connecting prior knowledge to new situations and noticing patterns with prompting from a teacher or peer. |

**Learning Targets**

- Notice repetitive actions in computation and look for more shortcut methods
- Use repeated reasoning to understand algorithms and make generalizations about patterns

**Learning Design**

- Provides problem situations that allow students to explore regularity and repeated reasoning
- Provides rich tasks that encourage students to use repeated reasoning to form generalizations and provides opportunities for students to communicate these generalizations

# WGSD Curriculum – Math 8th Grade
## *Number Sense and Operations*

**High Priority Standards**

8.NS.A.1 Explore the real number system. a. Know the differences between rational and irrational numbers. b. Understand that all rational numbers have a decimal expansion that terminates or repeats. c. Convert decimals which repeat into fractions and fractions into repeating decimals. d. Generate equivalent representations of rational numbers.
8.NS.A.2 Estimate the value and compare the size of irrational numbers and approximate their locations on a number line.

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will understand that there are numbers that are not rational, and approximate them by rational numbers. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Using rational approximations of irrational numbers to locate them on a number line and to make numerical comparisons.<br>● Converting between fractions and repeating decimals.<br>● Comparing rational and irrational numbers.<br>● Generating equivalent representations of rational numbers (fractions, decimals and percentages).<br><br>2: Student demonstrates they are nearing proficiency by:<br>● Recognizing and recalling specific vocabulary, such as: rational, irrational, terminating, repeating, equivalent, simplify, truncate.<br>● Performing processes such as:<br>o Identifying approximate locations of familiar irrational numbers on a number line.<br>o Identifying numbers as rational or irrational.<br>o Converting between fractions and terminating decimals.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by:<br>● Identifying square roots of numbers less than 100.<br>● Identifying pi as not rational.<br>● Describing how every rational number has a decimal expansion. |

**Learning Targets**

- 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
  - Convert repeating decimals into fractions. Limit to the thousandths place (e.g. $\frac{7}{111} = 0.\overline{063}$)
  - Convert fractions into repeating decimals. Limit to the thousandths place (e.g. $0.\overline{123} = \frac{123}{999}$)

- Know that all irrational numbers can be written as non-terminating, non-repeating decimals. Limit square roots to less than or equal to six hundred twenty-five.

- Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., $\pi^2$)
  - Estimate the decimal representation of an irrational number (e.g., $\pi, \sqrt{2}, \sqrt{3}$, etc.).
  - Compare rational and irrational numbers and approximate their locations on a number line.
    - Limit estimation of irrational numbers to less than the square root of one hundred.
    - Exclude all fractions with a radical in the numerator or denominator.
    - Exclude simplified radicals with a coefficient (e.g., $2\sqrt{2}$). *For example, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations*

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Expressions, Equations and Inequalities*

**High Priority Standards**

8.EEI.A.1 Know and apply the properties of integer exponents to generate equivalent expressions.
8.EEI.A.2 Investigate concepts of square and cube roots. a. Solve equations of the form x2 = p and x3 = p, where p is a positive rational number. b. Evaluate square roots of perfect squares less than or equal to 625 and cube roots of perfect cubes less than or equal to 1000. c. Recognize that square roots of non-perfect squares are irrational.
8.EEI.A.3 Express very large and very small quantities in scientific notation and approximate how many times larger one is than the other.
8.EEI.A.4 Use scientific notation to solve problems. a. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. b. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities.

**Learning Goal**

Students will be able to work with radicals and integer exponents.

**Proficiency Scale**

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Applying the multiplication and division properties of exponents to simplify expressions containing terms with the same numeric base.
- Applying properties of exponents to simplify expressions containing terms with a power raised to a power, negative exponents, and exponent of zero.
- Multiplying and dividing two expressions written in scientific notation using integer exponent properties.
- Approximating how many times larger one expression in scientific notation is than another.
- Solving equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: base, exponent, coefficient, cube root, square root, squared, cubed, standard form, scientific notation, equivalent, irrational, rational.
- Performing processes such as:
    - Evaluating the cube root of perfect cubes less than or equal to 1000.
    - Recognizing that square roots of non-perfect squares are irrational.
    - Converting large or small numbers between scientific and standard notation.
    - Adding and subtracting two expressions written in scientific notation when the power of ten is the same.
    - Determining the most reasonable and appropriate unit of measure to use in a given situation.

1: Student demonstrates a limited understanding or skill with the learning goal by:

- Evaluating the square root of perfect squares less than or equal to 625.
- Identifying standard form and scientific notation.

**Learning Targets**

- Know and apply the properties of integer exponents to generate equivalent numerical expressions, including expressions with more than one operation.
  - Simplify an expression that contains two or more terms with the same base being multiplied by adding the integer exponents.
  - Simplify an expression that contains two or more terms with the same base being divided by subtracting the integer exponents.
  - Simplify an expression that contains a power raised to another power by multiplying the integer exponents.
  - Generate an equivalent expression containing a negative exponent by converting to the multiplicative inverse. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$
  - Generate an equivalent expression containing a base raised to the power of zero by converting to one.
  - Know any base raised to a power of zero will simplify to be one.
  - Know that the multiplication and division properties will only work when the base is the same.
  - Only numeric bases (no variables). Answers should be in exponential form to assess if the student can apply the property. Include expressions with more than one operation.

- Investigate concepts of square and cube roots.
  - Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where $p$ is a positive rational number. (e.g. $x^2 = 16$; $x = \pm\sqrt{16}$ ; $x = \pm 4$)
  - Evaluate square roots of perfect squares less than or equal to 625 and cube roots of perfect cubes less than or equal to 1000.
  - Recognize that square roots of non-perfect squares are irrational. *(e.g., explain why numbers are or are not perfect squares using area models)*

- Express very large and very small quantities in scientific notation and approximate how many times larger one is than the other.
  - Express very large and very small quantities in scientific notation with the first factor written less than ten and equal to or greater than one.
  - Know that a number multiplied by a base of ten raised to a positive exponent, the equivalent expression will result in a larger number than the original factor.
  - Know that a number multiplied by a base of ten raised to a negative exponent will result in a smaller number than the original factor.
  - Approximate how many times larger one expression (written in scientific notation) is than another expression (written in scientific notation). *For example, estimate the population of the United States as 3 times $10^8$ and the population of the world as 7 times $10^9$, and determine that the world population is more than 20 times larger*

- Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.
  - Multiply two expressions written in scientific notation using integer exponent properties (including where at least 1 expression is in scientific notation).
  - Divide two expressions written in scientific notation using integer exponent properties (including where at least 1 expression is in scientific notation).
  - Convert a number from standard notation into scientific notation to perform operations.
  - Add or subtract two expressions written in scientific notation when the power of ten is the same.

- Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities
  - Use scientific notation to choose unit of appropriate size for measurement.
  - Determine the most reasonable and appropriate unit of measure to use in a given situation. (e.g. use millimeters per year for tectonic place movement).
  - Use a calculator to input and interpret scientific notation.

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Expressions, Equations and Inequalities*

**High Priority Standards**

8.EEI.B.5 Graph proportional relationships. a. Interpret the unit rate as the slope of the graph. b. Compare two different proportional relationships.
8.EEI.B.6 Apply concepts of slope and y-intercept to graphs, equations and proportional relationships. a. Explain why the slope (m) is the same between any two distinct points on a non-vertical line in the Cartesian coordinate plane. b. Derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will understand the connections between proportional relationships, lines, and linear equations. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Interpreting the unit rate as the slope of a graph in a proportional relationship.<br>● Converting proportional relationships to linear equations in slope-intercept form while also explaining when and why the *y*-intercept is zero.<br>● Calculating slope by using the slope formula and right triangles (finding the slope by counting).<br>● Explaining why the slope is the same between any two distinct points on a non-vertical line in a coordinate plane.<br><br>2: Student demonstrates they are nearing proficiency by:<br>● Recognizing and recalling specific vocabulary, such as: linear, line, slope, y-intercept, axis, coordinate plane, graph, origin, point, similar, table, vertical, horizontal, proportional relationship, right triangle method, independent variable, dependent variable, unit rate.<br>● Performing processes such as:<br>o Comparing two different proportional relationships represented in different ways.<br>o Calculating the slope of a line by any method and identifying the y-intercept of a line.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by graphing a proportional relationship on a coordinate plane. |

**Learning Targets**

- Graph proportional relationships
  - Interpret the unit rate (1, r) as the slope of the graph when given a proportional relationship.
  - Use the unit rate (1, r) to graph a proportional relationship that passes through the origin.

- Compare two different proportional relationships represented in different ways.
  - Compare the slopes of two proportional relationships given multiple representations including tables, graphs and equations. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed. Values may include integers and/or decimals and fractions that simplify to the hundredths place.

- Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane.

- Derive the equation y = mx for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at $b$.
  - Write an equation in slope-intercept form when given a table of values.
  - Write an equation in slope-intercept form when given a linear graph.
  - Write an equation in slope-intercept form when given two-points on a line.
  - Write an equation in slope-intercept form when given a real-world linear situation.
  - Write an equation in slope-intercept form when given the slope and the y-intercept of a line.
  - Write an equation in slope-intercept form when given the slope and one-point on the line.

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Expressions, Equations and Inequalities*

**High Priority Standards**

8.EEI.C.7 Solve linear equations and inequalities in one variable. a. Create and identify linear equations with one solution, infinitely many solutions or no solutions. b. Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and combining like terms.
8.EEI.C.8 Analyze and solve systems of linear equations. a. Graph systems of linear equations and recognize the intersection as the solution to the system. b. Explain why solution(s) to a system of two linear equations in two variables correspond to point(s) of intersection of the graphs. c. Explain why systems of linear equations can have one solution, no solution or infinitely many solutions. d. Solve systems of two linear equations.

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will be able to analyze and solve linear equations, inequalities and pairs of simultaneous linear equations. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Solving word problems leading to two linear equations in two variables.<br>● Solving systems of two linear equations using graphing, substitution and elimination.<br>● Explaining why systems of linear equations can have one solution, no solution, or infinitely many solutions.<br>● Solving multi-step linear equations and inequalities in one variable using the distributive property and/or collecting like terms.<br><br>2: Student demonstrates they are nearing proficiency by:<br>● Recognizing and recalling specific vocabulary, such as: system of equations, coefficient, point of intersection, distributive property, combining like terms, infinite, collinear, no solution.<br>● Performing processes such as:<br>○ Graphing systems of linear equations and recognizing the intersection as the solution to the system.<br>○ Creating and identifying linear equations in one variable with one solution, infinitely many solutions, or no solution.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by solving one- and two-step linear equations and inequalities in one variable with integer coefficients. |

**Learning Targets**

- Solve linear equations and inequalities in one variable
    - Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where $a$ and $b$ are different numbers)
    - Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and collecting like terms. Values may include integers and/or decimals and fractions that simplify to the hundredths place.
- Analyze and solve systems of linear equations
    - Graph systems of linear equations.
    - 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.
        - The scale of the coordinate grid should allow for the y-intercept to be graphed on a scale value. Limited to only two equations, both in slope-intercept form.
    - Explaining why systems of linear equations can have one solution, no solution, or infinitely many solutions.
        - Students may determine the number of solutions using a graph, analyzing for slopes/y-intercepts or solving the system.
    - Solve real-world and mathematical problems leading to two linear equations in two variables.
        - When given a real-world context that can be modeled with a system of equations with one solution, the student will be able to explain what the solution (x, y) values represent.
    - Solve systems of two linear equations in two variables algebraically, using substitution, elimination or inspection (*For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6).*
        - Both equations should be provided in the same form.

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Functions*

**High Priority Standards**

8.F.A.1 Explore the concept of functions. (The use of function notation is not required.) a. Understand that a function assigns to each input exactly one output. b. Determine if a relation is a function. c. Graph a function.

8.F.A.2 Compare characteristics of two functions each represented in a different way.

8.F.A.3 Investigate the differences between linear and nonlinear functions. a. Interpret the equation y = mx + b as defining a linear function, whose parameters are the slope (m) and the yintercept (b). b. Recognize that the graph of a linear function has a constant rate of change c. Give examples of nonlinear functions.

| **Learning Goal** | **Proficiency Scale** |
|---|---|
| Students will be able to define, evaluate, and compare functions. | 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.<br><br>3: Student demonstrates mastery with the learning goal as evidenced by:<br>● Recognizing that the graph of a linear function has a constant rate of change.<br>● Producing a function as a rule that assigns to each input exactly one output.<br>● Comparing characteristics of two functions represented in different ways (equations, graphs, tables, or verbal description).<br><br>2: Student demonstrates they are nearing proficiency by:<br>● Recognizing and recalling specific vocabulary, such as: function, vertical line test, input, output, linear, nonlinear, rate of change.<br>● Performing processes such as:<br>○ Comparing properties of two functions represented in the same way.<br>○ Determining if a relation is a function from a graph, table, or set of ordered pairs.<br>○ Interpreting equations in the form y = mx + b as linear functions, whose graph is a straight line.<br>○ Graphing a function from a table of values.<br><br>1: Student demonstrates a limited understanding or skill with the learning goal by:<br>● Producing input and output pairs for a given function.<br>● Identifying whether an input/output pair satisfies a function.<br>● Classifying functions as linear or nonlinear based on a graph, table, equation, or set of ordered pairs. |

**Learning Targets**

- Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
    - The use of function notation and "domain" or "range" vocabulary is not required. Values may include integers and/or decimals and fractions that simplify to the hundredths place.
- Determine if a relation is a function by using multiple representations, such as a mapping diagram, a set of ordered pairs, a table and/or a graph.
- When given a set of input and output values, graph a function on a coordinate grid.
- Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)
    - Compare the slope (rate of change) of two functions represented in a different way. Compare the y-intercept (initial value) of two functions represented in a different way.
    - *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change*
- Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line. Interpret that (m) represents the slope and (b) represents the y-intercept. Recognize that the graph of a linear function has a constant rate of change.
- give examples of a nonlinear function as a list of points, a table, a graph, an equation or a real world-context. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Functions*

**High Priority Standards**

8.F.B.4 Use functions to model linear relationships between quantities. a. Explain the parameters of a linear function based on the context of a problem. b. Determine the parameters of a linear function. c. Determine the x-intercept of a linear function.

8.F.B.5 Describe the functional relationship between two quantities from a graph or a verbal description.

**Learning Goal**

Students will be able to use functions to model relationships between quantities.

**Proficiency Scale**

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Describing what the slope, y-intercept, and x-intercept mean in the context of a given situation.
- Determining the slope, y-intercept, and x-intercept of a linear function from a graph, two points, a table, an equation, or a description of a relationship.
- Describing the functional relationship between two quantities from a graph or description.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: rate of change, linear, nonlinear, y-intercept, initial amount, function, coefficient, slope formula, variable.
- Performing processes such as:
    - Explaining that the slope is the constant rate of change and the y-intercept is the initial value.
    - Finding the rate of change of a linear relationship displayed in a graph or table.

1: Student demonstrates a limited understanding or skill with the learning goal by identifying a function that models a linear relationship between two quantities.

**Learning Targets**

- Determine the parameters of a linear function.
  - Determine the slope of a linear function given a description of the relationships or from two points, tables, or graphs.
  - Determine the y-intercept of a linear function given a description of the relationships or from two points, tables, or graphs.

- Explain the parameters of a linear function based on the context of a problem.
  - Explain that the slope is the constant rate of change and describe what this means in the context of a given situation.
  - Explain that the initial value is the y-intercept and describe what this means in the context of a given situation.

- Determine the x-intercept of a linear function.
  - Identify an x-intercept from a graph and determine its meaning In the context of a given situation.
  - Identify an x-intercept from a table and determine its meaning In the context of a given situation.
  - Identify an x-intercept from an equation (e.g., in slope-intercept form y=mx+b or standard form ax+by=c) and determine its meaning In the context of a given situation.

- Describe the functional relationship between two quantities from a graph or a verbal description.
  - Description of the functional relationship could include increasing/decreasing, linear/nonlinear, continuous/discrete, and/or constant.
  - Sketch a graph when given a description of the functional relationship.

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Geometry and Measurement*

**High Priority Standards**

8.GM.A.1 Verify experimentally the congruence properties of rigid transformations. a. Verify that angle measure, betweeness, collinearity and distance are preserved under rigid transformations. b. Investigate if orientation is preserved under rigid transformations.
8.GM.A.2 Understand that two-dimensional figures are congruent if a series of rigid transformations can be performed to map the preimage to the image. a. Describe a possible sequence of rigid transformations between two congruent figures.
8.GM.A.3 Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates.
8.GM.A.4 Understand that two-dimensional figures are similar if a series of transformations (rotations, reflections, translations and dilations) can be performed to map the pre-image to the image. a. Describe a possible sequence of transformations between two similar figures.
8.GM.A.5 Explore angle relationships and establish informal arguments. a. Derive the sum of the interior angles of a triangle. b. Explore the relationship between the interior and exterior angles of a triangle. c. Construct and explore the angles created when parallel lines are cut by a transversal. d. Use the properties of similar figures to solve problems.

**Learning Goal**

Students will understand congruence and similarity using physical models, transparencies, or geometry software.

**Proficiency Scale**

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Describing the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates.
- Describing a sequence of transformations to determine the congruence of two figures.
- Describing a sequence of transformations to determine the similarity of two figures.
- Constructing rotations and dilations of figures in a coordinate plane.
- Using properties of similar figures to solve problems.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: reflections, translations, dilations, rotations, scale factor, image, pre-image, transformation, congruent figures, similar figures, axis of symmetry, point of rotation, symmetry, exterior angle, transversal, supplementary, congruent.
- Performing processes such as:
    - Verifying that angle measure, betweenness, collinearity and distance are preserved under rigid transformations.
    - Constructing reflections and translations of figures in a coordinate plane.
    - Finding missing angle measures in a triangle or in parallel lines cut by a transversal.
    - Identifying the sum of the interior angles of a triangle as equal 180 degrees.

1: Student demonstrates a limited understanding or skill with the learning goal by identifying reflections, rotations, and translations and the result of these rigid motions on figures.

**Learning Targets**

- Verify that angle measures, betweenness (the distance that point b is between point a and point c), collinearity, and distance, are preserved under rigid transformations of rotations, reflections, and translations.
- Verify that any line (including parallel lines) transformed under a rigid transformation of rotation, reflection, or translation will still be a line.
- Verify that after a rigid transformation of rotation, reflection, or translation, corresponding angles and corresponding line segments are congruent.
- Investigate if orientation is preserved under rigid transformations.
- Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
    - Limit the center of rotation to a vertex of the figure or the origin and rotations to 90◦, 180◦, 270◦. Limited to triangles and quadrilaterals or shapes that consist of triangles and quadrilaterals.
- Understand that two-dimensional figures are congruent if a series of rigid transformations (rotations, reflections, translations) can be performed to map the pre-image to the image.
    - Given two congruent figures, the student will describe the sequence of rigid transformations (rotations, reflections, translations) that justifies the congruence between them.
- Understand that two-dimensional figures are similar if a series of rigid transformations (rotations, reflections, translations, and dilations) can be performed to map the pre-image to the image.
    - Given two similar figures, the student will describe the sequence of rigid transformations (rotations, reflections, translations, and dilations) that justifies the similarity between them.
- Explore the relationship between the interior and exterior angles of a triangle. Derive the sum of the interior angles of a triangle. Students are not required to give formal proofs at this point.
- Construct and explore the angles created when parallel lines are cut by a transversal. Establish informal arguments to determine angle measurements created when parallel lines are cut by a transversal. Students will not be required to identify angles by name at this level. (e.g., alternate interior angles, alternate exterior angles).
- Use the properties of similar figures (congruent corresponding angles) to solve problems.

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Geometry and Measurement*

**High Priority Standards**

8.GM.B.6 Use models to demonstrate a proof of the Pythagorean Theorem and its converse.
8.GM.B.7 Use the Pythagorean Theorem to determine unknown side lengths in right triangles in problems in two- and three-dimensional contexts.
8.GM.B.8 Use the Pythagorean Theorem to find the distance between points in a Cartesian coordinate system.

**Learning Goal**

Students will understand and apply the Pythagorean Theorem.

**Proficiency Scale**

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:
- Applying the Pythagorean Theorem to determine the unknown side lengths of right triangles in two- and three-dimensional contexts.
- Finding the distance between two points in a coordinate system in two dimensions.

2: Student demonstrates they are nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: right angle, congruent, parallel, perpendicular, leg, hypotenuse, distance formula, Pythagorean theorem, proof, converse.
- Performing processes such as:
  - Applying the Pythagorean Theorem to determine whether or not a given triangle is a right triangle, given its side lengths.
  - Finding the distance between two points on a horizontal or vertical line in a two-dimensional coordinate system.

1: Student demonstrates a limited understanding or skill with the learning goal by identifying the hypotenuse and the legs of a right triangle given the side lengths or an image of a right triangle.

**Learning Targets**

- Explain a proof of the Pythagorean Theorem and its converse
- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions
- Apply the Pythagorean Theorem to find the distance between two points in a coordinate system

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Geometry and Measurement*

**High Priority Standards**

8.GM.C.9 Solve problems involving surface area and volume. a. Understand the concept of surface area and find surface area of pyramids. b. Understand the concepts of volume and find the volume of pyramids, cones and spheres.

**Learning Goal**

Students will be able to solve real-world and mathematical problems involving volume of cones, pyramids and spheres.

**Proficiency Scale**

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Calculating the volume of cones, triangular and rectangular pyramids, and spheres in mathematical and real-world problems.
- Calculating the surface area of triangular and rectangular pyramids.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: radius, circumference, diameter, height, perpendicular, area, volume, Base, cone, cylinder, sphere, pyramid.
- Performing processes such as:
  - Identifying the appropriate formula for the volumes of a cone, a pyramid, and a sphere.
  - Connecting the key dimensions to the appropriate variables in the formula.

1: Student demonstrates a limited understanding or skill with the learning goal by identifying the key dimensions (i.e., radius, height, circumference, and diameter) of cones, pyramids, and spheres.

**Learning Targets**

- Solve real-world and mathematical problems involving surface area and volume.
  - Understand the concept of surface area and find surface area of pyramids (triangular and rectangular).
  - Understand the concept of volume and find the relationships among pyramids (triangular and rectangular), cones and spheres.
    - Given measurements will be whole numbers. Will not have composite figures. Answers may be given in terms of π.

**Learning Design**

# WGSD Curriculum – Math 8th Grade
## *Data Analysis, Statistics and Probability*

**High Priority Standards**

8.DSP.A.1 Construct and interpret scatter plots of bivariate measurement data to investigate patterns of association between two quantities.
8.DSP.A.2 Generate and use a trend line for bivariate data, and informally assess the fit of the line.
8.DSP.A.3 Interpret the parameters of a linear model of bivariate measurement data to solve problems.
8.DSP.A.4 Understand the patterns of association in bivariate categorical data displayed 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.

**Learning Goal**

Students will investigate patterns of association in bivariate data.

**Proficiency Scale**

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Writing an equation for the trend line or line of best fit for a given scatter plot with a linear association.
- Using the equation for the line of best fit to solve problems and interpreting the slope and y-intercept in the context of the data.
- Interpreting and using relative frequencies from a two-way table to describe possible association between two variables.

2: Student demonstrates they are nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: positive association, negative association, linear association, nonlinear association, cluster, scatter plot, independent variable, dependent variable, outlier, bivariate, frequency, relative frequency, trend line (line of best fit).
- Performing processes such as:
    - Investigating a scatter plot for patterns such as outliers and nonlinear association.
    - Informally finding a line of best fit for a given scatter plot that suggests a linear association.
    - Informally assessing the fit of the line of best fit by evaluating the closeness of the data points to the line.
    - Calculating frequencies from categorical data in a two-way frequency table.

1: Student demonstrates a limited understanding or skill with the learning goal by:

- Investigating a scatter plot for positive, negative, and linear association.
- Investigating a scatter plot for clustering between two quantities.
- Constructing a scatter plot from given data.
- Constructing a two-way frequency table of given categorical data.

**Learning Targets**

- Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities.
- Describe patterns in scatter plots such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- Generate and use a trend line for bivariate data, and informally assess the fit of the line.
    - Know that straight lines are widely used to model relationships between two quantitative variables.
    - Know that not all trend lines start at the origin and not all trend lines pass through the data points
    - For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line
    - Explain that a line of best fit that is very close to the data points has a strong fit to the data set and a line of best fit that is further from the data points has a weaker fit to the data set.
- Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height*
- Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.
    - Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.
    - Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*

**Learning Design**

# WGSD Curriculum – Math 8th Grade

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