



Course Overview

Concept(s)	Big Ideas / Enduring Understanding(s)
Problem Solver	- Develops questions to analyze a path to find solutions. - Repeatedly uses evidence to establish a position, evaluate their process and modify their plan.
Innovation/Creativity	- Is confident enough to take risks and inspire others. - Uses creative approaches to explore, design, and communicate innovative solutions while being receptive to feedback and are open minded to new ideas.
Collaborative Learner	- Works with others to challenge ideas, make connections, and reach a common goal. - Takes opportunities to lead, but also understand when to be a contributor to a common goal/outcome.
Respect a Range of Perspectives	Engages in respectful, informed discourse about a variety of topics.
Growth Mindset	- Embrace learning with a positive approach and as a continuous process - Approach failures with grit and the knowledge that they provide opportunities to persevere and overcome challenges
Self Advocate	- Aware of their needs and communicates areas of strengths as well as areas for growth, and - Understands how and why to take action to ensure that their needs are met.
Solving Equations & Inequalities	- Inverse operations are an integral part of solving equations and inequalities. - Functions and number operations play fundamental roles in helping us to make sense of various situations.

● Solving Systems of Equations & Inequalities	● There are real world situations that can be modeled using two or more equations. ● There are a variety of factors to consider when solving systems of equations. ● There are a variety of solutions to systems of equations ranging from no solution to infinite solutions.
● Graphs & Equations of Functions	● Algebraic models and graphical representations are tools that can help us make meaningful connections to solve real-world situations. ● Functions are used to model mathematical relationships between two quantities. ● The relationship between the variables in a function determines the function type. ● The parent function is the simplest form of a function. ● Graphs of functions can be altered by including numbers in certain parts of their equations.
● Factoring	● Factors are a subset of a product and with the distributive property allow options in solving polynomials. ● Multiplying and factoring polynomials are related. ● Solving polynomials involves the reversal of operations, the distributive property and rules of exponents. ● There are a variety of strategies to consider when finding the roots of quadratic equations.

At a Glance

Unit Titles	Length of Unit
Linear Relationships	4 Weeks
Solving Linear Equations and Inequalities	5 Weeks
Systems of Linear Equations and Inequalities	4 Weeks
Functions	4 Weeks
Working with Nonlinear Functions	4 Weeks
Quadratic Functions	5 Weeks
Exponential Functions	4 Weeks

Unit 1	Linear Relationships	Length of Unit	4 weeks
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Essential Questions	● If there is a pattern relating two variables, is it strong enough to allow me to make predictions? ● What kind of equation will express a relationship? ● How can I use an equation to answer questions about a relationship?
Standards	● 8.EE.B.5 - Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. ● 8.F.B.4 - 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. ● 8.F.A.3 - 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. ● HSA-CED.A.2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ● HSA-REI.D.10 - Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). ● HSF-LE.A.1 - Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. ● HSF-LE.A.2 - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs. ● HSF-LE.B.5 - Interpret the parameters in a linear or exponential function in terms of a context.
Key Vocabulary	❖ Slope ❖ Rate of Change ❖ Linear Relationship ❖ Slope-Intercept Form ❖ Horizontal Line ❖ Vertical Line ❖ x-Intercept ❖ y-intercept

❖ Standard Form of a Line

<i>Students will KNOW...</i>	<i>Students will be able to (DO)...</i>
The set of all points satisfying a linear relationship form a line.	● Interpret a slope as the change in the output per unit of input. ● Interpret the coefficients of a linear equation written in slope-intercept form. ● Write equations that model linear relationships.
The standard form of a line represents possible combinations of x and y to reach a fixed sum.	● Find and interpret x- and y-intercepts of lines given in standard form. ● Identify the slope and y-intercept of lines given in standard form.

Evidence of Learning:	Within this unit, student understanding will be determined using a learning continuum through ... ● Entrance/Exit Tickets ● Quizzes ● Self-Assessments ● Teacher Observations ● End of Unit Assessment
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Unit 2	Solving Linear Equations and Inequalities	Length of Unit	6 Weeks
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Essential Questions	● How can we use expressions, equations, and inequalities to model and solve real-world problems?
Standards	● 7.EE.B.4 - Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. ● HSA-REI.A.1 - Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. ● HSA-CED.A.1 - Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. ● HSA-SSE.A.1 - Interpret expressions that represent a quantity in terms of its context.

	● HSA-REI.B.3 - Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. ● HSA-CED.A.3 - Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
Key Vocabulary	❖ Solution ❖ Inverse Operations ❖ Inequality ❖ Compound Inequality

<i>Students will KNOW...</i>	<i>Students will be able to (DO)...</i>
An equation can be written in many equivalent ways that have the same solution.	● Use properties of equality to write equivalent equations. ● Use inverse operations to undo the original operations in reverse order to isolate the variable.
The solutions to an inequality are the range of values that make the inequality true.	● Solve inequalities by extending strategies related to solving equations. ● Represent solutions to an inequality using a ray on the number line. ● Write and solve inequalities to represent the constraints and solutions to a problem.

Evidence of Learning:	Within this unit, student understanding will be determined using a learning continuum through . . . ● Entrance/Exit Tickets ● Quizzes ● Self-Assessments ● Teacher Observations ● End of Unit Assessment
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Unit 3	Systems of Linear Equations and Inequalities	Length of Unit	6 Weeks
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Essential Questions	● What are the advantages and disadvantages of solving systems of linear equations graphically vs algebraically?
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	• What types of relationships can be modeled by systems of linear graphs? • How can we use expressions, equations, and inequalities to model and solve real-world problems?
Standards	• 8.EE.C.8 - Analyze and solve pairs of simultaneous linear equations. a Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. • HSA-CED.A.3 - Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. • HSA-REI.C.6 - Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. • HSA-REI.D.10 - Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). • HSA-REI.C.5 - Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. • HSA-REI.D.12 - Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
Key Vocabulary	❖ System of Linear Equations ❖ Solution to a System ❖ Substitution ❖ Elimination ❖ System of Inequalities

<i>Students will KNOW...</i>	<i>Students will be able to (DO)...</i>
A solution to an equation is any ordered pair on its graph and the solution to a system of equations is the ordered pair that lies on the graphs of both equations.	1. Solve for a break-even or equilibrium point by setting two linear expressions in slope-intercept form equal to one another or graphing. 2. Interpret the graph of a linear system before, at, and after the intersection point in context.

	3. Explain what the graph of a linear system looks like with 0, 1 or infinitely many solutions by describing the slopes and y-intercepts of the equations.
Equivalent expressions can be substituted for one another.	1. Use the relationship between variables to rewrite an equation with two variables in terms of one variable and solve the system. 2. Write new equations by adding, subtracting, or scaling the given equations. 3. Identify the algebraic structures that make a system of linear equations have 0, 1, or infinitely many solutions.
The shaded region on a coordinate plane represents all the ordered pairs that satisfy an inequality.	1. Graph an inequality in two variables by graphing the related equation and shading in the appropriate direction. 2. Write and graph inequalities and look for solutions.

Evidence of Learning:	Within this unit, student understanding will be determined using a learning continuum through . . . • Entrance/Exit Tickets • Quizzes • Self-Assessments • Teacher Observations • End of Unit Assessment
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Unit 4	Functions	Length of Unit	4 Weeks
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Essential Questions	• What are the key features of a function and how do these features connect to real world applications?
Standards	• HSF-IF.A.1 - Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. • HSF-IF.A.2 - Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. • HSF-IF.C.9 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). • HSF-IF.B.4 - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

	● HSF-IF.B.5 - Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ● HSF-IF.A.3 - Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. ● HSF-LE.A.2 - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ● HSF-IF.C.7 - Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ● HSF-IF.B.6 - Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
Key Vocabulary	❖ Functions ❖ Function Notation ❖ Input/Domain ❖ Output/Range ❖ Relation ❖ Vertical Line Test ❖ Maximum ❖ Minimum ❖ Interval ❖ Recursive Rule ❖ Piecewise Function

<i>Students will KNOW...</i>	<i>Students will be able to (DO)...</i>
A function from one set (called the domain) to another set (called the range) is a mapping that assigns to each element of the domain exactly one element of the range.	1. Use function notation to describe a function's input and corresponding output. 2. Determine if a relation is a function or not. 3. Evaluate functions and write equations represented as a graph, table, equation or verbal description. 4. Use function notation to write a rule for a sequence.

Piecewise functions have different rules for different intervals of their domain.	1. Evaluate piecewise functions.
The rate of change of a function can be estimated across a specified interval.	1. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.

Evidence of Learning:	Within this unit, student understanding will be determined using a learning continuum through . . . • Entrance/Exit Tickets • Quizzes • Self-Assessments • Teacher Observations • End of Unit Assessment
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Unit 5	Working with Nonlinear Functions	Length of Unit	5 Weeks
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Essential Questions	• How do transformations, translations and reflections affect the parent function? • What are the key features of a function and how do these features connect to real world applications? • How does understanding how to simplify expressions help you solve mathematical problems?
Standards	❖ HSF-LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions: ❖ HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ❖ HSF-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. ❖ HSA-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. ❖ HSN-RN.A.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5(1/3)^3$ to hold, so $(5^{1/3})^3$ must equal 5.

	❖ HSN-RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. ❖ HSA-CED.A.1 Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i> ❖ HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. ❖ 8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $32 \times 3^{-5} = 3^{-3} = 1/33 = 1/27$.
Key Vocabulary	❖ Linear Growth ❖ Nonlinear Growth ❖ Parent Function ❖ Step Function ❖ Absolute Value Function ❖ Vertex ❖ Power Function ❖ Square Root Function ❖ Radicals

<i>Students will KNOW...</i>	<i>Students will be able to (DO)...</i>
A nonlinear function is a function whose graph is not a straight line.	1. Determine if a function exhibits linear or nonlinear growth by identifying whether there is a constant rate of change in tables, graphs, and verbal descriptions. 2. Evaluate, interpret and graph scenarios that can be modeled with step functions, absolute value functions, and power functions. 3. Compare the growth rates of power functions as it relates to the degree of the function.
An absolute value function describes distances between points to the shape and symmetry of their graphs.	1. Solve equations with absolute value functions graphically and algebraically.
Equivalent expressions can be written using properties of exponents.	1. Simplify expressions using exponential properties.

Square roots, cube roots, and nth roots are operations that undo squares, cubes, and nth powers, respectively.	1. Graph the parent function $y = \sqrt{x}$ and describe its key features including domain, range, and intercepts. 2. Solve equations involving roots.
A radical is in simplest form if the radicand has no perfect square factors.	1. Use exponent properties to write equivalent expressions. 2. Simplify radicals.

Evidence of Learning:	Within this unit, student understanding will be determined using a learning continuum through . . . • Entrance/Exit Tickets • Quizzes • Self-Assessments • Teacher Observations • End of Unit Assessment
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Unit 6	Quadratic Functions	Length of Unit	5 Weeks
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Essential Questions	• How do transformations, translations and reflections affect the parent function? • What are the key features of a function and how do these features connect to real world applications? • How can we solve a quadratic equation and what do the solutions mean? • How can the nature of the roots of a quadratic equation be determined from the graph of a quadratic equation? • What characteristics of a polynomial determine how to factor it completely?
Standards	❖ HSF-BF.A.1 Determine an explicit expression, a recursive process, or steps for calculation from a context. ❖ HSF-BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. ❖ HSF-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

	❖ HSF-IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ❖ HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ❖ HSF-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. ❖ HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ❖ HSA-REI.B.4 Solve quadratic equations in one variable.
Key Vocabulary	❖ Quadratic ❖ Second Difference ❖ Axis of Symmetry ❖ Horizontal/Vertical shift ❖ Vertical Stretch ❖ Vertical Shrink ❖ Parabola ❖ Intercept Form ❖ Vertex Form ❖ Factoring ❖ Zeroes/Roots

<i>Students will KNOW...</i>	<i>Students will be able to (DO)...</i>
Quadratic functions are represented by parabolas, which have an axis of symmetry through their vertex.	1. Graph a quadratic function. 2. Use graphs and tables to identify the vertex, intercepts, and other values of a quadratic function.
Each form of a quadratic equation reveals different features of the graph, such as the x-and y-intercepts, the vertex, and the transformations that occurred from the parent function.	1. Use equations to identify the vertex, intercepts, and other values of a quadratic function. 2. Identify the effect of specific transformations (vertical shifts, horizontal shifts, vertical stretches) on the graph of the parent function.

	3. Connect numerical changes in outputs of transformed functions with graphs of transformed functions.
Factoring is a way to rewrite equations so they become more easily solvable.	1. Factor quadratic functions in standard form with GCF and when $a=1$.
The x-intercepts of a parabolic function $y=f(x)$ are the solutions to the equation $f(x) = 0$.	1. Identify x-intercepts/zeros of a quadratic function from standard form using factoring and symmetry.

Evidence of Learning:	Within this unit, student understanding will be determined using a learning continuum through . . . ● Entrance/Exit Tickets ● Quizzes ● Self-Assessments ● Teacher Observations ● End of Unit Assessment
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Unit 7	Exponential Functions	Length of Unit	4 weeks
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Essential Questions	● How do transformations, translations and reflections affect the parent function? ● What are the key features of a function and how do these features connect to real world applications? ● What characterizes exponential growth and decay and how can we identify them in the real world?
Standards	❖ HSF-BF.A.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. ❖ HSF-BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. ❖ HSF-LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

	❖ HSF-LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). ❖ HSF-LE.A.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. ❖ HSF-LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context. ❖ HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ❖ HSF-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
Key Vocabulary	❖ Exponential Growth ❖ Exponential Decay ❖ Initial Value ❖ Horizontal Asymptote ❖ Growth/Decay Factor

<i>Students will KNOW...</i>	<i>Students will be able to (DO)...</i>
Patterns representing repeated multiplication can be described with equations involving exponents.	1. Write explicit rules for geometric sequences using the initial term and the common ratio. 2. Construct exponential functions given a description, table, or graph. 3. Use exponential models to make predictions. 4. Interpret the parameters of an exponential function in terms of its context.
The graph of an exponential function reveals different features, such as the x-and y-intercepts and the transformations that occurred from the parent function.	1. Graph equations of the form $y = b^x$, $y = ab^x$, and $y = b^x + k$ and identify the domain, range, y-intercept, and asymptote. 2. Describe how the parameters in $y = ab^x + k$ affect the y-intercept of the graph, the steepness of the graph, and the horizontal asymptote.

Evidence of Learning:	Within this unit, student understanding will be determined using a learning continuum through . . . ● Entrance/Exit Tickets ● Quizzes ● Self-Assessments ● Teacher Observations ● End of Unit Assessment
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