

**Mathematics Standards**

**Algebra**

**Course Overview:** In this course students will apply their current mathematical knowledge to solve problems. This course will involve representation of both numbers and letters and we will learn to simplify algebraic expressions and solve algebraic equations while relating this information to real world problems.

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

**Unit 1 Functions (10 Days)**

**Description:** In this unit, students will explore nonlinear functions and learn how to describe a function completely. They will see the shapes and behaviors of several different nonlinear functions. This chapter also introduces students to sharing their mathematical knowledge with a study team as they work together to solve problems.

**Standards**

1. Students will be reminded of the multiple representations of a linear function as they form study teams for the chapter. Students will be challenged to work together as a team as they consider the output of various composite relations. (F-IF.1, F-IF.2)
2. Students will collect and analyze data with tables and graphs. Students will be introduced to contexts that result in proportional, inversely proportional, and exponential data. (F-IF.7a, F-IF.7e)
3. Students will describe a parabola, using its intercepts, minima, maxima, vertex, symmetry, and whether it is positively or negatively oriented. (A-REI.10, F-IF.4, F-IF.7a)
4. Students will write summary statements describing the graph of square roots. They will generate a list of questions that will facilitate future relation investigations. (A-REI.10, F-IF.4, F-IF.7b)
5. Students will graph and describe cube root and absolute value relations. (A-REI.10, F-IF.7b)
6. Students will understand the input/output nature of relations and will begin to understand the possible limitations for the domain and range. (F-IF.1, F-IF.2)
7. Students will determine which relations are functions and which are not, using both graphs and tables. (F-IF.1, F-IF.2, F-IF.5)
8. Students will be able to describe the domain and range of a relation by examining an equation or graph. (F-IF.1, F-IF.2, F-IF.5)

**Unit 2 Linear Relationships (10 Days)**

**Description:** In this chapter students will focus on the starting value and growth of linear functions. They will look for connections between the multiple representations of linear functions: table, graph, equation, and situation. In this chapter, students will come to a deeper understanding of slope than they may have had in previous courses, and they will explore the idea of slope as a rate of change.

**Standards**

1. Students will write linear algebraic equations relating the figure number of a geometric pattern and its number of tiles. They will identify connections between the growth of a pattern, its starting value, and its linear equation. (F-IF.7a, F-LE.1a, F-LE.2, F-LE.5)
2. Students will gain an abstract understanding of slope as they discover that slope is the change in *y* (referred to as Δ*y*) divided by the change in *x*(referred to as Δ*x* ) between any two points on a line. They will continue to connect growth and starting value to multiple representations of a linear function. (F-IF.6, F-IF.7a, F-LE.1a, F-LE.2, F-LE.5)
3. Students will use slope triangles both to compare the relative steepness of lines and to build intuition about positive, negative, and zero slopes. (F-IF.4, F-IF.6, F-IF.7a, F-LE.1a, F-LE.5)
4. Students will formalize *y* = *mx + b* form and will explore what information is needed to determine a line. They will continue to write equations of lines given various pieces of information about the slope and *y*-intercept. They will develop an algorithm for finding the slope of a line through two points without graphing. Finally, students will investigate the slope of vertical lines. (A-SSE.1a, A-SS3.1b, A-REI.10, F-IF.4, F-IF.6, F-IF.7a, F-BF.1a, F-LE.1a, F-LE.5)
5. Students will apply their knowledge of finding the equation of the line from a graph to a motion problem by “walking the walk” of a graph with a given equation. Students will begin to connect slope with rate. (A-CED.2, F-IF.4, F-IF.7a, F-BF.1a, F-LE.1b, F-LE.2, F-LE.5)
6. Students will understand speed as a rate. Students will apply contextual meaning to *m* and *b*. (N-Q.1, N-Q.2, A-CED.2, F-IF.4, F-IF,6, F-IF.7a, F-IF.7b, F-IF.9, F-BF.1a, F-LE.1b, F-LE.2, F-LE.5)
7. **Students will practice finding slopes and writing linear equations while solving a challenging team puzzle.** (N-Q.2, A-CED.2, F-IF.4, F-IF.6, F-IF.7a, F-BF.1a, F-LE.1b, F-LE.2, F-LE.5)
8. Students will employ multiple methods to find the *y*-intercept of a line given its slope and one point on it. They will learn how to solve for the *y*-intercept to find the equation of a line algebraically. ( N-Q.2, A-CED.2, F-IF.4, F-IF.6, F-IF.7a, F-BF.1a, F-LE.1b, F-LE.2, F-LE.5)
9. Students will use their knowledge of *y* = *mx* + *b* to find the equations of lines from two points on a table or graph. (A-REI.10, F-IF.7a, F-BF.1a, F-LE.2)

**Unit 3 Simplifying and Solving (11 Days)**

**Description:** In this chapter you will focus on multiplying expressions. You will also solve equations that contain products. While these new ideas will be introduced using algebra tiles, you will also develop a method to multiply expressions without using tiles.

**Standards**

1. Students will expand exponential expressions into repeated multiplication in order to simplify them. They will also discover shortcuts that will later be formalized into the laws of exponents. (A-SSE.3c)
2. Students will formalize the laws of exponents and will use them to deduce the meaning of *x*0 and *x*−1. (A-SSE.3c)
3. Students will use algebra tiles to make another equation ↔ situation connections. Algebra tiles are a way to represent an equation physically and visually. The objective of this lesson is for students to become comfortable with the physical representation of equations (algebra tiles). (A-REI.1, A-REI.3)
4. Students will identify dimensions of rectangles formed with algebra tiles (identify factors of quadratics). They will write the area of composite rectangles as a sum and as a product. (A-SSE.3a)
5. Students will multiply polynomial expressions using algebra tiles. Students will use the Distributive Property with polynomial expressions. (A-APR.1)
6. Students will continue to practice multiplying expressions and will begin to use generic rectangles to simplify the process. Students will find missing dimensions of generic rectangles given pieces of area and will find missing pieces of area given dimensions. (A-APR.1)
7. Students will solve linear equations that involve multiplication. Students will solve problems that involve absolute value. (A-REI.1, A-REI.3)
8. Students will solve multi-variable equations for one of the variable. (A-SSE.1a, A-APR.1, A-CED.4, A-REI.3)
9. **Students will solve single- and multi-variable linear equations**. (A-CED.4, A-REI.3)

**Unit 4 Systems of Equations (11 Days)**

**Description:** In this unit, students will learn how to solve word problems by writing a pair of equations, called a system of equations. Then they will solve the system of equations with the same multiple representations you used for solving linear equations: table, graph, and by manipulating the equations. Along the way, they will develop ways to solve different forms of systems, and will learn how to recognize when one method may be more efficient than another. By the end of this chapter, students will know multiple ways to find the point of intersection of two lines and will be able to solve systems that arise from different situations.

**Standards**

1. Students will define variables and write equations to solve word problems. They will review the connections between a graph, table, and the equations of a system of equations and how to write equations to solve word problems. They will solve a simple system of equations. (N-Q.2, A-SSE.1b, A-CED.1, A-CED.3, A-REI.6, F-LE.1b)
2. Students will continue to learn how to write equations from word problems. Students will solve a system of equations by rewriting one of the equations so that they can use the Equal Values Method. (N-Q.2, A-CED.1, A-CED.2, A-CED.3, A-REI.6)
3. Students will understand how to use substitution to solve systems of linear equations. Students will also recognize the benefits of using substitution in certain situations. (A-CED.3, A-REI.6)
4. Students will examine how a solution to a system of equations relates to those equations and to a graph of those equations. (N-Q.2, A-CED.3, A-REI.5, A-REI.6, A-REI.10)
5. Students will develop the Elimination Method for solving systems of equations. (A-CED.3, A-REI.5, A-REI.6)
6. Students will study more complex applications of the Elimination Method. Students will learn that multiplying both sides of an equation by a constant can create an equivalent equation. Furthermore, students will understand that different approaches to setting up an elimination problem yield the same result. (A-CED.3, A-REI.5, A-REI.6)
7. Students will review each strategy for solving systems of linear equations and choose the best strategy. Students will learn that all methods should produce the same result but that some methods are more efficient based on the form of the system given. (A-CED.3, A-REI.5, A-REI.6)
8. Students continue to make connections between solving equations, graphing, manipulating expressions, and problem solving. (N-Q.1, A-CED.2)

**Unit 5 Sequences (12 Days)**

**Description:** In this unit students will review and strengthen their algebra skills while they learn about arithmetic and geometric sequences. Early in the chapter, students will find themselves using familiar strategies such as looking for patterns and making tables to write algebraic equations describing sequences of numbers. Later in the chapter, they will develop shortcuts for writing equations for certain kinds of sequences.

**Standards**

1. Students will represent exponential growth with a diagram, table, and graph. Students will write descriptions of exponential growth based on the patterns in their tables, recognize patterns of exponential growth, and use their descriptions to make predictions. (N-Q.2, F-LE.1c)
2. Students will generate data and model the data collected with tables, equations, and graphs. They will calculate the rebound ratio when a ball bounces. The function is linear. (F-IF.7e, F-LE.1c)
3. Students will be introduced to an example of exponential decay and compare it to the linear function from the previous lesson. F-IF.7e, F-LE.1c)
4. Students will be introduced to sequences and will sort them into groups based on patterns in their representations. They will identify sequences generated by adding a constant as arithmetic, and those generated by multiplying by a constant as geometric*.* (F-BF.2, F-LE.2)
5. Students will learn the vocabulary and notation for arithmetic sequences as they develop formulas for the *n*th term. (F-IF.3, F-BF.2, F-LE.2)
6. Students will write sequences from recursive equations. They will write recursive equations for arithmetic sequences, and convert between explicit and recursive equations for arithmetic sequences. (F-IF.3, F-BF.2, F-LE.2)
7. Students will look at and compare patterns of growth in linear and exponential tables. (F-IF.6, F-LE.1a, F-LE.3)
8. **Students will find equations for geometric sequences and see relationships between geometric sequences and exponential functions. Students will use geometric sequences to solve problems involving percent increase and decrease.** (A-SSE.4, F-IF.6, F-LE.1c, F-LE.2)
9. Students will recognize that all sequences are functions with domains limited to positive integers. Students will use graphical methods to solve exponential equations. (F-IF.3)

**Unit 6 Modeling Two-Variable Data (12 Days)**

**Description:** In this unit students will be describing a dependent relationship, called the association, between two numerical variables. They will use scatterplots of data to create lines and curves that model the data and then use those models to make predictions. Students will mathematically describe the form, direction, strength, and outliers of an association.

**Standards**

1. Students will review drawing a line of best fit by hand. They will make predictions based on their linear model and will interpret slope and *y*‑intercept in context. (N-Q.1, S-ID.6a, S-ID.6c, S-ID.7)
2. Students will learn how to calculate, interpret, and graphically represent a residual. Students will learn that extrapolation with a statistical model can lead to nonsensical results. They will interpret slope and *y*-intercept in context. (N-Q.1, S-ID.6a, S-ID.6c)
3. Students will graphically determine an upper and lower bound on the prediction they make from a linear best-fit model. (N-Q.1, N-Q.3, S-ID.6a, S-ID.6c)
4. Students will find the least squares regression line (LSRL) using their calculators and understand that it is the line that minimizes the sum of the squares of the residuals. (N-Q.1, S-ID.6a, S-ID.6C)
5. Students will observe the impact of an outlier on the LSRL. Students will determine if a linear model is a good fit for the data by creating and visually analyzing residual plots. (N-Q.1, S-ID.6a, S-ID.6b)
6. Students will calculate the correlation coefficient and observe the scatter for various extremes of *r*. Students will also describe an association between two variables in more mathematical terms. (N-Q.1, S-ID.6a, S-ID.8)
7. Students will understand that cause and effect cannot be determined from a study that reports an association. (N-Q.1, S-ID.6a, S-ID.9)
8. Students will interpret the correlation coefficient squared in context. (N-Q.1, S-ID.6a, S-ID.8)
9. Students will fit a non-linear model to data that shows a curved trend. (N-Q.1, S-ID.6a)

**Unit 7 Exponential Functions (11 Days)**

**Description:** In this unit students will learn more about the family of exponential functions. They will also build more advanced algebra skills, such as solving for an indicated variable, simplifying or rewriting exponential expressions, working with fractional exponents, and finding the exponential function that passes exactly through any pair of given points. Students will learn about several important applications of exponential functions.

**Standards**

1. Students will investigate the family of functions *y* = *bx*. They will make and justify statements about the behaviors of graphs in this family. (F-IF.4, F-IF.7e)
2. Students will deepen and extend their understanding of exponential functions by examining the multiplier (“*b*”) and starting point (“*a*”) in different representations. Students will generalize the roles of *a* and *b* for the equation *y* = *a* · *bx*. (A‑CED.1, A‑CED.2, F‑IF.6, F‑IF.7e, F‑IF.8b, F‑LE.1a, F‑LE.1c, F‑LE.2,F‑LE.5)
3. Students will use what they know about linear and exponential functions to investigate the relationship between simple and compound interest. (A‑SSE.1b, A‑CED.1, A‑CED.2, F‑IF.6, F‑IF.7b, F‑IF.7e, F‑IF.8b,F‑LE.1a, F‑LE.1c, F‑LE.2, F‑LE.5)
4. Students will represent exponential decay in multiple ways and will further investigate the effect when the exponent is 0 or negative. (A‑SSE.3c, A‑CED.1, A‑CED.2, F‑IF.7e, F‑IF.8b, F‑LE.1c, F‑LE.2, F‑LE.5)
5. Students will use what they know about exponential growth to write equations for exponential functions presented as graphs. (A‑CED.1, A‑CED.2, F‑IF.4, F‑IF.5, F‑IF.7b, F‑IF.7e, F‑IF.8b, F‑LE.1c,F‑LE.2, F‑LE.5
6. Students will complete the exponential multiple representations web, solidifying connections between the table, equation, graph, and situations representations of an exponential function. (N‑Q.1, N‑Q.2, A‑CED.1, A‑CED.2, F‑IF.4, F‑IF.5, F‑IF.7e, F‑IF.8b,F‑IF.9, F‑LE.1c, F‑LE.2, F‑LE.5)
7. Students will find equations of linear and exponential functions by using known quantities to solve for a missing parameter. Students will interpret fractional exponents. (A-APR.4, N‑RN.1, N‑RN.2, F‑IF.5, F‑IF.7e, F‑BF.1a, F‑LE.2)
8. Students will find linear functions and exponential equations of the form *y* =*abx* given two points. (A‑REI.10, F‑IF.7e, F‑BF.1a, F‑LE.2
9. Students will write and graphically solve a system of exponential functions in the context of investigating used-car prices. (N-Q.2, F-IF.7e, F-BF.1a, F-LE.1c)

**Unit 8 Quadratic Functions- 10 Days**

**Description:** In this unit, a quadratics web will challenge students to find connections between the different representations of a quadratic function. Through this endeavor, they will learn how to rewrite quadratic equations in several forms, and how to use their graphing calculator to assist them.

**Standards**

1. Students will review how to build rectangles with tiles and learn shortcuts for finding the dimensions of a completed generic rectangle. Students will discover that the products of the terms in each diagonal of a generic rectangle are equal. (A-SSE.3a)
2. Students will develop an algorithm to factor quadratic expressions without algebra tiles. (A-SSE.3a)
3. Students will continue to practice their factoring skills while learning about special cases: quadratic expressions with missing terms, quadratics that are not in standard form, and quadratics with more than one possible factored form. (A-SSE.3a)
4. Students will complete their focus on factoring by considering expressions that can be factored first with a common factor and then again using the quadratic factoring method. (A-SSE.2, A-SSE.3a)
5. Students will learn a quick way to factor perfect square trinomials and quadratics that are a difference of squares. (A-SSE.2, A-SSE.3a)
6. Students will identify connections between different representations of quadratics: an equation, a table, a situation, and a graph. Students will also connect the intercepts and vertex of a parabola to a situation. (N‑Q.1, A‑SSE.3a, A‑CED.2, F‑IF.4, F‑IF.5, F‑IF.7a, F‑IF.8a,F‑IF.9, F‑BF.1a)
7. Students will learn that they can sketch the graph of a quadratic rule quickly, using its intercepts. Students will also learn how to find the *x‑*intercepts of a parabola by factoring the corresponding quadratic equation and applying the Zero Product Property. (A‑SSE.3a, A-APR.3, A‑CED.2, A‑REI.4b, F‑IF.8a, F‑BF.1a)
8. Students will use graphing calculators and the graphing form of a quadratic equation to find the *x-*intercepts and vertex of a parabola. Students will use square roots to solve an equation. (A‑SSE.3a, A‑CED.2, A‑REI.4b, F‑IF.4, F‑IF.7a, F‑IF.8a, F‑BF.1a)
9. Students will practice moving from a table, graph, or situation, to a quadratic rule. (A-SSE.3a, A-CED.2, F-IF.4, F-IF.7a, F-IF.8a, F-IF.9, F-BF.1a)
10. Students will learn how to convert the equation of a parabola into graphing form by completing the square. (A‑SSE.1b, A‑SSE.3b, A‑REI.4a, F‑IF.7a, F‑IF.8a)

**Unit 9 Solving Quadratics and Inequalities- 11 Days**

**Description:** Students will extend their ability to solve quadratic equations, and deciding which method of solving is most efficient. So far in this course students have focused on what you can determine when two expressions are equal. By using what they know about balancing equations, students can now solve linear and quadratic equations for a given variable. Students will learn how to deal with these types of relationships, called inequalities. They will develop ways to represent solutions to inequalities both algebraically and graphically. In addition, students will extend their ability to work with mathematical sentences by learning how to write inequalities that describe situations.

**Standards**

1. Students will expand their skills using the Zero Product Property to solve quadratic equations. They will develop the method of completing the square to solve equations. (A-SSE.3b, A-APR.2, A-REI.2, A-REI.4a, A-REI.4b)
2. Students will learn how to use the Quadratic Formula to solve quadratic equations. (A-REI.4a, A-REI.4b)
3. Students will continue to solve quadratic equations, including some that are not in standard form, and some that have only one solution or no real solutions. (A‑CED.1, A‑CED.2, A‑REI.4a, A‑REI.4b, F‑IF.8a)
4. Students will practice using the Zero Product Property, completing the square, and the Quadratic Formula, by deciding which method is best to try first for different types of equations. They will also be reminded that creating graphs and tables can help them estimate a solution or verify an algebraic one. (A‑CED.1, A‑CED.2, A‑REI.4a, A‑REI.4b, F‑IF.8a)
5. Students will learn how to solve linear inequalities with one variable and how to represent the solutions on a number line. (A-CED.1, A-REI.3)
6. Students will continue to develop their ability to solve linear, one-variable inequalities by finding a boundary point and testing a value in the inequality. Students will use an inequality to solve a word problem. (N-Q.2, A-CED.1, A-REI.3)
7. Students will learn how to graph linear inequalities with two variables. (A-CED.3, A-REI.10, A-REI.12)
8. Students will continue to learn how to graph linear and non-linear inequalities that contain two variables. Students will also use the graph of a two-variable, linear inequality to solve a word problem. (N-Q.2, A-CED.3, A-REI.12)
9. Students will continue to develop their ability to graph two-variable inequalities as they learn how to graph constraints using systems of inequalities. (A-CED.3, A-REI.12)
10. Students will continue to learn how to graph systems of inequalities and will apply this understanding to solve problems. (N-Q.2, A-CED.3, A-REI.12)
11. Students will practice writing inequalities from a word problem. Students will use a system of inequalities to create a graph of a feasible region and then will analyze different scenarios based on the feasible region. (N-Q.2, A-CED.3, A-REI.12)

**Unit 10 Solving Complex Equations- 12 Days**

**Description:** In this unit students will extend their solving skills to include other types of equations, including equations with square roots, absolute values, variables in exponents, and messy fractions. Then they will learn how to determine the number of possible solutions for an equation without actually solving them. Students will also consider “imaginary” solutions to quadratic equations. This unit also focuses on intersections of functions. Students will learn how to use the intersection of the graphs of two functions to find the solution to an equation. Then they will solve quadratic and absolute value inequalities. Before all that, students will start this chapter by determining if there is an association between two categorical variables that are represented on a two-way table.

**Standards**

1. Students will calculate probabilities and determine association from data arranged in two-way tables. Students will create relative frequency tables. (S-ID.5)
2. Students will learn how to solve complicated equations (ones with large numbers, fractions, or decimals) and simple exponential equations by rewriting and solving a simpler equivalent equation. (A-SSE.3c, A-APR.6, A-REI.2, A-REI.3)
3. Students will continue to learn how to solve complicated linear and quadratic equations that involve fractions by rewriting and solving an equivalent equation. (A-REI.1, A-REI.3)
4. Students will learn multiple methods for solving single-variable equations involving exponents and square roots. (A-SSE.1b, A-REI.1)
5. Students will learn how to determine the number of solutions to an absolute value equation or a quadratic written in perfect square form. Students will also learn how to express their solutions in exact and approximate forms. (A-REI.4b)
6. Students will learn how to derive the Quadratic Formula by completing the square. Students will be introduced to imaginary numbers as solutions to quadratic equations. They will look at where imaginary numbers fall in the overall number system. (N-RN.3, A-REI.4a, A-REI.4b)
7. Students will practice solving various equations using the methods from Lesson 10.2.3 and will gain confidence in how to select the best method. Students will also be introduced to quadratic inequalities through a context. (A‑SSE.1b, A‑REI.1, A‑REI.3, , A‑REI.4b)
8. Students will learn how to distinguish between intercepts and intersections and will learn how to solve systems of equations when one or both equations is/are not linear. They will then use intersections of functions to find solutions to the related single-variable equations. (A-REI.7, A-REI.11)
9. Students will strengthen their quadratic-solving skills while investigating the possible ways two parabolas or a line and a parabola can intersect. Students will also learn that using an algebraic method to find points of intersection is more reliable than graphing the system. (A-REI.7, A-REI.11)
10. Students will learn how to solve complicated single-variable inequalities, including those with absolute values and those with squared terms. (A-REI.3)

**Unit 11 Functions and Data- 15 Days**

**Description:** Students will start this chapter by looking at how they can change functions and then how they can “undo” functions. Then they will model a golf game and compare their results with other teams. Students will review the ways to graphically show data, and decide whether to use scatterplots or two histograms to compare two variables. They will use statistics to compare two sets of data: center, shape, spread and outliers. Finally, students will learn a new way to describe the variability (the spread) in data called the standard deviation. The course ends with some challenging investigations in which students will draw upon some of the mathematics they have learned this year in order to solve the problems.

**Standards**

1. Students will add or multiply by a constant to transform linear, quadratic, and exponential functions. (F-IF.1, F-IF.7a, F-BF.1b, F0BF.3)
2. Students will “undo” functions to find the inverse function. (F-BF.4a)
3. Students will review the differences between graphical representations of single-variable data. (S-ID.1, S-ID.3)
4. Students will compare the center, shape, spread, and outliers of two collections of numerical data. (S-ID.1, S-ID.2, S-ID.3)
5. Students will find and interpret standard deviation. (S-ID.1, S-ID.2, S-ID.3)
6. Students will collect and analyze data. They will find the equation of a least squares regression line, describe the association, verify the residual plot, create upper and lower boundary lines, and use the statistics to make a prediction. (S-ID.6a, S-ID.6b, S-ID.6c, S-ID.7, S-ID.8)
7. Students will review their knowledge of relations, including domain, range, functions, intercepts, and symmetry. (F-IF.5)
8. Students will connect their understanding of functions, inequalities, and solving equations to analyze a complicated inequality. (F-IF.5)
9. Students will use multiple representations to maximize a set of quadratic data. They will interpret algebraic and graphical results. (N-Q.2, N-Q.3, A-SSE.3a, A-CED.1, A-CED.3, F-IF.4)
10. Students will write and solve exponential functions. They will solve a linear programming problem. (N-Q.2, N-Q.3, A-CED.1, A-CED.3, F-IF.4, F-IF.7e, F-IF.8b, F-LE.1a, F-LE.1c, F-LE.2, F-LE.5)