8th Grade Mathematics – Scope and Sequence – MSD of Pike Township

Purpose Statement

The purpose of this scope and sequence document is to ensure that MSD of Pike Township has a viable and guaranteed Mathematics curriculum. It is meant to provide the foundational skills, strategies, and concepts necessary for our students to leave Pike Township college and career ready. Please remember that this scope and sequence is based on the Indiana Academic Standards and the typical progress of students. Use your professional judgment when addressing the individual needs of your students. If you need to shorten or lengthen a unit, then do so based on mastery of standards, evidence from your classroom assessments and professional observations. Always consider the students' need and interest as well as other content area topics to guide your units of study. Collaborate with your instructional coach and school librarian to plan and implement the units of study, mini-lesson ideas, and instructional resources.

Components Included in the Scope and Sequence

Mathematics Content

As you work with your students, please remember the following:

- *Students are expected to **apply** the math they previously learned as they progress through the year and to the next level.*
- *Math content builds on previous lessons and years, but students learn in many different ways and take many different paths to learn concepts. Provide students with many opportunities throughout the year to tackle and master math content in their world.*
- *All students are mathematicians. Find ways to allow our students to make true connections with math content.*
- *Math instruction should incorporate reading and writing.*

Process Standards for Mathematics

As you work with your students, please remember the following:

- *The Process Standards for Mathematics are the "how" when delivering mathematics instruction. They rely on students communicating with each other about mathematics in order to learn mathematics.*
- *The Process Standards for Mathematics are expected student behaviors.*

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.***

Each Component Includes:

Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
These goals define the necessary habits, skills, and dispositions we want students to know and be able to do when the unit is completed.	The Indiana Academic Standards listed represent the priority standards for the unit. Other standards may be taught explicitly or implicitly.	The strategy and skill focus gives guidance for lesson topics and ideas. It also gives ideas for teaching strategies you might rely upon for instruction. The goal is for students to understand these skills/strategies by the end of the unit.	Academic vocabulary includes the words that are needed to understand the content. Assessment vocabulary should be integrated throughout the year. They should be explicitly taught and used regularly.	This is where you will find your connection to possible instructional resources. Ask your school librarian and/or instructional coach for assistance in this area also!	Ideas for scaffolding support for striving mathematicians, English learners and special education is provided. Please use your available resources to differentiate for students. Ask your building resource teachers for assistance if needed.

Testing Vocabulary to be Taught Throughout the Year

Best: "Which statement **BEST** describes the two shapes?" Although more than one option might make sense, students will need to choose one that is better than all the others.
Choose: "**Choose** TWO fractions that are greater than 0.50." Students will be asked to choose one or more items that fit the criteria.
Complete: "**Complete** the table by filling in the missing numbers." Students may be asked to complete tables, graphs, and/or statements.
Define the Variable: Students should be able to provide a precise description of a variable used in an equation.
Enter: "**Enter** the product. 214 x 12". Students will be asked to enter items. This means they type the answer in the appropriate place.
Greatest: "What is the **GREATEST** number of hats Sarah can buy?"
Identify: "**Identify** all errors in Jenna's work." Students will need to choose one or more items that fit the criteria.
In ALL: "How much money does Amy spend **IN ALL**?" Students will need to give a total. This does not mean to simply apply an operation, though. Students will need to read critically to determine the operation(s) that make(s) sense.
More/Fewer: "How many **MORE** stickers does Jimmy need to complete his collection?" Students will need to compare two quantities and determine how much more or less one quantity is than another.
Plot: "**Plot** an X on the line plot to represent Eric's data." Students will need to place data points on a coordinate grid, data display, or number line.
Represent: "**Represent** 0.20 as a fraction." Students will need to be able to translate between different forms of the same concept (i.e. fractions and decimals, equivalent fractions, equivalent expressions).
Select: "Select the shape(s) that match the given attributes**."** Students will need to choose one or more items that fit the criteria.
Shade: "Shade squares in the grid that represent the given fraction." Students will need to fill in the appropriate amount
Show All Work: Students will need to show all work needed to solve problems in order to receive full credit.
Solve/Evaluate: "Solve. 145 + 82" or **"Evaluate.** 145 + 82" Students will need to give an answer for the test item.
Use Word, Numbers and/or Symbols: "Use words, numbers, and/or symbols to support your answer." Students will need to explain their ideas clearly using math words, numbers or symbols. It should include evidence from the problem and student work.

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Quarter 1 Weeks 1 – 7	Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
Math Content: **Unit 1: Introducing Mathematics The Real Number System**	• Mathematicians understand the relative size of real numbers and can connect them to every-day situations. • Mathematicians express real numbers in a variety of ways and can fluently navigate between representations. • Mathematicians use the Pythagorean Theorem to solve real-world problems. • Mathematicians use real numbers to solve problems occurring in every-day life.	**8.NS.2** **8.NS.3** **8.GM.8** **8.GM.9** **8.C.1** Support Standards 8.NS.1 8.NS.4 8.C.2 8.GM.7	• Express rational numbers as decimals and fractions. • Approximate the value of irrational numbers and plot them on number lines. • Describe the relationship between sets of real numbers using visual models. • Order a set of real numbers arising from mathematical and real-world contexts. • Apply properties of integer exponents to evaluate expressions. • Convert between numbers in standard decimal notation and scientific notation. • Add, subtract, multiply, and divide numbers expressed with scientific notation. • Solve problems using Pythagorean Theorem, i.e. distance on the coordinate plane and finding the measure of any missing side. • Solve problems involving rational and irrational numbers. • Solve problems involving properties of exponents. • Solve multi-step real-world problems involving rational numbers. • Solve problems involving scientific notation. • Solve problems using Pythagorean Theorem	base cube root exponent integer irrational number negative number perfect cube perfect square positive number power principal square root rational number real number repeating decimal scientific notation square root standard notation terminating decimal whole number Pythagorean Theorem	**Curriculum Support Document** This link provides additional resources for critical standards. Critical standards are those in bold. **Go Math:** • Grade 7 Online Material – Getting ready for 8th grade • Unit 1: Modules 1 and 2 • Unit 5: Module 12 **Connected Mathematics:** • Accentuate the Negative (G7) • Additional Practice and Skills (G7) (pg.58 – 82) • Growing, Growing, Growing (G8) • Additional Practice and Skills (G8) (pg. 45 – 47) **Weeks of Inspirational Math** https://www.youcubed.org/week-inspirational-math/ **Illustrative Mathematics Tasks:** http://www.illustrativemathematics.org **Inside Mathematics:** Patterns in Prague (8.GM.8, PS.5, PS.6) http://www.insidemathematics.org/assets/common-core-math-tasks/patterns%20in%20prague.pdf Rugs (8.NS.2, 8.GM.8, PS.2, PS.5) http://www.insidemathematics.org/assets/common-core-math-tasks/rugs.pdf	***Spiral review: use critical standards from previous units** **Prerequisite Skills:** • Compare rational numbers • Write mixed numbers as improper fractions • Understand the difference in subsets of rational numbers • Understand whole number exponents • Multiply and divide by powers of 10 • Find the square of a number **Scaffolding Support: (ELL: SPED; Striving learners)** • Go Math: differentiation materials • Open ended problems with multiple entry points • Written instructions • Small group instruction • Graphic Organizers • Manipulatives • Concrete models • Encourage multiple ways to solve problems • Models of finished products • Picture Support • Ask all students to show their strategies while explaining • Games for practicing at home
Process Standards for Mathematics Problem Solving:	• Mathematicians model relationships using multiple representations (including diagrams, graphs, equations, tables and precise language as appropriate). • Mathematicians discern structure to connect and communicate mathematical ideas. • Mathematicians use precise language, calculations and representations of mathematical ideas.	PS.2 PS.6 PS.7	• Use multiple representations when they use number lines to estimate the locations of and order rational and irrational numbers given as symbols. • Use a Venn diagram to structure relationships between sets of numbers. • Connect and communicate mathematical with logical statements about the relationship between sets of numbers and describe which set best describes numbers applied to real-life situations. • Express rational numbers accurately in both fractional and decimal form, translating fluently between the forms. • Precisely represent and communicate ideas about irrational numbers, square roots, and cube roots.			

- 8.NS.1: Give examples of rational and irrational numbers and explain the difference between them. Understand that every number has a decimal expansion; for rational numbers, show that the decimal expansion terminates or repeats, and convert a decimal expansion that repeats into a rational number.
- 8.NS.2: Use rational approximations of irrational numbers to compare the size of irrational numbers, plot them approximately on a number line, and estimate the value of expressions involving irrational numbers.
- 8.NS.3: Given a numeric expression with common rational number bases and integer exponents, apply the properties of exponents to generate equivalent expressions.
- 8.NS.4: Use square root symbols to represent solutions to equations of the form x^2 = p, where p is a positive rational number.
- 8.C.1: Solve real-world problems with rational numbers by using multiple operations.
- 8.C.2: Solve real-world and other mathematical problems involving numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology, such as a scientific calculator, graphing calculator, or excel spreadsheet.
- 8.GM.7: Use inductive reasoning to explain the Pythagorean relationship.
- 8.GM.8: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions.
- 8.GM.9: Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane.

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Quarter 1/2 Weeks 8 – 11	Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
Math Content: **Unit 2:** **Proportional and Non-Proportional Relationships**	• Mathematicians use unit rates and proportional reasoning to solve real-world problems. • Mathematicians connect unit rates with slope of a line and represent these concepts in a variety of ways. • Mathematicians represent and solve word problems using equations. • Mathematicians represent proportional and non-proportional relationships with equations and graphs.	**8.AF.4** **8.AF.6** Support Standards 8.AF.7	• Represent linear proportional situations with tables, graphs, and equations. • Use data from a table or graph to determine the rate of change or slope and y-intercept in mathematical and real-world problems. • Graph proportional relationships, interpreting the unit rate as the slope of the line that models the relationship represent linear non-proportional situations with tables, graphs, and equations in the form of $y = mx + b$, $b \neq 0$. • Use data from a table or graph to determine the rate of change or slope and y-intercept in real-world problems. • Distinguish between proportional and non-proportional situations using tables, graphs, and equations in the form $y = kx$ and $y = mx + b$, where $b \neq 0$. • Sketch and analyze graphs that represent a relationship between two quantities. • Compare properties of two linear equations.	constant constant of proportionality equivalent ratios linear equation ordered pair proportion proportional relationship rate rate of change ratio slope slope-intercept form of an equation unit rate x-coordinate y-coordinate y-intercept	**Curriculum Support Document** This link provides additional resources for critical standards. Critical standards are those in bold. **Go Math:** • Unit 2: Modules 3 and 4 • Module 3 is a review of 7th grade standards….review as necessary. **Connected Mathematics:** • Comparing and Scaling (G7) • Additional Practice and Skills (G7) (pg. 39 – 57) • CC Additional Investigations (G7) (pg. 1 – 6) • Thinking with Math Models (G8) • Additional Practice and Skills (G8) (pg. 1 – 25) **Good Questions for Math Teaching:** pg. 31 – 45, 91 - 114 **Inside Mathematics:** Vincent's Graphs (8.AF.4, 8.AF.6) http://www.insidemathematics.org/assets/common-core-math-tasks/vincent's%20graphs.pdf **Illustrative Mathematics Tasks:** http://www.illustrativemathematics.org Art Class (1, 2), Buying Bananas, Buying Coffee, Music Companies, Robot Races, Sore Throats (1), Walk-a-thon, Fishing Adventures, Bookstore Account, Gotham City Taxes, Coffee by the pound, Comparing speeds in graphs and equations, Peaches and plums, Sore throats (2), Who has the best job?, Foxes and rabbits, Function rules, US garbage (1), Battery charging,	***Spiral review: use critical standards from previous units** **Prerequisite Skills:** • Write fractions as decimals • Solve proportions • Find unit rates • Integer operations • Graph ordered pairs **Scaffolding Support: (ELL: SPED; Striving learners)** • Go Math: differentiation materials • Open ended problems with multiple entry points • Written instructions • Small group instruction • Graphic Organizers • Manipulatives • Concrete models • Encourage multiple ways to solve problems • Models of finished products • Picture Support • Ask all students to show their strategies while explaining • Games for practicing at home
Process Standards for Mathematics Problem Solving:	• Mathematicians create and use representations to organize, record and communicate ideas. • Mathematicians apply math they know to problems arising in everyday life, society and the workplace.	PS. 2 PS. 4	• Use tables to model relationships between corresponding real-world proportional values. • Write equations to explain proportional relationships. • Connect real-world unit rates to the slope of a line. • Use graphs and equations to represent real-world proportional relationships. • Compare two or more linear equations across various representations. • Describe example real-world situations that are modeled by proportional relationships.			

- 8.AF.4: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described.
- 8.AF.6: Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in $y = mx + b$ that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem.
- 8.AF.7: Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed).

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Quarter 2 Weeks 12 – 15	Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
Math Content: **Unit 3:** **Algebraic Functions**	• Mathematicians understand that a function represents a dependence of one quantity on another and maps each input value to a single output value. • Mathematicians understand that a function can be represented concretely, numerically, graphically, verbally and algebraically. • Mathematicians use variables to generalize linear patterns and represent problem situations that can be modeled by linear functions. • Mathematicians create, analyze, and interpret graphs of a variety functions (including distance-time graphs), connecting rates to direction and steepness of a line.	**8.AF.4** **8.AF.5** **8.AF.6** **8.DSP.1** **8.DSP.3** **8.C.1** Support Standards 8.AF.3 8.AF.7 8.DSP.2	• Write an equation in the form y = mx + b to model a linear relationship between two quantities using verbal, numerical, tabular, and graphical representations. • Identify functions using sets of ordered pairs, tables, mappings, and graphs. • Analyze properties of different types of graphs, including linear functions, nonlinear functions, and distance-time graphs • Compare properties of two linear functions from different representations. • Contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation. • Represent and describe patterns of data on a graph. • Create trend lines to make predictions from data in a scatterplot. • Sketch and analyze graphs that represent a relationship between two quantities. • Compare properties of two or more linear equations. • Graph a pair of linear equations to approximate the solution. • Solve problems involving scatterplots.	bivariate data cluster data dependent variable function independent variable input linear equation linear function maximum value minimum value nonlinear relationship ordered pair outlier output proportional relationship rate of change scatter plot slope slope-intercept form of an equation trend line x-coordinate y-coordinate y-intercept	**Curriculum Support Document** This link provides additional resources for critical standards. Critical standards are those in bold. **Go Math:** • Unit 2: Modules 5, 6 and 14 • IN Success Lessons: A1, A2 & A3 • **SKIP: Lessons 6.1, 6.2, 6.4** **Connected Mathematics:** • Variables and Patterns (G7) • Additional Practice and Skills (G7) (pg. 1 – 20) • Moving Straight Ahead (G7) • Additional Practice and Skills (G7) (pg. 83 – 113) • Thinking with Math Models (G8) • Additional Practice and Skills (G8) (pg. 1 – 25) **Good Questions for Math Teaching:** pg. 91 – 114 **Inside Mathematics:** Party (8.AF.3, 8.AF.4, PS.2, PS.3) House Prices (8.AF.3, 8.AF.6, PS.1, PS.2) http://www.insidemathematics.org/performance-assessment-tasks **Illustrative Mathematics Tasks:** http://www.illustrativemathematics.org Bike race, Distance, Riding by the library, Tides, Battery charging, Introduction to linear functions, Foxes and rabbits, Function rules, US garbage (1), Coffee by the pound, Comparing speeds in graphs and equations, Peaches and plums, Sore throats (2), Who has the best job?, Foxes and rabbits, Function rules, US garbage (1), Battery charging,	***Spiral review: use critical standards from previous units** **Prerequisite Skills:** • Write fractions as decimals • Inverse operations • Use tables and verbal descriptions to describe a linear relationship • Graph linear relationships • Evaluate expressions for give values • Connect words and equations **Scaffolding Support: (ELL: SPED; Striving learners)** • Go Math: differentiation materials • Open ended problems with multiple entry points • Written instructions • Small group instruction • Graphic Organizers • Manipulatives • Concrete models • Encourage multiple ways to solve problems • Models of finished products • Picture Support • Ask all students to show their strategies while explaining • Games for practicing at home
Process Standards for Mathematics Problem Solving:	• Mathematicians create and use representations to organize, record and communicate ideas. • Mathematicians apply math they know to problems arising in everyday life, society and the workplace.	PS. 2 PS. 4	• Use tables, equations, verbal descriptions, pictorial representations, and graphs to model relationships between corresponding real-world linear relationships. • Connect real-world unit rates to the slope and direction of segments of distance-time graphs. • Use trend lines to describe a correlation in bivariate data and make predictions based on the data.			

- 8.AF.3: Understand that a function assigns to each x-value (independent variable) exactly one y-value (dependent variable), and that the graph of a function is the set of ordered pairs (x,y).
- 8.AF.4: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described.
- 8.AF.6: Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem.
- 8.AF.7: Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed).
- 8.DSP.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantitative variables. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- 8.DSP.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and describe the model fit by judging the closeness of the data points to the line
- 8.DSP.3: Write and use equations that model linear relationships to make predictions, including interpolation and extrapolation, in real-world situations involving bivariate measurement data; interpret the slope and y-intercept.
- 8.C.1: Solve real-world problems with rational numbers by using multiple operations.

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Quarter 2/3 Weeks 16 – 22	Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
Math Content: **Unit 4:** **Equations and Systems of Equations**	• Mathematicians analyze situations involving linear functions and formulate linear equations to solve problems. • Mathematicians investigate methods for solving linear equations using concrete models, graphs, and the properties of equality, select a method, and solve the equations. • Mathematicians interpret and determine the reasonableness of solutions to linear equations for given contexts.	**8.AF.1** **8.AF.2** **8.C.1** Support Standards 8.AF.8	• Solve multi-step equations and inequalities with the variable on both sides and with rational number coefficients and constants. • Solve multi-step equations and inequalities that require expanding expressions using the distributive property and collecting like terms. • Analyze and explain equations in one variable that have no solutions, one solution or infinitely many solutions. • Understand that the solution to a system of equations is the point of intersection of their graphs. • Solve systems of two linear equations in two variables using graphing. • Analyze the graphs of linear systems of equations that have no solution or an infinite number of solutions. • Represent real-world situations using systems of equations. • Solve multi-step linear equations fluently. • Represent and solve real-world problems using linear equations. • Solve problems involving rational and irrational numbers. • Solve multi-step real-world problems involving rational numbers.	algebraic expression coefficient common denominator constant equation inequality integers least common multiple linear equation operations ordered pair slope slope-intercept form solution solution of a system of equations system of equations variable x-axis x-intercept y-axis y-intercept	**Curriculum Support Document** This link provides additional resources for critical standards. Critical standards are those in bold. **Go Math:** • Unit 3: Modules 7 and 8 • IN Success Lessons: A4 & A5 **Connected Mathematics:** • The Shapes of Algebra (G8) • Additional Practice and Skills (G8) (pg. 137 – 170) **Good Questions for Math Teaching:** pg. 91 – 114 **Illustrative Mathematics Tasks:** http://www.illustrativemathematics.org Coupons vs. discount, Sammy's chipmunk and squirrel observations, solving equations, The sign of the solutions **Inside Mathematics:** Squares and Circles (8.AF.1, 8.AF.7, PS.7, PS.8) http://www.insidemathematics.org/assets/common-core-math-tasks/squares%20and%20circles.pdf	***Spiral review: use critical standards from previous units** **Prerequisite Skills:** • Find common denominators • Multiply decimals by powers of 10 • Connect words and equations • Write and solve two-step equations • Graph linear equations **Scaffolding Support: (ELL: SPED; Striving learners)** • Go Math: differentiation materials • Open ended problems with multiple entry points • Written instructions • Small group instruction • Graphic Organizers • Manipulatives • Concrete models • Encourage multiple ways to solve problems • Models of finished products • Picture Support • Ask all students to show their strategies while explaining • Games for practicing at home
Process Standards for Mathematics Problem Solving:	• Mathematicians make sense of problems and persevere in solving them. • Mathematicians create and use representations to organize, record and communicate ideas. • Mathematicians apply math they know to problems arising in everyday life, society and the workplace.	PS. 1 PS. 2 PS. 4	• Solve problems with EASE by **E**xploring given information, formulating an **A**ttack plan, **S**olving, and **E**xplaining your solution. • Ask questions during the problem-solving process such as "Does this make sense?" and "Is the solution reasonable?" • Create and solve multi-step equations and inequalities for real-world contexts, relating the solution back to the context. • Describe and solve (by graphing) possible real-world situations that are modeled with a system of linear equations.			

- 8.AF.1: Solve linear equations with rational number coefficients fluently, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and inequalities in one variable and solve such problems.
- 8.AF.2: 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 transforming a 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).
- 8.AF.8: Understand that solutions to a system of two linear equations correspond to points of intersection of their graphs because points of intersection satisfy both equations simultaneously. Approximate the solution of a system of equations by graphing and interpreting the reasonableness of the approximation.
- 8.C.1: Solve real-world problems with rational numbers by using multiple operations.

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Quarter 3 Weeks 23– 25	Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
Math Content: **Unit 5:** **Measurement Geometry**	• Mathematicians apply the Pythagorean Theorem and its converse in real-world and problem situations. • Mathematicians use nets, sketches, and models of geometric solids to find the surface area and volume of polyhedrons. • Mathematicians connect a geometric solid to its formula for surface area and volume. • Mathematicians use estimation in problem-solving situations involving volume and surface area to check for reasonableness of calculations. • Mathematicians use models of geometric figures to explore and explain the effects of slicing them with a plane figure.	**8.GM.2** **8.C.1** Support Standards 8.GM.1	• Model and use the Pythagorean Theorem and its converse to solve problems. • Determine the distance between two points on a coordinate plane using the Pythagorean Theorem. • Model the relationship between the volume of a cylinder and a cone and the volume of a rectangular prism and a pyramid having both congruent bases and height and connect that relationship to their volume formulas. • Solve problems involving the volume of cones, spheres and pyramids, including rational number side-lengths. • Solve problems involving the surface area of spheres. • Use rational number side-lengths for geometric problems. • Use visual or concrete models to slice geometric figures with a plane section. • Solve problems involving Pythagorean Theorem. • Solve problems involving square roots. • Describe attributes of three-dimensional objects. • Solve problems involving volume of cones, spheres and pyramids. • Solve problems involving surface area of spheres. • Solve multi-step real world problems involving rational numbers.	acute angles angles area base circumference cone cross section cylinder diameter edge face height hypotenuse legs length ordered pair perimeter plane polyhedron prism pyramid radius right angle right triangle sphere square root surface area theorem vertex width x-coordinate y-coordinate	**Curriculum Support Document** This link provides additional resources for critical standards. Critical standards are those in bold. **Go Math:** • Unit 5: Module 13 • Review complex area and missing area problems • IN Success Lessons: A6, A7, A8 & A9 **Connected Mathematics:** • Filling and Wrapping (G7) • Additional Practice and Skills (G7) (pg. 114 – 138) • CC Additional Investigations (G7) (pg. 19 – 26) • CC Additional Investigations (G8) (pg. 23 – 40) • Looking for Pythagoras (G8) • Additional Practice and Skills (G8) (pg. 26 – 44) **Good Questions for Math Teaching:** pg. 17 – 29, 77 – 89, 133 – 155 **Illustrative Mathematics Tasks:** http://www.illustrativemathematics.org Comparing snow cones, Flower vases, Glasses, Shipping rolled oats, Converse of the Pythagorean Theorem, Running on the football field	***Spiral review: use critical standards from previous units** **Prerequisite Skills:** • Write and solve equations • Use exponents and the order of operations to simplify expressions • Graph ordered pairs • Find the square of a number and the square root of a number • Round decimals • Find the circumference and area of a circle • Find the volume of prisms and cylinders **Scaffolding Support: (ELL: SPED; Striving learners)** • Go Math: differentiation materials • Open ended problems with multiple entry points • Written instructions • Small group instruction • Graphic Organizers • Manipulatives • Concrete models • Encourage multiple ways to solve problems • Models of finished products • Picture Support • Ask all students to show their strategies while explaining • Games for practicing at home
Process Standards for Mathematics Problem Solving:	• Mathematicians are purposeful with the tools they choose to help them solve problems. • Mathematicians use precise language, calculations and representations of mathematical ideas. • Mathematicians look for repeated calculations to develop formulas.	PS. 5 PS. 6 PS. 8	• Use a variety of tools to help visualize the concepts of volume and surface area and connect them to their formulas. • Use a coordinate plane and concepts related to graphing to solve problems involving right triangles. • Use care and precision with language, calculations, and unit labels. • Connect formulas for area, volume, and surface area to nets, concrete models, and repeated calculations.			

- 8.GM.1: Identify, define and describe attributes of three-dimensional geometric objects (right rectangular prisms, cylinders, cones, spheres, and pyramids). Explore the effects of slicing these objects using appropriate technology and describe the two-dimensional figure that results.
- 8.GM.2: Solve real-world and other mathematical problems involving volume of cones, spheres, and pyramids and surface area of spheres.
- 8.C.1: Solve real-world problems with rational numbers by using multiple operations.

8th Grade Mathematics – Scope and Sequence – MSD of Pike Township

Quarter 3/4 Weeks 26 – 28	Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
Math Content: **Unit 6: Transformational Geometry**	• Mathematicians predict, experiment with, and graph transformations (including rotations, reflections, translations and dilations) on a coordinate plane. • Mathematicians explain the effects on a figure from the pre-image to the new image. • Mathematicians define similarity using proportional relationships and dilations. • Mathematicians prove congruence and similarity of figures based on the sequence of transformations (including rotations, reflections, translations and dilations) in a coordinate plane.	**8.GM.6** **8.C.1** Support Standards 8.GM.3 8.GM.4 8.GM.5	• Determine and explain the properties of orientation and congruence of translations, reflections and rotations in a coordinate plane. • Express the effect of translations, reflections, and rotations in a coordinate plane using an algebraic representation. • Explain the sequence of rotations, reflections and translations to prove congruence between two given figures in a coordinate plane. • Compare and contrast the attributes of a shape and its dilation(s) on a coordinate plane. • Represent algebraically the effect of a scale factor applied to two-dimensional figures on a coordinate plane with the origin as the center of dilation. • Explain the sequence of rotations, reflections, translations and dilations to prove similarity between two given figures in a coordinate plane. • Solve problems involving transformations: (translations, rotations, reflections and dilations). • Solve multi-step real-world problems involving rational numbers.	center of dilation center of rotation congruent coordinate plane dilation enlargement image line of reflection origin parallelogram pre-image quadrants quadrilateral ratio reduction reflection rhombus rotation scale scale factor similar transformation translation trapezoid x-axis y-axis	**Curriculum Support Document** This link provides additional resources for critical standards. Critical standards are those in bold. **Go Math:** • Unit 4: Modules 9 and 10 **Connected Mathematics:** • CC Additional Investigations (G7) (pg. 19 – 34) • CC Additional Investigations (G8) (pg. 13 – 22) **Good Questions for Math Teaching:** pg. 77 - 89 **Illustrative Mathematics Tasks:** http://www.illustrativemathematics.org Partitioning a hexagon, Reflecting a rectangle over a diagonal, Is this a rectangle?, Comparing snow cones, Flower vases, Glasses, Shipping rolled oats **Inside Mathematics:** Aaron's Designs (8.GM.5, 8.GM.6, PS.5, PS.6) http://www.insidemathematics.org/assets/common-core-math-tasks/aaron's%20designs.pdf	***Spiral review: use critical standards from previous units** **Prerequisite Skills:** • Integer operations • Classify, draw, and graph plane figures • Congruence **Scaffolding Support: (ELL: SPED; Striving learners)** • Go Math: differentiation materials • Open ended problems with multiple entry points • Written instructions • Small group instruction • Graphic Organizers • Manipulatives • Concrete models • Encourage multiple ways to solve problems • Models of finished products • Picture Support • Ask all students to show their strategies while explaining • Games for practicing at home
Process Standards for Mathematics Problem Solving:	• Mathematicians justify their thinking using mathematical arguments. • Mathematicians ask questions to better understand others' thinking. • Mathematicians find and express similarities and differences between their thinking and others' thinking. • Mathematicians use known structures to make sense of new learning.	PS.3 PS.7	• Justify congruence or similarity of two objects represented on a coordinate plane using arguments based on transformations. • Evaluate others' justification of congruence or similarity with arguments based on transformations. • Use the structure of the coordinate plane to explore the effects of reflections, rotations, translations and dilations on geometric figures.			

- 8.GM.3: Verify experimentally the properties of rotations, reflections, and translations, including: lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.
- 8.GM.4: Understand 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. Describe a sequence that exhibits the congruence between two given congruent figures.
- 8.GM.5: Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. Describe a sequence that exhibits the similarity between two given similar figures.
- 8.GM.6: Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
- 8.C.1: Solve real-world problems with rational numbers by using multiple operations.

8th Grade Mathematics – Scope and Sequence – MSD of Pike Township

Quarter 4 Weeks 29 – 32	Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
Math Content: **Unit 7:** **Probability and Data Analysis**	• Mathematicians collect and organize data, make and interpret scatter plots and two-way tables, and model, predict, and make decisions and critical judgments in solving problems. • Mathematicians describe independent and dependent quantities in functional relationships for given problem situations and write trend line equations to answer questions arising from problem situations. • Mathematicians understand the meaning of a probability of 0, ½ and 1 within a specific context to understand certain or unlikely events. • Mathematicians analyze experimental probability and compare it to theoretical probability for simple and compound events, explaining possible reasons for areas of discrepancy.	**8.DSP.4** Support Standards 8.DSP.1 8.DSP.2 8.DSP.3 8.DSP.5 8.DSP.6	• Represent bivariate data in a scatter plot. • Describe patterns (i.e. clustering, outliers, positive or negative association, linear or nonlinear association, etc.) in bivariate data represented in scatter plots. • Draw trend lines to represent linear associations with data. • Write equations of trend lines and use them to make predictions (interpolations and extrapolations) about real-world situations. • Interpret the slope and y-intercept of a trend line. • Represent sample spaces and determine probability of simple and compound events. • Describe independent, dependent, complementary and mutually exclusive events. • Develop and use the multiplication counting principle when working with situations with a large number of outcomes. • Represent and solve real-world problems using linear equations. • Sketch and analyze graphs that represent a relationship between two quantities. • Solve multi-step real-world problems involving rational numbers. • Solve problems involving scatterplots. • Solve problems involving probability of compound events. • Use the multiplication counting principle to solve problems.	association bivariate data cluster complement compound event conditional relative frequency dependent event extrapolation frequency independent event interpolation joint relative frequency marginal relative frequency multiplication counting principle mutually exclusive outcome outlier ratio relative frequency sample space scatter plot slope slope-intercept form of an equation theoretical probability tree diagram trend line two-way relative frequency table x-coordinate y-coordinate y-intercept	**Curriculum Support Document** This link provides additional resources for critical standards. Critical standards are those in bold. **Go Math:** • Unit 6: Modules 14 • IN Success Lessons: A10, A11 & A12 **Connected Mathematics:** • How Likely is it? (G6) • Additional Practice and Skills (G6) (pg. 100 – 111) • What Do You Expect? (G7) • CC Additional Investigations (G7) (pg. 27 – 34) • Say it With Symbols (G8) • Additional Practice and Skills (G8) (pg. 109 – 135) **Good Questions for Math Teaching:** pg. 91 – 131 **Inside Mathematics**: Scatter Diagram (8.DSP.1, 8.DSP.2) http://www.doe.in.gov/sites/default/files/standards/mathematics/2014-07-25-math-g8-architecturewith-front-matter_br.pdf **Illustrative Mathematics Tasks:** http://www.illustrativemathematics.org	***Spiral review: use critical standards from previous units** **Prerequisite Skills:** • Evaluate expressions • Write linear equations • Solve two-step equations • Ways to display data • Simplify fractions • Represent rational numbers as fractions, decimals and percents • Find the percent of a number • How to represent and analyze quantitative data **Scaffolding Support: (ELL: SPED; Striving learners)** • Go Math: differentiation materials • Open ended problems with multiple entry points • Written instructions • Small group instruction • Graphic Organizers • Manipulatives • Concrete models • Encourage multiple ways to solve problems • Models of finished products • Picture Support • Ask all students to show their strategies while explaining • Games for practicing at home
Process Standards for Mathematics Problem Solving:	• Mathematicians make sense of problems and persevere in solving them. • Mathematicians create and use representations to organize, record and communicate ideas. • Mathematicians apply math they know to problems arising in everyday life, society and the workplace.	PS.1 PS.2 PS.4	• Solve problems with EASE by **E**xploring given information, formulating an **A**ttack plan, **S**olving, and **E**xplaining your solution. • Ask questions during the problem-solving process such as "Does this make sense?" and "Is the solution reasonable?" • Model real-world data with linear equations and use those equations to make predictions about the population. • Use probability to describe and solve real-world problems.			

- 8.DSP.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantitative variables. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- 8.DSP.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and describe the model fit by judging the closeness of the data points to the line
- 8.DSP.3: Write and use equations that model linear relationships to make predictions, including interpolation and extrapolation, in real-world situations involving bivariate measurement data; interpret the slope and y-intercept.
- 8.DSP.4: Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. Understand and use appropriate terminology to describe independent, dependent, complementary, and mutually exclusive events.
- 8.DSP.5: Represent sample spaces and find probabilities of compound events (independent and dependent) using methods, such as organized lists, tables, and tree diagrams.
- 8.DSP.6: For events with a large number of outcomes, understand the use of the multiplication counting principle. Develop the multiplication counting principle and apply it to situations with a large number of outcomes

8th Grade Mathematics – Scope and Sequence – MSD of Pike Township

Quarter 4 Weeks 33 – 36	Essential Goals	Priority Standards	Strategies/Skills	Academic Vocabulary	Instructional Resources	Differentiation
Math Content: **Unit 8:** **Reinforce and Extend Mathematical Understandings**	• Mathematicians practice critical grade level skills, in a variety of formats, to prepare them for more complex mathematical understandings. • Mathematicians make sense of a variety of problems and persevere in solving them. • Mathematicians reason abstractly and quantitatively to solve problems. • Mathematicians construct viable arguments and critique the reasoning of others. • Mathematicians apply math skills and understandings to solve real-world problems. • Mathematicians use a variety of tools to aid them in solving mathematical and real-world problems. • Mathematicians use structures and patterns to solve problems efficiently.	**8.C.1** **8.AF.1** **8.AF.6** **8.GM.8**	• Use pre and post assessments to determine reinforcement or extension of skills and understandings. • Use multiple representations to solve problems. • Connect mathematics to students' daily lives. • Use correct mathematical vocabulary. • Use accurate labels, symbols and calculations. • Work in teams to solve problems and justify solutions. • Select an appropriate tool to solve a problem and explain why the tool makes sense to use. • Explain whether or not a solution or process is reasonable for the problem situation.	abstract reasoning argument construct critique efficient mathematical models persevere precision proficient quantitative reasoning reasonable reasoning repeated reasoning strategically structure	**Curriculum Support Document** This link provides additional resources for critical standards. Critical standards are those in bold. **Go Math:** Unit 7 – Review Projects Unit 7 GR Modules 1, 2, 3, 4 **Good Questions for Math Teaching** **Connected Mathematics** **Laying The Foundation (NMSI)** **Illustrative Mathematics Tasks:** http://www.illustrativemathematics.org **Inside Mathematics:** Picking Apples http://www.insidemathematics.org/assets/common-core-math-tasks/picking%20apples.pdf	***Spiral review: use critical standards from previous units** **Scaffolding Support: (ELL: SPED; Striving learners)** • Go Math: differentiation materials • Open ended problems with multiple entry points • Written instructions • Small group instruction (Allow students to manipulate the animations in Agile Mind) • Graphic Organizers • Manipulatives • Concrete models • Encourage multiple ways to solve problems • Models of finished products • Picture Support • Ask all students to show their strategies while explaining • Games for practicing at home

- 8.C.1: Solve real-world problems with rational numbers by using multiple operations.
- 8.AF.1: Solve linear equations with rational number coefficients fluently, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and inequalities in one variable and solve such problems.
- 8.AF.6: Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem.
- 8.GM.8: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions.

Process Standards for Mathematics

The Process Standards demonstrate the ways in which students should develop conceptual understanding of mathematical content, and the ways in which students should synthesize and apply mathematical skills.	
PS.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. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” and "Is my answer reasonable?" They understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
PS.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.
PS.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 analyze situations by breaking them into cases and recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions and 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. They justify whether a given statement is true always, sometimes, or never. Mathematically proficient students participate and collaborate in a mathematics community. They listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.
PS.4: Model with mathematics.	Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace using a variety of appropriate strategies. They create and use a variety of representations to solve problems and to organize and communicate mathematical ideas. Mathematically proficient students apply what they know and 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 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.
PS.5: Use appropriate tools strategically.	Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Mathematically 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. Mathematically proficient students identify relevant external mathematical resources, such as digital content, and use them to pose or solve problems. They use technological tools to explore and deepen their understanding of concepts and to support the development of learning mathematics. They use technology to contribute to concept development, simulation, representation, reasoning, communication and problem solving.
PS.6: Attend to precision.	Mathematically proficient students communicate precisely to others. They use clear definitions, including correct mathematical language, 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 express solutions clearly and logically by using the appropriate mathematical terms and notation. They specify units of measure and label axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently and check the validity of their results in the context of the problem. They express numerical answers with a degree of precision appropriate for the problem context.
PS.7: Look for and make use of structure.	Mathematically proficient students look closely to discern a pattern or structure. They step back for an overview and shift perspective. They recognize and use properties of operations and equality. They organize and classify geometric shapes based on their attributes. They see expressions, equations, and geometric figures as single objects or as being composed of several objects.
PS.8: Look for and express regularity in repeated reasoning.	Mathematically proficient students notice if calculations are repeated and look for general methods and shortcuts. They notice regularity in mathematical problems and their work to create a rule or formula. Mathematically proficient students maintain oversight of the process, while attending to the details as they solve a problem. They continually evaluate the reasonableness of their intermediate results.

NUMBER SENSE	
8.NS.1	Give examples of rational and irrational numbers and explain the difference between them. Understand that every number has a decimal equivalent. For rational numbers, show that the decimal equivalent terminates or repeats, and convert a repeating decimal into a rational number.
8.NS.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, plot them approximately on a number line, and estimate the value of expressions involving irrational numbers.
8.NS.3	Given a numeric expression with common rational number bases and integer exponents, apply the properties of exponents to generate equivalent expressions.
8.NS.4	Use square root symbols to represent solutions to equations of the form x^2 = p, where p is a positive rational number.

COMPUTATION	
8.C.1	Solve real-world problems with rational numbers by using multiple operations.
8.C.2	Solve real-world and other mathematical problems involving numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology, such as a scientific calculator, graphing calculator, or excel spreadsheet.

ALGEBRA AND FUNCTIONS	
8.AF.1	Solve linear equations and inequalities with rational number coefficients fluently, including those whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and inequalities in one variable and solve such problems.
8.AF.2	Generate linear equations in one variable with one solution, infinitely many solutions, or no solutions. Justify the classification given.
8.AF.3	Understand that a function assigns to each x-value (independent variable) exactly one y-value (dependent variable), and that the graph of a function is the set of ordered pairs (x,y).

8.AF.4	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described.
8.AF.5	Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equation
8.AF.6	Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem.
8.AF.7	Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed).
8.AF.8	Understand that solutions to a system of two linear equations correspond to points of intersection of their graphs because points of intersection satisfy both equations simultaneously. Approximate the solution of a system of equations by graphing and interpreting the reasonableness of the approximation.

GEOMETRY AND MEASUREMENT	
8.GM.1	Identify, define, and describe attributes of three-dimensional geometric objects (right rectangular prisms, cylinders, cones, spheres, and pyramids). Explore the effects of slicing these objects using appropriate technology and describe the two-dimensional figure that results.
8.GM.2	Solve real-world and other mathematical problems involving volume of cones, spheres, and pyramids and surface area of spheres.
8.GM.3	Verify experimentally the properties of rotations, reflections, and translations, including: lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.
8.GM.4	Understand 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. Describe a sequence that exhibits the congruence between two given congruent figures.

8.GM.5	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. Describe a sequence that exhibits the similarity between two given similar figures.
8.GM.6	Explore dilations, translations, rotations, and reflections on two-dimensional figures in the coordinate plane.
8.GM.7	Use inductive reasoning to explain the Pythagorean relationship.
8.GM.8	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions.
8.GM.9	Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane.

DATA ANALYSIS, STATISTICS, AND PROBABILITY	
8.DSP.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantitative variables. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
8.DSP.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and describe the model fit by judging the closeness of the data points to the line.
8.DSP.3	Write and use equations that model linear relationships to make predictions, including interpolation and extrapolation, in real-world situations involving bivariate measurement data. Interpret the slope and y-intercept in context.
8.DSP.4	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. Understand and use appropriate terminology to describe independent, dependent, complementary, and mutually exclusive events.
8.DSP.5	Represent sample spaces and find probabilities of compound events (independent and dependent) using organized lists, tables, and tree diagrams.
8.DSP.6	For events with a large number of outcomes, understand the use of the multiplication counting principle. Develop the multiplication counting principle and apply it to situations with a large number of outcomes.

Number Sense		
Grade 6	**Grade 7**	**Grade 8**
6.NS.1: Understand that positive and negative numbers are used to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge). Use positive and negative numbers to represent and compare quantities in real-world contexts, explaining the meaning of 0 in each situation.	7.NS.3: Know there are rational and irrational numbers. Identify, compare, and order rational and common irrational numbers (√2, √3, √5, ∏) and plot them on a number line.	8.NS.1: Give examples of rational and irrational numbers and explain the difference between them. Understand that every number has a decimal expansion; for rational numbers, show that the decimal expansion terminates or repeats, and convert a decimal expansion that repeats into a rational number.
6.NS.2: Understand the integer number system. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself (e.g., –(–3) = 3), and that 0 is its own opposite.		
6.NS.3: Compare and order rational numbers and plot them on a number line. Write, interpret, and explain statements of order for rational numbers in real-world contexts.		8.NS.2: Use rational approximations of irrational numbers to compare the size of irrational numbers, plot them approximately on a number line, and estimate the value of expressions involving irrational numbers.
6.NS.4: Understand that the absolute value of a number is the distance from zero on a number line. Find the absolute value of real numbers and know that the distance between two numbers on the number line is the absolute value of their difference. Interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.		
6.NS.5: Know commonly used fractions (halves, thirds, fourths, fifths, eighths, tenths) and their decimal and percent equivalents. Convert between any two representations (fractions, decimals, percents) of positive rational numbers without the use of a calculator.		
6.NS.6: Identify and explain prime and composite numbers.	7.NS.1: Find the prime factorization of whole numbers and write the results using exponents.	8.NS.3: Given a numeric expression with common rational number bases and integer exponents, apply the properties of exponents to generate equivalent expressions.
6.NS.7: Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers from 1 to 100, with a common factor as a multiple of a sum of two whole numbers with no common factor.		
6.NS.8: Interpret, model, and use ratios to show the relative sizes of two quantities. Describe how a ratio shows the relationship between two quantities. Use the following notations: a/b, a to b, a:b.		
6.NS.9: Understand the concept of a unit rate and use terms related to rate in the context of a ratio relationship.		
6.NS.10: Use reasoning involving rates and ratios to model real-world and other mathematical problems (e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations).		
	7.NS.2: Understand the inverse relationship between squaring and finding the square root of a perfect square integer. Find square roots of perfect square integers.	8.NS.4: Use square root symbols to represent solutions to equations of the form x^2 = p, where p is a positive rational number.

Computation		
Grade 6	**Grade 7**	**Grade 8**
6.C.1: Divide multi-digit whole numbers fluently using a standard algorithmic approach.		
6.C.2: Compute with positive fractions and positive decimals fluently using a standard algorithmic approach.	7.C.1: Understand p + q as the number located a distance |q| from p, in the positive or negative direction, depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.	
	7.C.2: Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.	
	7.C.3: Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers.	
	7.C.4: Understand that integers can be divided, provided that the divisor is not zero, and that every quotient of integers (with non-zero divisor) is a rational number. Understand that if p and q are integers, then –(p/q) = (–p)/q = p/(–q).	
	7.C.7: Compute with rational numbers fluently using a standard algorithmic approach.	
6.C.3: Solve real-world problems with positive fractions and decimals by using one or two operations.	7.C.6: Use proportional relationships to solve ratio and percent problems with multiple operations, such as the following: simple interest, tax, markups, markdowns, gratuities, commissions, fees, conversions within and across measurement systems, percent increase and decrease, and percent error.	8.C.1: Solve real-world problems with rational numbers by using multiple operations.
	7.C.8: Solve real-world problems with rational numbers by using one or two operations.	
6.C.4: Compute quotients of positive fractions and solve real-world problems involving division of fractions by fractions. Use a visual fraction model and/or equation to represent these calculations.	7.C.5: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.	
6.C.5: Evaluate positive rational numbers with whole number exponents.		8.C.2: Solve real-world and other mathematical problems involving numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology, such as a scientific calculator, graphing calculator, or excel spreadsheet.
6.C.6: Apply the order of operations and properties of operations (identity, inverse, commutative properties of addition and multiplication, associative properties of addition and multiplication, and distributive property) to evaluate numerical expressions with nonnegative rational numbers, including those using grouping symbols, such as parentheses, and involving whole number exponents. Justify each step in the process.		

Algebra and Functions		
Grade 6	**Grade 7**	**Grade 8**
6.AF.1: Evaluate expressions for specific values of their variables, including expressions with whole-number exponents and those that arise from formulas used in real-world problems.		
6.AF.2: Apply the properties of operations (e.g., identity, inverse, commutative, associative, distributive properties) to create equivalent linear expressions and to justify whether two linear expressions are equivalent when the two expressions name the same number regardless of which value is substituted into them.	**7.AF.1:** Apply the properties of operations (e.g., identity, inverse, commutative, associative, distributive properties) to create equivalent linear expressions, including situations that involve factoring (e.g., given 2x - 10, create an equivalent expression 2(x - 5)). Justify each step in the process.	
6.AF.3: Define and use multiple variables when writing expressions to represent real-world and other mathematical problems, and evaluate them for given values.		
6.AF.4: Understand that solving an equation or inequality is the process of answering the following question: Which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.		**8.AF.2:** 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 transforming a 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).
6.AF.5: Solve equations of the form x + p = q, x - p = q, px = q, and x/p = q fluently for cases in which p, q and x are all nonnegative rational numbers. Represent real world problems using equations of these forms and solve such problems.	**7.AF.2:** Solve equations of the form px + q= r and p(x + q) = r fluently, where p, q, and r are specific rational numbers. Represent real-world problems using equations of these forms and solve such problems.	**8.AF.1:** Solve linear equations with rational number coefficients fluently, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and inequalities in one variable and solve such problems.
6.AF.6: Write an inequality of the form x > c, x ≥ c, x < c, or x ≤ c, where c is a rational number, to represent a constraint or condition in a real-world or other mathematical problem. Recognize inequalities have infinitely many solutions and represent solutions on a number line diagram.	**7.AF.3:** Solve inequalities of the form px +q (> or ≥) r or px + q (< or ≤) r, where p, q, and r are specific rational numbers. Represent real-world problems using inequalities of these forms and solve such problems. Graph the solution set of the inequality and interpret it in the context of the problem.	
6.AF.7: Understand that signs of numbers in ordered pairs indicate the quadrant containing the point; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. Graph points with rational number coordinates on a coordinate plane.		
6.AF.8: Solve real-world and other mathematical problems by graphing points with rational number coordinates on a coordinate plane. Include the use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.		

Algebra and Functions		
Grade 6	**Grade 7**	**Grade 8**
6.AF.9: 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.	**7.AF.4:** Define slope as vertical change for each unit of horizontal change and recognize that a constant rate of change or constant slope describes a linear function. Identify and describe situations with constant or varying rates of change.	
	7.AF.5: Graph a line given its slope and a point on the line. Find the slope of a line given its graph.	
	7.AF.6: Decide whether two quantities are in a proportional relationship (e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin).	
	7.AF.7: Identify the unit rate or constant of proportionality in tables, graphs, equations, and verbal descriptions of proportional relationships.	
	7.AF.8: Explain what the coordinates of a point on the graph of a proportional relationship mean in terms of the situation, with special attention to the points (0, 0) and (1,r), where r is the unit rate.	
6.AF.10: Use variables to represent two quantities in a proportional relationship in a real-world problem; write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.	**7.AF.9:** Identify real-world and other mathematical situations that involve proportional relationships. Write equations and draw graphs to represent proportional relationships and recognize that these situations are described by a linear function in the form y = mx, where the unit rate, m, is the slope of the line.	**8.AF.6:** Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem.
		8.AF.7: Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed).
		8.AF.3: Understand that a function assigns to each x-value (independent variable) exactly one y-value (dependent variable), and that the graph of a function is the set of ordered pairs (x,y).
		8.AF.4: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described.
		8.AF.5: Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equations.
		8.AF.8: Understand that solutions to a system of two linear equations correspond to points of intersection of their graphs because points of intersection satisfy both equations simultaneously. Approximate the solution of a system of equations by graphing and interpreting the reasonableness of the approximation.

Geometry and Measurement		
Grade 6	**Grade 7**	**Grade 8**
6.GM.1: Convert between measurement systems (English to metric and metric to English) given conversion factors, and use these conversions in solving real-world problems.		
6.GM.2: Know that the sum of the interior angles of any triangle is 180º and that the sum of the interior angles of any quadrilateral is 360º. Use this information to solve real-world and mathematical problems.		
6.GM.3: Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate; apply these techniques to solve real-world and other mathematical problems.	**7.GM.1:** Draw triangles (freehand, with ruler and protractor, and using technology) with given conditions from three measures of angles or sides, and notice when the conditions determine a unique triangle, more than one triangle, or no triangle.	
6.GM.4: Find the area of complex shapes composed of polygons by composing or decomposing into simple shapes; apply this technique to solve real-world and other mathematical problems.	**7.GM.5**: Understand the formulas for area and circumference of a circle and use them to solve real-world and other mathematical problems; give an informal derivation of the relationship between circumference and area of a circle.	
6.GM.5: Find the volume of a right rectangular prism with fractional edge lengths using unit cubes of the appropriate unit fraction edge lengths (e.g., using technology or concrete materials), and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = lwh and V = Bh to find volumes of right rectangular prisms with fractional edge lengths to solve real-world and other mathematical problems.	**7.GM.6:** Solve real-world and other mathematical problems involving volume of cylinders and three-dimensional objects composed of right rectangular prisms.	**8.GM.2:** Solve real-world and other mathematical problems involving volume of cones, spheres, and pyramids and surface area of spheres.
6.GM.6: Construct right rectangular prisms from nets and use the nets to compute the surface area of prisms; apply this technique to solve real-world and other mathematical problems.	**7.GM.7:** Construct nets for right rectangular prisms and cylinders and use the nets to compute the surface area; apply this technique to solve real-world and other mathematical problems.	**8.GM.1:** Identify, define and describe attributes of three-dimensional geometric objects (right rectangular prisms, cylinders, cones, spheres, and pyramids). Explore the effects of slicing these objects using appropriate technology and describe the two-dimensional figure that results.
	7.GM.3: Solve real-world and other mathematical problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing. Create a scale drawing by using proportional reasoning.	
	7.GM.4: Solve real-world and other mathematical problems that involve vertical, adjacent, complementary, and supplementary angles.	
		8.GM.3: Verify experimentally the properties of rotations, reflections, and translations, including: lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.
		8.GM.4: Understand 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. Describe a sequence that exhibits the congruence between two given congruent figures.
	7.GM.2: Identify and describe similarity relationships of polygons including the angle-angle criterion for similar triangles, and solve problems involving similarity.	**8.GM.5:** Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. Describe a sequence that exhibits the similarity between two given similar figures.
		8.GM.6: Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
		8.GM.7: Use inductive reasoning to explain the Pythagorean relationship.
		8.GM.8: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions.
		8.GM.9: Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane.

Data Analysis, Statistics (and Probability for Gr.7-8)		
Grade 6	**Grade 7**	**Grade 8**
6.DS.1: Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for the variability in the answers. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.	**7.DSP.1:** Understand that statistics can be used to gain information about a population by examining a sample of the population and generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.	
	7.DSP.2: Use data from a random sample to draw inferences about a population. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.	
6.DS.2: Select, create, and interpret graphical representations of numerical data, including line plots, histograms, and box plots.	**7.DSP.4:** Make observations about the degree of visual overlap of two numerical data distributions represented in line plots or box plots. Describe how data, particularly outliers, added to a data set may affect the mean and/or median.	
6.DS.3: Formulate statistical questions; collect and organize the data (e.g., using technology); display and interpret the data with graphical representations (e.g., using technology).		
6.DS.4: Summarize numerical data sets in relation to their context in multiple ways, such as: report the number of observations; describe the nature of the attribute under investigation, including how it was measured and its units of measurement; determine quantitative measures of center (mean and/or median) and spread (range and interquartile range), as well as describe any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered; and relate the choice of measures of center and spread to the shape of the data distribution and the context in which the data were gathered.	**7.DSP.3:** Find, use, and interpret measures of center (mean and median) and measures of spread (range, interquartile range, and mean absolute deviation) for numerical data from random samples to draw comparative inferences about two populations.	
	7.DSP.5: Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Understand that a probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. Understand that a probability of 1 indicates an event certain to occur and a probability of 0 indicates an event impossible to occur.	**8.DSP.4:** Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. Understand and use appropriate terminology to describe independent, dependent, complementary, and mutually exclusive events.
	7.DSP.6: Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its relative frequency from a large sample.	**8.DSP.5:** Represent sample spaces and find probabilities of compound events (independent and dependent) using methods, such as organized lists, tables, and tree diagrams.
	7.DSP.7: Develop probability models that include the sample space and probabilities of outcomes to represent simple events with equally likely outcomes. Predict the approximate relative frequency of the event based on the model. Compare probabilities from the model to observed frequencies; evaluate the level of agreement and explain possible sources of discrepancy.	**8.DSP.6:** For events with a large number of outcomes, understand the use of the multiplication counting principle. Develop the multiplication counting principle and apply it to situations with a large number of outcomes.
		8.DSP.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantitative variables. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
		8.DSP.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and describe the model fit by judging the closeness of the data points to the line.
		8.DSP.3: Write and use equations that model linear relationships to make predictions, including interpolation and extrapolation, in real-world situations involving bivariate measurement data; interpret the slope and y-intercept.