

**Mathematics Standards**

**Pre-Algebra**

**Course Overview:** In this course, students will learn to use new models and methods to think about problems as well as solve them. Students will be developing powerful mathematical tools and learning new ways of thinking about and investigating situations. They will be making connections, discovering relationships, figuring out what strategies can be used to solve problems, and explaining your thinking. Learning to think in these ways and communicate about their thinking is useful in mathematical contexts, other subjects in school, and situations outside the classroom. The mathematics students have learned in the past will be valuable for learning in this course.

**Bold standards are essential standards that all students will learn as they complete the course.**

**Unit 1 Problem Solving (8 Days)**

**Description:** In this chapter students will be introduced to many of the big ideas they will explore and the ways in which they will be working. Students will apply their current mathematical knowledge to solve problems, some of which will be revisited later in the course using new algebraic tools. In the second part of this chapter, students will develop methods for solving problems that involve proportional relationships. Finally, this chapter is about problem solving. Students will use a variety of problem-solving strategies that will remain useful throughout this course, including collecting data, finding patterns, writing and solving an equation, and drawing a graph.

**Standards**

1. Students will begin to interpret points and continuous graphs, understanding that a point conveys two pieces of information and that a continuous graph conveys trends. Students will also be given the opportunity to get to know the members of their study teams while interpreting the graphs. (8.F.1)
2. Students will actively experience the *xy*-coordinate system in order to review its elements and informally be introduced to a linear function. (5.G.1)
3. This lesson will introduce scatterplots as tools for organizing data and making predictions. Students will learn the importance of carefully scaling the axes of a graph. Also, students will be introduced to the concept of dependent and independent measurements. (8.SP.2)
4. Students will review what they learned in previous courses about proportional relationships using graphs and tables. They will also compare rates in different representations of proportional relationships. (8.EE.5)
5. Students will investigate different strategies for solving proportions written as equivalent ratios. (7.RP.3)

**Unit 2 Simplifying with variables (9 Days)**

**Description:** In this chapter, students will learn what a variable is. They will also learn how to write and simplify algebraic expressions. Students will then compare two complicated algebraic expressions. Finally students will learn how to solve for a variable if they know that two expressions are equal.

**Standards**

1. Students will be introduced to algebra tiles, which will lay the foundation for later work with manipulating algebraic expressions and solving equations. Students will name each tile by its area and will learn how to simplify an expression by combining like terms. (8.EE.7a)
2. As students find the perimeter of shapes formed with tiles, they will differentiate between the dimensions (length and width) of the tiles and the area. Students will need to apply their understanding of combining like terms to find the simplest expression to represent perimeter. (8.EE.7a)
3. Students will learn about the different interpretations of “minus” and how to represent negatives with algebra tiles. Students will also construct and simplify algebraic expressions using the tiles. (8.EE.7a)
4. Students will deepen their understanding of the concept of zero and will learn how to represent zero in multiple ways with algebra tiles. Students will also build and simplify algebraic expressions using tiles. (8.EE.7a)
5. Students will practice using different interpretations of “minus” as they represent negatives with algebra tiles. Students will also build and simplify algebraic expressions using the tiles and will begin to use Expression Comparison Mats to determine whether two expressions are the same or different. (8.EE.7a)
6. Students will practice simplifying algebraic expressions using algebra tiles and will use an Expression Comparison Mat to determine which of two expressions is greater. (8.EE.7a)
7. Students will practice simplifying algebraic expressions using algebra tiles and will use an Expression Comparison Mat to determine which of two expressions is greater. Students will also learn how to record their work in order to show their solution steps. (8.EE.7a)
8. Students will begin solving equations for x and will strengthen their simplification skills. (8.EE.7a, 8.EE.7b)
9. **Students will continue solving equations for xand will begin to consider special types of solutions such as “all numbers” and “no solution.” They will also strengthen their simplification and recording skills**. (8.EE.7a, 8.EE.7b)

**Unit 3 Graphs and Equations (13 Days**)

**Description:** In this chapter, students will extend their understanding of the use of variables, such as xand y. They will learn about tools like graphing calculators that will help them explore how variables affect tile patterns, tables, and graphs. Students will continue to develop their ability to solve equations. In this chapter, students will also begin to learn about the multiple representations of data. In this chapter, students will learn how to represent a situation using a table, rule, and graph, how to graph linear and parabolic rules, as well as what it means for something to be the solution to an equation.

**Standards**

1. Students will learn how to identify the rule for a pattern and state it in words. At this point, students will work toward concise and descriptive rules using words. (8.F.1)
2. Students will continue to find rules for patterns and will write rules algebraically using symbolic notation. Students will also evaluate algebraic expressions to make predictions about a pattern. (8.F.1, 8.F.2, 8.F.3, 8.F.4)
3. Students will graph data points from a pattern on the *x* → *y* coordinate plane. Students will learn how to use graphing technology to graph data points and equations. Students will learn the difference between discrete and continuous graphs and will understand how to use a graph to verify a prediction. (8.F.1, 8.F.2, 8.F.3, 8.F.4)
4. Students will practice plotting points from an *x→y* table and will practice setting up appropriate axes for a data set. (8.F.1, 8.F.2, 8.F.3, 8.F.4)
5. Given a linear equation or a contextual situation, students will set up and complete a table, plot the points, and draw the graph using an appropriate scale. Students will also practice graphing decimal values. (8.F.1, 8.F.2, 8.F.3, 8.F.4)
6. Given a linear or quadratic equation, students will create *x* → *y* tables, scale axes, plot points, and draw complete graphs. (8.F.1, 8.F.2, 8.F.3, 8.F.4)
7. Students will use graphs and rules to analyze a contextual situation with a limited domain. Students will also learn how to identify common errors in scaling and plotting points. (8.F.4)
8. Students will review and practice their equation-solving skills. They will also learn how to check their answer. Finally, students will recognize that a solution is a value that makes an equation true. (8.EE.7a, 8.EE.7b)
9. Students will further develop their understanding of what makes a solution to an equation. They will work with equations that have one solution, an infinite number of solutions, and no solutions. At the same time, they will get more practice with solving equations while writing down their steps, making further progress toward being able to solve linear equations without the use of manipulatives. (8.EE.7a, 8.EE.7b)
10. Students will continue to practice solving equations, including some equations that cannot be solved using algebra tiles. These equations will come from a context used in Section 3.1, leading students to expand their idea of a solution to include its meaning in relation to an application. (8.EE.7b)
11. Students will continue to practice solving equations that cannot be solved using algebra tiles. These equations will come from contexts used in Section 3.1, leading students to think of their solutions in terms of real-world applications. (8.EE.7b)
12. Students will develop the Distributive Property and use it to solve linear equations. (8.EE.7b)

**Unit 4 Multiple Representations- 9 Days**

**Description:** In this chapter students will build on the work they did in the previous two chapters. This unit focuses solely on the connections between the four representations of data: patterns, tables, graphs, and equations (also referred to as “rules”). In this chapter, students will learn how to change any representation of data to another representation and how to use the connections between patterns, tables, graphs, and rules to solve problems.

**Standards**

1. **Students will discover connections between all of the representations of a pattern: a graph, a table, a geometric presentation, and an equation. Students will also look at different ways to represent the connections.** (8.F.2, 8.F.4)
2. Students will write linear algebraic rules relating the figure number of a geometric pattern and its number of tiles. They will identify connections between the growth of a pattern and its linear equation. (8.F.2, 8.F.4)
3. Students will connect linear geometric patterns with patterns on a graph, specifically focusing on how a geometric pattern grows and how the size of Figure 0 can be determined from information on a graph. (8.F.2, 8.F.4)
4. Students will develop new connections between multiple representations of patterns and identify rules for these patterns using the *y = mx + b* form of a linear equation. Students will then apply their understanding of m as the pattern of growth and b as Figure 0 or the starting point of the pattern to write a rule from a graph and to create a pattern based on a linear rule. (8.EE.6, 8.F.2, 8.F.4)
5. Students will apply their understanding of growth, Figure 0, and connections between multiple representations to situations where they are presented with disparate pieces of information and must generate a complete pattern. Students will apply their understanding of growth and Figure 0 to new contexts in order to generate complete representations. (8.F.2, 8.F.4)
6. Students will apply their knowledge of m as the pattern of growth and bas Figure 0 or the starting value of a pattern to create graphs quickly without using an *x→y* table. (8.F.2, 8.F.4)
7. Students will practice moving directly from one representation to another in the Representations of Patterns Web. (8.F.2, 8.F.4)

**Chapter 5 Systems of Equations (9 Days)**

**Description:** In this chapter, most of students work will focus on rules (equations). Specifically, they will focus on how to solve them. In this chapter, students will learn how to solve multi-variable equations for one of the variables. Students will also learn how to solve equations with fractional coefficients. Students will learn how to find the point where two lines intersect. Finally students will learn how to use the connections between graphs, tables, rules, and patterns to solve problems.

**Standards**

1. Students will solve two-variable linear equations for one variable. (8.EE.7b)
2. Students will extend what they learned about solving equations with integer coefficients to equations that involve fractions and decimals. They will learn how to change fractional and decimal coefficients and constants to integers. (8.EE.7b)
3. Students will begin a focus on systems of equations and will examine the meaning of points of intersection. (8.EE.8a)
4. Students will continue to develop an understanding of solving systems of equations through the lens of multiple representations. Students will write rules and find intersections from contexts in word problems. (8.EE.8c)
5. Students will learn how to solve systems of equations algebraically when both equations are in *y = mx + b* form. (8.EE.8b, 8.EE.8c)
6. Students will continue work with solving systems of equations using the Equal Values Method when equations are not in *y*-form and learn to identify systems that represent the same line or parallel lines (that is, systems that have infinitely many solutions or no solution). (8.EE.8b, 8.EE.8c)

**Unit 6 Transformations and Similarity (10 Days)**

**Description:** In this chapter, students will learn how to transform shapes by flipping, turning, and sliding them on a coordinate graph. Students will also learn how to describe movement on a graph using coordinates and expressions. Finally students will compare shapes and use similarity to find missing side lengths of polygons, especially triangles.

**Standards**

1. Students will learn how to move a shape on a coordinate graph using rigid transformations – translations (slides), rotations (turns), and reflections (flips). (8.G.1a, 8.G.1b, 8.G.1c)
2. Students review graphing strategies, learn that different methods to transform shapes can sometimes be used interchangeably, describe and complete transformations on a coordinate plane, and use coordinates to describe the position of objects in a plane (flat surface). (8.G.1a, 8.G.1b, 8.G.1c, 8.G.2, 8.G.3, 8.G.4)
3. Students will extend their techniques for using integer expressions to record movement on a number line to using expressions to represent movement on the coordinate graph. Students will also practice identifying whether a shape has been translated, rotated, or reflected. (8.G.1a, 8.G.1b, 8.G.1c, 8.G.2, 8.G.3, 8.G.4)
4. **Students will practice performing and identifying each type of transformation (translation, rotation, or reflection) in order to move shapes on a coordinate grid to create a unique drawing.** (8.G.3)
5. Students will be introduced to the concept of dilation. (8.G.3)
6. Students will develop an understanding of how dilations by different numbers result in changes in shapes. They will also compare shapes to determine similarity. (8.G.3, 8.G.4)
7. Students will develop an understanding of congruence and how it relates to similarity and use shapes to explore different scale factors. (8.G.1a, 8.G.1b, 8.G.1c, 8.G.2, 8.G.4)
8. Students will use sequences of transformations to show that two figures are similar or congruent. (8.G.2, 8.G.4)
9. Students will continue to develop their understanding of ratio and similarity. They will identify actions that enlarge and reduce shapes, and use scale factors to find unknown side lengths. (8.G.4)
10. Students will recognize that equivalent fractions can be used to find missing parts of similar figures. (8.G.4)

**Unit 7 Slope and Association (11 Days)**

**Description:** In this chapter students will create scatterplots that show the relationship between two variables. They will also be able to identify associations between sets of data and represent the relationship with a trend line. Students will also be able to measure the steepness of a line by using slope. Students will also be able to find the slope of a line given its equations, its graph, or any two points on the line. Finally students will be able to find the equation of a trend line fit linear data.

**Standards**

1. Students will learn to construct and interpret circle graphs using central angles and percents.
2. Students will create scatterplots and identify whether there is a relationship between two sets of data. Students will draw a line of best fit and use it to make predictions. (8.SP.1)
3. Students will continue to develop their understanding of different associations and will consider the direction of an association. Students will create and use scatterplots to make predictions, if possible, and identify when it is not possible to make predictions. (8.SP.1, 8.SP.2)
4. Students will review and strengthen their knowledge of *y = mx + b* and the relations of linear graphs and their equations. Students will also remember that for data to be linear, the data must have constant growth and that for a point to lie on the graph, it must make the equation true. (8.EE.6, 8.F.3)
5. Students will learn to describe the rate of change of a line (slope) numerically, as the ratio between the vertical change and horizontal change. (8.EE.6)
6. Students will identify slopes from graphs, and will recognize the effect of scaling on the steepness of a line. (8.EE.6)
7. Students will connect negative slope with decreasing rates of change and a slope of zero with no change. Students will also use slope to describe the average rate when the rate is not constant. (8.EE.6)
8. Students will write equations representing proportional relationships and connect the constant of proportionality to the slope of a graph to the unit rate. (8.EE.5, 8.EE.6)
9. Students will use their understanding of *y = mx + b* to write the equation for a line of best fit to represent scattered data that is roughly linear by calculating the slope from two points. Students will use this equation and a graph to make and justify predictions. Students will interpret the slope and *y*‑intercept of a best fit line in context. (8.SP.3)
10. Students will continue to write the equation for a line of best fit to represent scattered data that is roughly linear. Students will be able to fully describe an association between two numerical variables using form, direction, strength, and outliers. (8.SP.2, 8.SP.3)
11. Students will informally look for and describe associations between two *categorical* variables in two-way tables. They will develop understanding that association can be seen in table rows or in table columns. (8.SP.4)

**Unit 8 Exponents and Functions (11 days)**

**Description:** In this unit students will learn how to calculate compound interest. Students will also learn how to determine whether a relationship grows linearly or exponentially. They will rewrite expressions using exponents and scientific notation. Finally students will determine is a relation is a function by looking at its table or graph.

**Standards**

1. Students will learn to recognize linear and non-linear situations from tables and graphs. (8.F.3)
2. Students will calculate compound interest over different periods of time. Students will recognize that compound interest is an example of multiplicative growth that is represented by a curve on a graph and with an exponent in an equation. (8.EE.1)
3. Students will compare simple and compound interest, and will identify each kind of interest in multiple representations. (8.EE.1)
4. Students will simplify expressions written with positive exponents and will build understanding of writing numbers greater than one in scientific notation. (8.EE.1, 8,EE.3)
5. Students will continue to develop methods for simplifying expressions with positive exponents, and will be able to recognize the difference between raising a single number to a power and raising a grouped quantity to a power. (8.EE.1)
6. Students will continue to develop methods for simplifying expressions with positive exponents, and will learn what negative and zero exponents represent. (8.EE.1)
7. Students will compare and perform computations with numbers written in scientific notation, connecting this to their work with simplifying exponent expressions. They will perform these calculations with and without a calculator. (8.EE.4)
8. Students will determine which relationships are functions and which are not, using both a graph and a table. They will practice identifying and describing functions. (8.F.1, 8.F.3, 8.F.5)

**Unit 9 Angles and the Pythagorean Theorem (14 Days)**

**Description:** In this unit students will learn how to find the measurements of missing angles made by a line that intersects parallel lines. They will also be able to find unknown angles inside and outsides of triangles. Students will be able to determine if two triangles are similar by looking at their angles. Students will also be able to find missing side lengths of right triangles by using the Pythagorean Theorem. They will be able to find the square root of a number and identify irrational numbers. Finally students will be able to convert terminating and repeating decimals into fractions.

**Standards**

1. Students will establish facts about angles formed when parallel lines are cut by a transversal. (8.G.5)
2. Students will learn that the sum of the angles in any triangle is 180°. (8.G.5)
3. Students will learn that the exterior angle of a triangle is equal to the sum of the two remote angles. (8.G.5)
4. Students will investigate the AA criterion for similar triangles. (8.G.5)
5. Students will compare the side lengths of squares to see what combinations of side lengths will make triangles. They will focus on those that make triangles to identify patterns in the combinations that make right, acute, and obtuse triangles. (8.G.1a)
6. **Students will identify the relationship between side lengths of a right triangle as the Pythagorean Theorem and apply that relationship to solve problems.** (8.G.6, 8.G.7)
7. Students will understand the definitions of square root and irrational number. Students will find values of square roots by estimation, by using a calculator, and by using a graph. (8.EE.2, 8.G.6)
8. Students will distinguish rational numbers from irrational numbers. They will convert terminating and repeating decimals to fractions. They will also use rational approximations of irrational numbers to compare the size of irrational numbers and locate them on a number line. (8.NS.1, 8.NS.2, 8.EE.2)
9. Students will apply the Pythagorean Theorem to problems in a variety of two-dimensional, real-world contexts. (8.G.7, 8.G.8)
10. Students will use the Pythagorean Theorem to determine unknown lengths in real-world, three-dimensional problems. (8.G.7)
11. Students will explain a proof of the Pythagorean Theorem and its converse. (8.G.6)

**Unit 10 Surface Area and Volume (12 Days)**

**Description:** In this unit students will be able to find the cube root of a number. Students will also be able to find the surface areas of cylinders and pyramids. Finally students will be able to find the volumes of non-rectangular shapes, including cylinders, pyramids, cones, and spheres.

**Standards**

1. Students will use their knowledge of how to find the volume of a cube given a side length and to find the side length when given the volume. (8.EE.2)
2. Students will find the surface area and volume of a cylinder and a rectangular prism, comparing the process and resulting volumes. (8.G.9)
3. Students will demonstrate that the volume of a cylinder is three times the volume of a cone with the same height and base, and will demonstrate that the volume of a prism is three times the volume of a pyramid with the same height and base. (8.G.9)
4. Students will find the volume of a sphere and generalize the formula. Students will also solve problems involving three-dimensional solids in real-world contexts. (8.G.9)
5. Students will apply their knowledge of volume to create a cone with a maximum volume. (8.G.9)