

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 1:</u> Transformations	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> Geometric figures can be moved using four kinds of transformations—translations, rotations, reflections, and dilations. These movements help us understand congruence, similarity, and spatial reasoning.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.C-G.1.1.1 Identify and apply properties of rotations, reflections, and translations. M08.C-G.1.1.2 Given two congruent figures, describe a sequence of transformations that exhibits the congruence between them. M08.C-G.1.1.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. M08.C-G.1.1.4 Given two similar two-dimensional figures, describe a sequence of transformations that exhibits the similarity between them.	<u>Interdisciplinary Standards (if applicable):</u>

<u>Essential Questions:</u> 1. How do transformations affect the position, size, and shape of geometric figures? 2. What does it mean for two figures to be congruent or similar, and how can I prove it using transformations? 3. How can I use coordinates and rules to describe and predict the results of transformations? 4. How do sequences of transformations help explain the relationship between figures? What is the role of scale factor in dilations, and how does it impact similarity?	<u>Understandings:</u> 1. Transformations change the position of a figure on a coordinate plane. They may or may not change the orientation or size of the figure. 2. Translations, rotations, and reflections are rigid motions that preserve the size and shape of figures, meaning they produce congruent images. 3. Dilations are non-rigid transformations that change the size of a figure but preserve its shape and the proportionality of sides, producing similar figures. 4. Coordinates are essential tools for describing transformations, including identifying the pre-image and image of a figure after a transformation and describing a transformation that maps one figure onto another. 5. Graphical representations on the coordinate plane and algebraic rules (like $(x,y) \rightarrow (x+a,y+b)$) both help describe and understand transformations. 6. Multiple transformations can be combined to form a sequence of transformations, and we can determine the effect of such sequences both graphically and algebraically. 7. Figures are congruent if one can be mapped to another using a sequence of rigid motions. 8. Figures are similar if one can be mapped to another using a sequence of rigid motions and a dilation.
<u>Knowledge:</u> 1. The four types of transformations: Translation (slide), Reflection (flip), Rotation (turn), Dilation (resizing using a scale factor) 2. The effects a transformation has on a figure - a change in position, size, or orientation of a figure (clockwise or counterclockwise). 3. Translations, reflections, and rotations are rigid motions because they preserve distance and angle measures. The figures remain congruent, meaning the shape and size stay the same under rigid motions. 4. A dilation changes the size of a figure using a scale factor and a center of dilation. Dilated figures are similar to the original figure (same shape, proportional size). 5. Basic coordinate transformation rules and notation (e.g., translation: $(x,y) \rightarrow (x+a,y+b)$, reflection over x-axis: $(x,y) \rightarrow (x,-y)$, etc.)	<u>Do/Skills:</u> 1. Identify and perform basic geometric transformations (translations, rotations, reflections, and dilations) on figures in the coordinate plane. 2. Describe transformations using coordinates, including the effect on individual points and entire figures. 3. Recognize and apply rigid motions (translations, rotations, reflections) that preserve shape and size. 4. Recognize and apply non rigid motions (dilations) that preserve angle measure and proportionality of side lengths. 5. Use sequences of transformations (including combinations of rigid motions and dilations) to map one figure onto another. 6. Verify congruence by demonstrating that one figure can be mapped onto another using only rigid transformations. 7. Verify similarity by demonstrating that one figure can be mapped onto another using a sequence that includes a dilation. 8. Explain how properties such as angle measures, side lengths, and orientation are affected by various transformations.

6. How to apply transformation rules to find image points in the coordinate plane. 7. A sequence of transformations is more than one transformation being applied to a figure in sequence. This process can be used to determine if two figures are congruent or similar.	9. Apply transformation concepts to solve problems in mathematical and real-world contexts.
<u>Vocabulary:</u> transformation, translation, reflection, rotation, dilation, scale factor, image, pre-image, congruent, similar, rigid motion, center of dilation, orientation, coordinate plane, origin.	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 2:</u> The Real Number System	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> The real number system is made up of rational and irrational numbers. Understanding how these numbers relate allows us to describe quantities more precisely and solve problems across mathematics.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.A-N.1.1.1 Determine whether a number is rational or irrational. For rational numbers, show that the decimal expansion terminates or repeats (limit repeating decimals to thousandths). M08.A-N.1.1.2 Convert a terminating or repeating decimal to a rational number (limit repeating decimals to thousandths). M08.A-N.1.1.3 Estimate the value of irrational numbers without a calculator (limit whole number radicand to less than 144). Example: $\sqrt{5}$ is between 2 and 3 but closer to 2. M08.A-N.1.1.4 Use rational approximations of irrational numbers to compare and order irrational numbers. M08.A-N.1.1.5 Locate/identify rational and irrational numbers at their approximate locations on a number line. M08.B-E.1.1.2 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. Evaluate square roots of perfect squares (up to and including 12^2) and cube roots of perfect cubes (up to and including 5^3) without a calculator. Example: If $x^2 = 25$ then $x = \pm\sqrt{25}$.	<u>Interdisciplinary Standards (if applicable):</u>

<u>Essential Questions:</u> 1. What are the different types of real numbers in the real number system and where do they belong in the hierarchy? 2. How can we determine if a number is rational or irrational? 3. How can we approximate irrational numbers, locate them on a number line, and use this to compare and order real numbers in various forms? 4. How do we evaluate square roots and cube roots, including perfect and nonperfect squares and cubes? 5. How can we use square roots and cubes to solve equations?	<u>Understandings:</u> 1. The real number system includes both rational and irrational numbers. 2. Rational numbers can be written as a ratio of integers; irrational numbers cannot. 3. Every number has a place in the number system and can be visualized on a number line. 4. Square roots of non-perfect squares and non-repeating, non-terminating decimals are irrational. 5. Understanding and approximating irrational numbers helps us make sense of real-world measurements and quantities. 6. The decimal expansion of a number determines whether it is rational or irrational.
<u>Knowledge:</u> 1. The relationship and hierarchy among natural numbers, whole numbers, integers, rational numbers, and irrational numbers. 2. The difference between perfect squares and nonperfect squares and the difference between perfect cubes and nonperfect cubes. 3. The numbers that are perfect squares (1 to 144) and perfect cubes (1 to 125). 4. Rational numbers include integers, fractions, terminating decimals, and repeating decimals. 5. Irrational numbers are numbers that cannot be written as a fraction; their decimal forms are non-terminating and non-repeating. 6. Irrational numbers cannot be represented as exact decimals or fractions. 7. The meaning and use of square root ($\sqrt{}$) and cube root ($\sqrt[3]{}$) symbols. 8. Common irrational numbers include square roots of non-perfect squares (e.g., $\sqrt{2}$, $\sqrt{5}$) and numbers like π. 9. How to approximate the value of irrational numbers and place them on a number line. 10. Numbers can be compared and ordered even if they are irrational. 11. How to convert repeating decimals into rational numbers.	<u>Do/Skills:</u> 1. Identify and classify numbers as natural, whole, integers, rational, or irrational. 2. Explain the difference between rational and irrational numbers using examples. 3. Convert repeating decimals into fractions. 4. Approximate the value of irrational numbers (e.g., $\sqrt{2} \approx 1.41$). 5. Plot rational and irrational numbers on a number line. 6. Use square root and cube root symbols appropriately. 7. Compare and order real numbers, including irrational numbers. 8. Understand that irrational numbers cannot be represented as exact decimals or fractions. 9. Evaluate the square roots of perfect squares from 1 to 144. 10. Evaluate the cube roots of perfect cubes from 1 to 125. 11. Use square roots, cube roots to represent solutions to equations.

<u>Vocabulary:</u> Real Number, rational number, irrational number, integer, whole number, natural number, terminating decimal, repeating decimal, non-terminating decimal, square root ($\sqrt{}$), cube root ($\sqrt[3]{}$), perfect square, perfect cube	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 3:</u> Equations	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> Equations are mathematical statements that show the equality between expressions. Solving equations helps us find unknown values and understand relationships between quantities in both mathematical and real-world contexts.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.B-E.3.1.1 Write and identify 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). M08.B-E.3.1.2 Solve linear equations that have rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	<u>Interdisciplinary Standards (if applicable):</u>

<u>Essential Questions:</u> 1. What does it mean to solve an equation? 2. What strategies help us solve equations efficiently and accurately? 3. How can we use equations to represent and solve real-world situations? 4. How do you know if an equation has one solution, no solution, or infinitely many solutions? 5. How can we check whether our solution to an equation is correct? 6. How can solving equations help us make decisions or predictions in everyday life?	<u>Understandings:</u> 1. An equation is a mathematical statement of equality, and solving an equation means finding the value(s) that make the equation true. 2. Linear equations can have one solution, infinitely many solutions, or no solution, and we can determine this by analyzing the structure of the equation (e.g., using the distributive property and combining like terms). 3. Solving multi-step equations involves applying inverse operations systematically to isolate the variable. 4. Equations can represent real-world relationships, and translating word problems into equations allows us to model and solve problems logically. 5. Using properties of equality (addition, subtraction, multiplication, and division) allows us to manipulate and solve equations without changing their solutions. 6. Equations can be used to represent and analyze proportional and linear relationships, especially when graphing or interpreting data in real-life contexts.
<u>Knowledge:</u> 1. The meaning of a solution to an equation. 2. The properties of equality (addition, subtraction, multiplication, division) and inverse operations needed to solve equations. 3. The parts of a linear equation (coefficients, constants, variables). 4. An equation can have one, none, or infinitely many solutions. 5. How to recognize and solve equations with variables on both sides. 6. How equations can represent real-world and mathematical problems. 7. The difference between equations and expressions. 8. The difference between linear and nonlinear equations.	<u>Do/Skills:</u> 1. Solve multi-step linear equations in one variable, including those with rational number coefficients, variables on both sides, distributive property, and combining like terms 2. Analyze and determine the number of solutions an equation has. 3. Justify steps when solving equations using properties of operations. 4. Model and solve real-world problems using equations. 5. Translate verbal expressions and real-life scenarios into algebraic equations. 6. Check accuracy of solutions by substituting them back into the original equation.

<u>Vocabulary:</u> equation, variable, coefficient, constant, expression, solution, inverse operation, distributive property, like terms, one solution, no solution, infinite solutions, linear equation, nonlinear equation, equivalent	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th grade/8th grade Math	
<u>Unit 4:</u> Pythagorean Theorem	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> The Pythagorean Theorem ($a^2+b^2=c^2$) is a consistent relationship among the sides of a right triangle. The formula allows us to calculate unknown distances in both two and three dimensions in real-world problems.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.C-G.2.1.1 Apply the converse of the Pythagorean theorem to show a triangle is a right triangle. M08.C-G.2.1.2 Apply the Pythagorean theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. (Figures provided for problems in three dimensions will be consistent with Eligible Content in grade 8 and below.) M08.C-G.2.1.3 Apply the Pythagorean theorem to find the distance between two points in a coordinate system.	<u>Interdisciplinary Standards (if applicable):</u>
<u>Essential Questions:</u> 1. What is the Pythagorean Theorem and where can we apply the formula? 2. How can the Pythagorean Theorem be used to find missing side lengths in right triangles? 3. How is the Pythagorean Theorem used to solve real-world problems? 4. How does the Pythagorean Theorem help me measure distances in 3D space? 5. How can we determine whether a triangle is a right triangle based on its side lengths?	<u>Understandings:</u> 1. The Pythagorean Theorem defines a relationship between the legs and the hypotenuse of a right triangle. 2. The theorem can be used to find a missing side of a right triangle when two side lengths are known. 3. It only applies to right triangles and can also be used to verify whether a triangle is a right triangle. 4. The theorem has practical applications, including finding distances in coordinate geometry and real-world problems involving elevation, area, and space. 5. The distance formula is derived from the Pythagorean Theorem.

<u>Knowledge:</u> 1. The Pythagorean Theorem: $a^2+b^2=c^2$ where a and b are legs and c is the hypotenuse of a right triangle. 2. How to identify the hypotenuse and legs of a right triangle. 3. The Pythagorean theorem only applies to right triangles. How to apply the theorem to both 2D and 3D contexts. How to solve for a missing side and verify triangle types. 4. The distance formula ($d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$) comes from the Pythagorean Theorem.	<u>Do/Skills:</u> 1. Identify right triangles and label legs and hypotenuse correctly. 2. Apply the Pythagorean to find missing side lengths. 3. Solve real-world and mathematical problems involving right triangles. 4. Use the theorem in coordinate planes to find distances between points. 5. Extend understanding to three-dimensional problems (e.g., diagonals of rectangular prisms). 6. Determine whether a triangle is a right triangle by checking if the side lengths satisfy $a^2+b^2=c^2$.
<u>Vocabulary:</u> Pythagorean Theorem, leg (of a triangle), hypotenuse, right triangle, converse (of the Pythagorean Theorem), distance formula, coordinate plane, square root, perfect square, radical, irrational number, two-dimensional (2D), three-dimensional (3D), diagonal	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 5:</u> Functions	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> Functions describe how one quantity depends on another, and understanding functions helps us model relationships, identify patterns, and make predictions about real-world and mathematical situations.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.B-F.1.1.1 Determine whether a relation is a function. M08.B-F.1.1.2 Compare properties of two functions, each represented in a different way (i.e., algebraically, graphically, numerically in tables, or by verbal descriptions). 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. M08.B-F.1.1.3 Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line; give examples of functions that are not linear.	<u>Interdisciplinary Standards (if applicable):</u>
<u>Essential Questions:</u> 1. What is a function, and how can we tell if a relationship is a function or not? 2. How can we represent functions using equations, tables, graphs, and words? 3. What does the rate of change (slope) tell us about a function and its behavior? 4. How do input and output values relate in a function, and why is that relationship important? 5. How can we compare and interpret different functions in real-world and mathematical situations? 6. How do linear and nonlinear functions differ, and how can we recognize them in various forms (equations, graphs, and tables)?	<u>Understandings:</u> 1. A function is a relationship where each input has exactly one output, and this rule can be represented in multiple ways (e.g., tables, graphs, equations, or words). 2. The input and output of a function are connected through a consistent rule, often described with function notation such as $f(x)$. 3. Functions help describe patterns and relationships between quantities in both mathematical and real-world contexts. 4. Not all relationships are functions. 5. The rate of change and initial value of a linear function can be interpreted from a graph, equation, or table. 6. Different functions can be compared based on their rates of change and behaviors (e.g., increasing, decreasing, constant).

7. Why are functions useful for modeling real-life relationships and making predictions?	7. Linear functions create straight-line graphs, while nonlinear functions show curves or other patterns. 8. Graphing and analyzing functions helps predict and understand behavior in real-life scenarios.
<u>Knowledge:</u> 1. The definition of a function is a rule that assigns exactly one output for each input. 2. A functions can be represented in multiple ways - equations, tables, graphs, words (verbal descriptions), ordered pairs, and mappings 3. How to identify if a relation is a function, including using the vertical line test for graphs. 4. The difference between linear and nonlinear functions, and how to recognize each from a graph, table, or equation. 5. How to compare functions represented in different forms based on their rate of change and y-intercepts. 6. That functions can be used to model and solve real-world problems, showing how one quantity changes in relation to another.	<u>Do/Skills:</u> 1. Define and identify functions from a table, graph, equation, or set of ordered pairs. 2. Determine whether a relation is a function using tools such as the vertical line test and the "one input → one output" rule. 3. Describe the relationship between the input (independent variable) and the output (dependent variable) in a function. 4. Compare two functions presented in different forms (e.g., table vs. equation, graph vs. verbal description). 5. Analyze and interpret the rate of change (slope) and the initial value (y-intercept) of a function in context. 6. Generate a table or graph from a function rule, and vice versa. 7. Distinguish between linear and nonlinear functions based on equations, graphs, and tables. 8. Model and solve real-world problems using functions, interpreting what the function's behavior means in context.
<u>Vocabulary:</u> function, domain, range, independent/dependent variable, function notation ($f(x)$), rate of change (slope), initial value (y-intercept), linear vs. nonlinear functions	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 6:</u> Linear Relationships	__X__ Essential ____ Important ____ Compact
<u>Big Idea:</u> Linear relationships describe patterns of change between two variables, and can be represented, interpreted, and applied using equations, graphs, tables, and verbal descriptions to model and solve real-world problems.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.B-F.1.1.2 Compare properties of two functions, each represented in a different way (i.e., algebraically, graphically, numerically in tables, or by verbal descriptions). 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. M08.B-F.1.1.3 Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line; give examples of functions that are not linear. M08.B-F.2.1.1 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values. M08.B-F.2.1.2 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch or determine a graph that exhibits the qualitative features of a function that has been described verbally.	<u>Interdisciplinary Standards (if applicable):</u>
<u>Essential Questions:</u> 1. What does a linear relationship represent, and how can we determine if a relationship is linear or nonlinear??	<u>Understandings:</u> 1. Equations that can be written in slope-intercept form ($y = mx+b$) are linear equations that will produce a graph that is a straight line.

- How do we represent linear relationships using graphs, tables, equations, and words? - What is the meaning of the slope and y-intercept in a linear equation or graph? - How do we compare and interpret different linear relationships in real-world contexts? How do changes in the slope and y-intercept affect the behavior of a linear function?	- Multiple representations (tables, ordered pairs, equations, verbal descriptions, and graphs) can be used to show relationships between quantities. - A linear relationship shows a constant rate of change between two quantities. - The slope-intercept form ($y = mx + b$) of a linear equation can be written using slope and y-intercept. - Linear functions create straight lines on a graph; nonlinear functions do not. - The difference between independent and dependent variables. - How to recognize, analyze, and compare linear vs. nonlinear relationships. - The real-world significance of slope (rate of change) and y-intercept (initial value). - The slope of a line is the same using any two points on the line.
<u>Knowledge:</u> - A linear relationship shows a constant rate of change between two variables. - The slope of a line represents the rate of change; the y-intercept represents the initial value. - Linear equations can be used to model real-world relationships using the form $y = mx + b$. - Linear function graphs are straight lines; non-linear functions are not straight lines. - Independent and dependent variables define how one quantity changes in relation to another.	<u>Do/Skills:</u> - Graph ordered pairs on a coordinate plane. - Distinguish between linear and nonlinear relationships in graphs, equations, and tables. - Graph a linear equation in slope-intercept form. - Calculate slope from a graph (rise over run), a table (change in y over change in x), or from two coordinate points using the slope formula. - Interpret the slope and y-intercept in context of real-world problems. - Write linear equations from tables, graphs, and word problems. - Compare two linear functions represented in different forms (e.g., graph vs. equation). - Use function notation to describe and evaluate linear functions. - Solve real-world problems using linear models, including interpreting and justifying solutions. - Graph proportional relationships, interpreting unit rate as slope and initial value as the y-intercept.

<u>Vocabulary:</u> slope, y-intercept, ordered pair, slope-intercept form, rate of change, function, linear function or equation, nonlinear function or equation	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 7:</u> Scatter Plots	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> Scatter plots help us visually analyze the relationship between two variables, identify trends or associations, and use patterns in data to make informed predictions.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.D-S.1.1.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative correlation, linear association, and nonlinear association. M08.D-S.1.1.2 For scatter plots that suggest a linear association, identify a line of best fit by judging the closeness of the data points to the line. M08.D-S.1.1.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. 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. M08.B-F.2.1.2 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch or determine a graph that exhibits the qualitative features of a function that has been described verbally.	<u>Interdisciplinary Standards (if applicable):</u>
<u>Essential Questions:</u> 1. How can scatter plots help us understand relationships between two variables? 2. What does the pattern of data in a scatter plot tell us about the nature of the relationship? 3. How do we describe, analyze, and interpret trends and associations in bivariate data?	<u>Understandings:</u> 1. Scatter plots provide a visual representation of the relationship between two quantitative variables. 2. Patterns and trends in the data can suggest a type of association or correlation. 3. A trend line can be used to model data, summarize relationships, and make reasonable predictions.

- When is it appropriate to use a line of best fit, and how do we draw or interpret it? - How can scatter plots and trend lines be used to make predictions?	- Not all data relationships are linear, and interpreting associations requires analyzing the overall pattern. - Outliers and clusters may influence how we analyze and interpret bivariate data. - Real-world situations can be modeled using scatter plots and analyzed for decision-making.
<u>Knowledge:</u> - A scatter plot is a graph that shows the relationship between two variables. - Bivariate data involves two variables that are compared or analyzed together. - Patterns in scatter plots can have a positive association (as one variable increases, the other increases), a negative association (as one variable increases, the other decreases), or no association (no clear pattern). - A line of best fit approximates the trend in a scatter plot. - Clustering and outliers affect how data is interpreted. - A line of best fit can be used to make predictions about the bivariate data.	<u>Do/Skills:</u> - Construct a scatter plot from a table or a data set. - Describe associations between two variables as positive, negative, or no association, linear or nonlinear, and strong or weak. - Identify and interpret patterns in scatter plots (clusters, outliers). - Draw a trend line (line of best fit) to model a linear association. - Write an equation for the line of best fit and use the equation to make predictions. - Interpret the meaning of associations in context of real-world situations. - Distinguish between correlation and causation in data analysis (conceptually). - Analyze real-world bivariate data sets and make claims supported by evidence in the data.
<u>Vocabulary:</u> bivariate data, scatter plot, correlation/association, positive/negative/no association, trend line (line of best fit), clustering, outlier, prediction, interpolate/extrapolate	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 8:</u> Systems of Equations	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> A system of equations represents two or more relationships, and solving the system means finding values that make all the equations true. These solutions reveal where the relationships intersect and help us model and solve real-world problems.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.B-E.3.1.3 Interpret solutions to a system of two linear equations in two variables as points of intersection of their graphs because points of intersection satisfy both equations simultaneously. M08.B-E.3.1.4 Solve systems of two linear equations in two variables algebraically and estimate solutions by graphing the equations. Solve simple cases by inspection. Example: $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6. M08.B-E.3.1.5 Solve real-world and mathematical problems leading to two linear equations in two variables. Example: Given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.	<u>Interdisciplinary Standards (if applicable):</u>
<u>Essential Questions:</u> 1. What does it mean for two equations to form a system? 2. How can we determine the solution to a system of equations? 3. When is it best to use graphing, substitution, or elimination as the best method to solve a system? 4. What does the solution of a system tell us about the relationship between the equations? 5. How are systems of equations used to model and solve real-world problems?	<u>Understandings:</u> 1. Solving a system means finding the values of variables that make both equations true at the same time. 2. Systems of equations can have one solution, no solution, or infinite solutions, and each type of solution tells us something different about the relationship between the lines. 3. Different methods of solving systems have advantages depending on the context. 4. Systems of equations are powerful tools for comparing scenarios and solving real-world problems involving two variables.

<u>Knowledge:</u> 1. A system of linear equations consists of two or more linear equations with the same variables. 2. The solution to a system is the point(s) where the equations intersect (if any) and is usually written as an ordered pair (x, y). 3. The solution to a system is the value of the variables that can be substituted into both equations and make true statements. 4. Systems can have one solution (intersecting lines), no solution (parallel lines), or infinitely many solutions (same line). 5. There are three main methods used to solve systems: Graphing (visual), substitution (algebraic), and elimination (algebraic). 6. Real-world problems can be modeled with systems of equations involving quantities that vary together.	<u>Do/Skills:</u> 1. Identify and classify systems as having one, none, or infinite solutions by graphing both equations and analyzing the system visually, or by comparing slopes and y-intercepts based on their equations. 2. Solve systems using graphing, both by hand and using technology. 3. Solve systems using substitution (solving one equation for a variable and substituting into the other) 4. Solve systems using elimination (adding or subtracting equations to eliminate a variable) 5. Check the accuracy of solutions by substituting values into both equations. 6. Interpret the meaning of the solution in the context of a word problem. 7. Choose the most efficient method for solving a system based on how the equations are presented. 8. Model and solve real-world problems using systems (e.g., cost comparisons, distance/rate/time).
<u>Vocabulary:</u> system of equations, solution, graphing method, substitution method, elimination method, number of solutions, dependent vs. independent, intersecting lines, parallel lines, coinciding lines	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 9:</u> Exponents and Scientific Notation	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> Exponents and scientific notation are tools that allow us to represent, interpret, and operate with very large and very small numbers efficiently, making it possible to model real-world situations and solve problems across science, technology, and everyday life.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.B-E.1.1.1 Apply one or more properties of integer exponents to generate equivalent numerical expressions without a calculator (with final answers expressed in exponential form with positive exponents) M08.B-E.1.1.3 Estimate very large or very small quantities by using numbers expressed in the form of a single digit times an integer power of 10 and express how many times larger or smaller one number is than another. M08.B-E.1.1.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Express answers in scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology (e.g., interpret 4.7EE9 displayed on a calculator as 4.7×10^9).	<u>Interdisciplinary Standards (if applicable):</u>
<u>Essential Questions:</u> - How can properties of exponents be used to simplify and solve problems involving very large or very small numbers? - Why is scientific notation an effective way to represent and compare extremely large or small values? - How do patterns in exponents help us understand powers of 10 and place value in our number system? - In what ways does using scientific notation make real-world problem solving more efficient in fields like science,	<u>Understandings:</u> - Exponents provide a compact way to represent repeated multiplication. - Negative exponents provide a compact way to represent repeated division. - Integer exponents follow consistent rules (product rule, quotient rule, power of a power, zero and negative exponents). - Numbers can be expressed in different forms, and scientific notation is especially useful for representing very large and very small quantities. - Scientific notation connects mathematics to real-world applications in science, technology, and everyday problem solving.

engineering, and finance? - How do negative exponents extend our understanding of division and fractions? - How can we determine which representation—standard form, exponential form, or scientific notation—is most appropriate in a given situation? - How do exponents and scientific notation connect to measurement, accuracy, and technology in everyday life?	- Operations with numbers in scientific notation follow the same properties of operations as with other numbers, but require careful attention to place value and powers of ten. - Exponential notation and scientific notation support precision and efficiency in computation, modeling, and communication.
<u>Knowledge:</u> - The meaning of integer exponents. - Properties of exponents (product, quotient, power of a power, zero, negative exponents). - How to convert between standard form and scientific notation. - How to apply operations (multiplication/division) with numbers in scientific notation. - How to interpret scientific notation in real-world contexts.	<u>Do/Skills:</u> - Simplify expressions involving exponents using the exponent rules. - Represent numbers using scientific notation. - Perform operations with numbers in scientific notation. - Apply scientific notation to solve problems in science, technology, and everyday contexts.
<u>Vocabulary:</u> exponent, base, power, square, cube, negative exponent, scientific notation, standard form, coefficient	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th grade/8th grade Math	
<u>Unit 10:</u> Volume	<u> X </u> Essential <u> </u> Important <u> </u> Compact
<u>Big Idea:</u> Understanding and applying volume formulas for cylinders, cones, and spheres allows us to measure and compare the space three-dimensional objects occupy. These skills make it possible to solve meaningful real-world problems involving capacity, design, and spatial reasoning.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.C-G.3.1.1 Apply formulas for the volumes of cones, cylinders, and spheres to solve real-world and mathematical problems.	<u>Interdisciplinary Standards (if applicable):</u>
<u>Essential Questions:</u> 1. How can we find the volume of three-dimensional objects? 2. What is the relationship between the volumes of cylinders, cones, and spheres? 3. How are volume formulas derived? 4. How can we apply volume calculations in real-life situations?	<u>Understandings:</u> 1. Volume measures the amount of space a three-dimensional object occupies. 2. There are specific formulas to calculate the volume of cylinders, cones, and spheres. 3. The volume of a cone is one-third the volume of a cylinder with the same base and height. 4. The volume of a sphere relates to the cube of its radius. 5. Volume calculations have real-world applications (e.g., packaging, storage, engineering).
<u>Knowledge:</u> 1. The volume formulas for cylinders, cones, and spheres. 2. The geometric reasoning behind each formula. 3. The meaning and role of radius, height, and diameter in each shape's volume calculation. 4. How to use estimation, rounding, and units appropriately when working with volume. 5. How volume applies to real-world objects and problems.	<u>Do/Skills:</u> 1. Identify key components of cylinders, cones, and spheres (radius, height, diameter). 2. Select and apply the correct formula for volume based on the shape. 3. Calculate and compare volumes of different three-dimensional shapes. 4. Solve real-world problems involving volume, including multi-step problems. 5. Convert between units of volume as needed (e.g., cm^3 to m^3). 6. Write volume calculations in terms of π or as numbers rounded correctly to various place values. 7. Students will begin with two separate simple one-way tables and then transition to combining them into one two-way table to reveal joint outcomes. 8. Students will build tables from survey scenarios (e.g., class level vs. lunch

6. Calculations involving π can be written as an exact value (in terms of π) or as an approximate value using rounding rules.	choice), calculate marginal totals, and check consistency. 9. Students will convert counts into percentages of the whole, and interpret what they mean. 10. Students will calculate conditional relative frequencies. Students will analyze two-way tables for associations. 11. Students will design and collect their own two-categorical surveys (e.g., pets owned vs. chores assigned), create tables, and interpret associations.
<u>Vocabulary:</u> volume, cylinder, cone, sphere, radius, diameter, height, base area, π (pi), exact value (in terms of π), approximate value (rounded), cubic units, three-dimensional (3D), cross-section	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>

<u>Grade, Subject/Course:</u> 8th Grade, 8th Grade math	
<u>Unit 11:</u> Two-Way Tables M08.D-S.1.2.1 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 associations between the two variables.	__ X __ Essential ____ Important ____ Compact
<u>Big Idea:</u> Data can be organized, represented, and analyzed in two-way tables to reveal relationships and associations between two categorical variables.	
<u>PA Core Content Standards/Anchors (or National Standards):</u> M08.D-S.1.2.1 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 associations between the two variables. Example: Given data on whether students have a curfew on school nights and whether they have assigned chores at home, is there evidence that those who have a curfew also tend to have chores?	<u>Interdisciplinary Standards (if applicable):</u>
<u>Essential Questions:</u> - How can data be organized to show relationships between two categorical variables? - What do relative frequencies tell us about possible associations? - How do we decide if a relationship exists between two variables?	<u>Understandings:</u> - Organizing data into a two-way table allows us to compare two categorical variables at the same time. - Relative frequencies help us describe patterns and make comparisons more meaningful than raw counts. - Associations between variables can be identified by examining and comparing conditional relative frequencies. - A relationship between two categorical variables does not always mean causation. - Data representations must be interpreted in context to draw valid conclusions.

<u>Knowledge:</u> 1. Data can be collected and categorized into two variables. 2. A two-way frequency table organizes data to compare two variables. 3. Relative frequencies are used to identify patterns or associations between variables. 4. Associations are determined by comparing frequencies within the context of the data.	<u>Do/Skills:</u> 1. Collect categorical data from surveys or real-world scenarios. 2. Organize data into a two-way frequency table. 3. Compute row and column relative frequencies. 4. Compare relative frequencies to determine possible associations. 5. Explain reasoning about whether two variables are associated.
<u>Vocabulary:</u> categorical variable, two-way table, relative frequency, association, causation	<u>Core Resources:</u> Unit packets (notes and practice) Various Digital Math Resources
<u>Common Assessment(s):</u> Unit quizzes End of unit assessment	<u>Supplemental Resources:</u>