

Unit 1: Foundations of Algebra

Unit Overview: Students will continue to increase their understanding of constants, variables, coefficients, and exponents to develop and interpret algebraic expressions and equations in both linear and nonlinear contexts, including dimensional analysis and graphical reasoning. They will interpret data and explore the structure of equivalent algebraic expressions in various representations. Students will build algebraic models to represent real-world scenarios and use these models to solve problems in context. (Focus on MP.2, MP.4, MP.8)

Concept 1: Analyze Expressions and Equations

Concept Overview: Students build on their knowledge of constants, variables, and exponents to interpret algebraic expressions and equations in both linear and nonlinear contexts. They explore the structure of equivalent algebraic expressions in various representations. Students build algebraic models to represent real-world scenarios and use these models to solve problems in context.

Unit 1, Concept 1 Standards

- HSN-Q.A.1
- HSN-Q.A.2
- HSA-SSE.A.1a

Concept 2: Reason with Expressions and Equations

Concept Overview: Students focus on their understanding of algebraic expressions and equations in both linear and nonlinear contexts to include dimensional analysis and graphical reasoning. They interpret data and explore the structure of equivalent algebraic expressions in various representations. Students build algebraic models to represent real-world scenarios and use these models to solve problems in context.

Unit 1, Concept 2 Standards

- HSA-SSE.A.1
- HSA-SSE.A.1a
- HSA-SSE.A.1b
- HSN-Q.A.1,
- HSN-Q.A.2
- HSA-CED.A.1

Concept 3: Apply and Evaluate Expressions and Equations

Concept Overview: Students continue to concentrate on their knowledge of constants, variables, coefficients, and exponents to develop and interpret algebraic expressions and equations of increasing complexity to model real-world problems involving financial decisions.

Unit 1, Concept 3 Standards

- HSN-Q.A.1
- HSA-SSE.A.1
- HSA-SSE.A.1a
- HSA-CED.A.1
- HSA-CED.A.2

Unit 2: Equations and Inequalities

Unit Overview: Students will create and solve multistep linear equations and linear inequalities to model and solve a variety of problems. They will interpret the solution sets of equations and inequalities in the context of real-world problems, and distinguish viable from nonviable solutions. Students will begin to explore how to find the points of intersection of two functions. They will investigate compound inequalities in one variable and their relationship to absolute value equations and inequalities. Students will then solve and graph the equations. They will extend their ability to distinguish between situations with 0, 1, and many solutions, and apply this understanding to compound inequalities and absolute value equations and inequalities. Students will recognize that solutions can be verified by substituting them into the original equation and use this strategy to find extraneous solutions. (Focus on MP.3, MP.4, MP.8)

Concept 1: Solve Equations and Inequalities

Concept Overview: Students extend their understanding by creating and solving multistep linear equations and multistep linear inequalities to model and solve a variety of problems. They also learn to justify their steps when solving equations and inequalities. They interpret the solution sets of equations and inequalities in the context of real-world problems, and they distinguish viable from nonviable solutions. Finally, students begin to explore how to find the points of intersection of two functions and begin to understand what it means for $f(x) = g(x)$.

Unit 2, Concept 1 Standards

- HSA.CED.A.1
- HSA.CED.A.3
- HSA.REI.A.1
- HSA.REI.B.3
- HSA.REI.D.11

Concept 2: Rewrite Literal Equations

Concept Overview: Students build upon their knowledge of variables and their related units through literal equations. They rearrange variables in formulas and are expected to justify each step using mathematical properties while solving for a given variable.

Unit 2, Concept 2 Standards

- HSN-Q.A.1
- HSN-Q.A.2
- HSA-SSE.A.1.B
- HSA-CED.A.4
- HSA-REI.B.3

Concept 3: Solve Absolute Value Equations and Inequalities

Concept Overview: Students investigate compound inequalities in one variable and their relationship to absolute value equations and inequalities. They translate real-world constraints into compound inequalities and absolute value equations and inequalities, and solve and graph the equations. Students expand their ability to distinguish between situations with 0, 1, and many solutions, and apply this understanding to compound inequalities and absolute value equations and inequalities. They recall that solutions can be

Unit 2, Concept 3 Standards

- HSA-CED.A.3
- HSA-REI.B.3

verified by substituting them into the original equation and use this strategy to find extraneous solutions.

Unit 3: Functions

Unit Overview: Students will broaden their understanding of functions, use function notation, and interpret function notation in context. They will deepen their understanding of domain and range and analyze functions in context to determine which values for the domain and range make sense in the problem. Students will discover that arithmetic sequences are linear functions defined over a subset of the set of integers and compare properties of functions represented in different ways. They will identify the common difference as the average rate of change either from a table or a graph. Students will create arithmetic sequences from a description of a relationship and interpret the parameters in context. They will learn that geometric sequences are exponential functions defined over a subset of the integers and will write exponential functions in next-now, recursive, implicit, and explicit forms. Students will be able to distinguish between the average rate of change and the growth rate of geometric sequences. (Focus on MP.1, MP.7, MP.8)

Concept 1: Understand and Interpret Functions

Concept Overview: Students deepen their knowledge of functions, use function notation, and interpret function notation in context. They continue to develop their understanding of domain and range. Students analyze functions in context to determine which values for the domain and range make sense in the problem.

Unit 3, Concept 1 Standards

- HSF-IF.A.1
- HSF-IF.A.2
- HSF-IF.C.9
- HSF-LE.B.5

Concept 2: Analyze Arithmetic Sequences and Linear Functions

Concept Overview: Students learn that arithmetic sequences are linear functions defined over a subset of the set of integers and compare properties of functions represented in different ways. They identify the common difference as the average rate of change either from a table or a graph. Students create arithmetic sequences from a description of a relationship and interpret the parameters in context. They identify and write arithmetic sequences as an explicit expression or a recursive process, given a context, and translate between the two forms.

Unit 3, Concept 2 Standards

- HSF-IF.A.3
- HSF-IF.B.6
- HSF-IF.C.9
- HSF-BF.A.1a
- HSF-BF.A.2
- HSF-LE.A.1a
- HSF-LE.A.1b
- HSF-LE.A.2
- HSF-LE.B.5

Concept 3: Analyze Geometric Sequence and Exponential Functions

Concept Overview: Students discover that geometric sequences are exponential functions defined over a subset of the integers. They write exponential functions in next-now, recursive, implicit, and explicit forms. Students distinguish between the average rate of change and the growth rate of geometric sequences. They create and analyze geometric sequences from real-world contexts.

Unit 3, Concept 3 Standards

- HSF-IF.A.3
- HSF-IF.B.6
- HSF-IF.C.9
- HSF-LE.A.1
- HSF-LE.A.1c
- HSF-LE.A.2
- HSF-LE.A.3
- HSF-LE.B.5

Unit 4: Graphs of Functions

Unit Overview: Students will expand upon their prior understanding of linear and nonlinear functions. They will represent the functions in different forms and identify and interpret key features of the functions. Students will also combine linear or exponential functions to form new functions. In addition, they will apply their prior experience with transformations of plane figures as they investigate transformations of these functions. Students will determine the average rate of change over an interval for both linear and exponential functions and identify the meaning of various function parameters in context, including the domain, range, and appropriate scale. Students will also represent arithmetic and geometric sequences as linear and exponential relationships in the form of tables of values, equations, and graphs. (Focus on MP.2, MP.3, MP.4)

Concept 1: Analyze Graphs of Linear and Exponential Functions

Concept Overview: Students build on their prior understanding of linear and nonlinear functions. They represent linear and exponential functions in different forms, and they identify and interpret key features of the functions, including domain and range. Students also combine linear or exponential functions to form new functions. In addition, they apply their prior experience with transformations of plane figures as they investigate transformations of linear and exponential functions. Finally, they extend their understanding of transformations to explore and apply the relationships between the equations of parallel and perpendicular lines.

Unit 4, Concept 1 Standards

- HSA-REI.D.10
- HSF-IF.A.2
- HSF-IF.B.4
- HSF-IF.B.5
- HSF-IF.B.6
- HSF-IF.C.7a
- HSF-IF.C.7e
- HSF-BF.A.1a
- HSF-BF.A.1b
- HSF-BF.A.1c
- HSG-GPE.B.5

Concept 2: Compare Graphs of Linear and Exponential Functions

Concept Overview: Students distinguish key features of linear and exponential functions using multiple representations. They determine the average rate of change over an interval for both linear and exponential functions and identify the meaning of various function parameters in context, including the domain, range, and appropriate scale. Students also represent arithmetic and geometric sequences as linear and exponential relationships in the form of tables of values, equations, and graphs.

Unit 4, Concept 2 Standards

- HSF-IF.B.4
- HSF-IF.C.7a
- HSF-IF.C.7e
- HSF-IF.C.9
- HSF-LE.A.1
- HSF-LE.A.3
- HSF-LE.B.5

Unit 5: Systems of Equations and Inequalities

Unit Overview: Students will be able to explain the intersection of the two equations on a graph as the ordered-pair solution to the system. They will be able to explain the linear combination method and prove that replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. Students will apply their understanding of systems of linear inequalities to represent real-world contexts involving constraints and interpret whether the solutions are viable or nonviable options in context. They will graph various inequalities, determine the feasible region for solutions, and recognize that the solutions at the vertices represent the extreme points of the solution set. (Focus on MP.1, MP.2, MP.4)

Concept 1: Solve Systems of Equations and Inequalities

Concept Overview: Students interpret the intersection of the two equations on a graph as the ordered-pair solution to the system. They create and solve systems of equations and inequalities graphically. Students are able to explain the linear combination method and prove that replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. They apply their understanding of systems of linear inequalities to represent real-world contexts involving constraints and interpret whether the solutions are viable or nonviable options in context.

Unit 5, Concept 1 Standards

- HSA-CED.A.2
- HSA-CED.A.3
- HSA-CED.A.4
- HSA-REI.C.5
- HSA-REI.C.6
- HSA-REI.D.11
- HSA-REI.D.12

Concept 2: Use Systems in Decision Making: Linear Programming

Concept Overview: Students explore real-world problems involving systems, beginning with estimating solutions. They write systems of inequalities, involving constraints, to represent real-world situations. Students graph the various inequalities, determine the feasible region for solutions, and recognize that the solutions at the vertices represent the extreme points of the solution set. They interpret each of these solutions in terms of the real-world situation.

Unit 5, Concept 2 Standards

- HSA.CED.A.3
- HSN.Q.A.3

Unit 6: Descriptive Statistics

Unit Overview: Students will develop their ability to represent data with plots on the real number line and use the appropriate measures of center and spread. They will extend their understanding of measures of variation to include standard deviation and utilize additional statistical data to make more precise inferences. Students will identify the line of best fit and assess the fit of the line using residuals. Students will interpret the slope and y-intercept of the line of best fit in the context of the data and use the correlation coefficient to interpret the models. They will also study correlation and causation, and will distinguish between the two. Students will interpret relative frequencies in the context of data, including joint, marginal, and conditional relative frequencies. They will discover that possible associations and trends in data are best determined using conditional relative frequency. (Focus on MP.1, MP.2, MP.4)

Concept 1: Represent and Analyze Data

Concept Overview: Students extend their skill in representing data with plots on the real number line and use the appropriate measures of center and spread, building their understanding of measure of variation to include standard deviation and using more statistical data to make more precise inferences. They interpret two sets of data in terms of shape, center, and spread and account for the effect of extreme data points on a normal distribution.

Unit 6, Concept 1 Standards

- HSS-ID.A.1
- HSS-ID.A.2
- HSS-ID.A.3

Concept 2: Analyze Scatter Plots

Concept Overview: Students learn to formally identify the line of best fit and assess the fit of the line using residuals. They interpret the slope and y-intercept of the line of best fit in the context of the data and use the correlation coefficient to interpret the models. Students also explore correlation and causation, and distinguish between the two.

Unit 6, Concept 2 Standards

- HSS.ID.B.6b
- HSS.ID.B.6c
- HSS.ID.C.7
- HSS.ID.C.8
- HSS.ID.C.9

Concept 3: Interpret Two-Way Frequency Tables

Concept Overview: Students deepen their understanding of bivariate data and two-way frequency tables by interpreting relative frequencies in the context of data, including joint, marginal, and conditional relative frequencies. They discover that possible associations and trends in data are best determined using conditional relative frequency.

Unit 6, Concept 3 Standards

- HSS.ID.B.5

Unit 7: Nonlinear Functions

Unit Overview: Students will write and define piecewise functions. They will rely on their understanding of key features and interpretations of graphs to explore other nonlinear function families, including piecewise, absolute value, and step functions. Students will focus their work on square and cube root functions. They will use approximations of rational and irrational numbers to graph square root and cube root functions and will explore the effects of vertical and horizontal transformations to the functions. Students will relate the importance of restricted domain and range of the functions to its graph and to the context of the problem. Students will extend the properties of rational and irrational numbers, as well as integer exponents, to that of rational exponents. They will rewrite radical expressions using rational exponents. Students will use the properties of exponents to write equivalent expressions, providing insight into the structure of the expression. (Focus on MP.2, MP.4, MP.8)

Concept 1: Create and Analyze Piecewise Functions

Concept Overview: Students use their previous work with writing linear equations to write and define piecewise functions. They use their knowledge of key features and interpretations of graphs to explore other nonlinear function families, including piecewise, absolute value, and step functions. Students extend their knowledge of interpreting nonlinear functions to compare properties of functions represented in a different way: algebraically, graphically, numerically in tables, or by verbal descriptions.

Unit 7, Concept 1 Standards

- HSA-CED.A.2
- HSF-IF.C.7b
- HSF-IF.C.9

Concept 2: Investigate Square Root and Cube Root Functions

Concept Overview: Students extend their understanding of rational and irrational numbers to square and cube root functions. They use approximations of rational and irrational numbers to graph square root and cube root functions. Students explore the effects of vertical and horizontal transformations to the square root and cube root functions, as well as describe the features of the transformed functions. They also relate the importance of restricted domain and range of the functions to its graph and to the context of the problem.

Unit 7, Concept 2 Standards

- HSF-BF.B.3
- HSF-IF.B.4
- HSF-IF.B.5
- HSF-IF.C.7b

Concept 3: Investigate Rational Exponents

Concept Overview: Students build on the properties of rational and irrational numbers, as well as integer exponents, to that of rational exponents. They rewrite radical expressions, many of which are irrational, using rational exponents. Students employ the properties of exponents to write equivalent expressions, providing

Unit 7, Concept 3 Standards

- HSA-SSE.B.3.C
- HSN-RN.A.1
- HSN-RN.A.2

insight into the structure of the expression.

Unit 8: Exponential Functions

Unit Overview: Students will broaden their understanding of exponential functions to model real-world scenarios. They will learn how to interpret the domain, range, growth factor, and initial value in an exponential function in context. They will recognize situations that can be represented by exponential functions and will write and graph the equations that model exponential behavior. Students will go further into interpreting the parameters of the equations in the context of real-world problems and use laws of exponents to rewrite the functions. Students will also see complicated expressions by viewing one or more of their parts as a single entity as they explore compound interest. (Focus on MP.2, MP. 4,MP.5)

Concept 1: Represent Exponential Functions

Concept Overview: Students expand their knowledge of exponential functions to model real-world scenarios. They create exponential equations and use them to solve problems. They learn how to interpret the domain, range, growth factor, and initial value in an exponential function in context. Students graph exponential functions to analyze key features and understand the effects of changing the parameters of these functions. Students calculate and interpret the average rate of change for exponential functions.

Unit 8, Concept 1 Standards

- HSF-BF.A.1
- HSF-BF.A.1a
- HSF-BF.A.1b
- HSF-BF.B.3
- HSF-IF.B.4
- HSF-IF.B.5
- HSF-IF.B.6
- HSF-IF.C.7e

Concept 2: Analyze Exponential Growth and Decay Models

Concept Overview: Students continue to recognize situations that can be represented by exponential functions and write and graph the equations that model exponential behavior. They go further, interpreting the parameters of the equations in context of real-world problems and use laws of exponents to rewrite the functions in order to aid in their interpretation of them. Students also see complicated expressions by viewing one or more of their parts as a single entity as they explore compound interest. They graphically solve problems related to exponential functions.

Unit 8, Concept 2 Standards

- HSA-CED.A.2
- HSA-SSE.A.1b
- HSA-REI.D.11
- HSF-IF.C.7e
- HSF-IF.C.8b
- HSF-LE.A.1c
- HSF-LE.B.5
- HAS-SSE.B.3c

Unit 9: Polynomials

Unit Overview: Students will work with linear expressions and integer exponents as they begin to explore more complex polynomial expressions. They will interpret different parts of polynomials in context and begin to see expressions as sums, products, and factors instead of different entities. Students will add, subtract, and multiply polynomials to create equivalent expressions that will allow them to interpret different forms of quadratic functions. They will deepen their knowledge of properties of rational exponents and will use these properties to simplify variable expressions. Students will further explore algebraic expressions that can be expressed as products of factors. They will discover patterns to identify factors, leading to the examination of the structure of quadratic equations. Students will find different methods for factoring quadratic expressions. (Focus on MP.1, MP.7, MP.8)

Concept 1: Perform Operations on Polynomials

Concept Overview: Students build on their earlier work with linear expressions and integer exponents as they begin to explore more complex polynomial expressions. They interpret different parts of polynomials in context and begin to see expressions as sums, products, and factors instead of different entities. Students add, subtract, and multiply polynomials to create equivalent expressions that allow them to interpret different forms of quadratic functions in later investigations. They extend their knowledge of properties of rational exponents and use these properties to simplify variable expressions.

Unit 9, Concept 1 Standards

- HSA-SSE.A.1a
- HSA-SSE.A.1b
- HSA-APR.A.1
- HSN-RN-A.2

Concept 2: Factor Polynomials

Concept Overview: Students explore algebraic expressions that can be expressed as products of factors. They rely on patterns observed in previous work to identify factors, leading to the examination of the structure of quadratic equations. Students discover different methods for factoring quadratic expressions, including factoring by graphing and using geometric area models, as well as algebraically.

Unit 9, Concept 2 Standards

- HSA-SSE.A.1a
- HSA-SSE.A.2
- HSA-SSE.B.3a

Unit 10: Quadratic Expressions and Equations

Unit Overview: Students will use prior knowledge of functions and equations as they solve quadratic equations. They will use the properties of rational and irrational numbers to solve quadratic equations with rational or irrational solutions. In addition, students will begin to investigate some of the properties of quadratic functions. They will apply the quadratic formula to solve quadratic equations, and they will identify the type and number of real solutions given by the formula. Students will continue their exploration of quadratic functions and key features of the functions' graphs. (Focus on MP.3, MP.7, MP.8)

Concept 1: Solve Quadratics

Concept Overview: Students build on previous knowledge of functions and equations as they solve quadratic equations by factoring, taking square roots, completing the square, and graphing. They also use the properties of rational and irrational numbers to solve quadratic equations with rational or irrational solutions. In addition, students begin to investigate some of the properties of quadratic functions, reflecting on how the roots of equations determine the x-intercepts on the graph of the function. They use their new learning to develop the graph of the related function and determine some of the key features.

Unit 10, Concept 1 Standards

- HSN-RN.B.3
- HSA-REI.B.4a
- HSA-REI.B.4b
- HSA-APR.B.3
- HSF-IF.C.8
- HSF-IF.C.8a

Concept 2: Analyze Quadratic Equations

Concept Overview: Students derive the quadratic formula based on their understanding of solving quadratic equations by completing the square. They then apply the quadratic formula to solve quadratic equations, and they identify the type and number of real solutions given by the formula. They also make use of properties of rational and irrational numbers as they solve quadratic equations with rational or irrational solutions. In addition, students continue their exploration of quadratic functions and key features of the functions' graphs.

Unit 10, Concept 2 Standards

- HSN-RN.B.3
- HSA-REI.B.4a
- HSA-REI.B.4b
- HSA-APR.B.3
- HSF-IF.C.7a
- HSF-IF.C.8
- HSF-IF.C.8a

Unit 11: Graphs of Quadratic Functions

Unit Overview: Students will explore quadratic, exponential, and linear behaviors numerically, algebraically, and graphically. They will apply their understanding of completing the square to rewrite quadratic functions into vertex form and interpret quadratic functions in both standard and vertex form. They will graph quadratic functions and interpret intercepts, maxima, and minima. (Focus on MP.2, MP.4, MP.5)

Concept 1: Analyze Graphs of Quadratic Functions

Concept Overview: Students further analyze and compare quadratic, exponential, and linear behaviors numerically, algebraically, and graphically. They apply their understanding of completing the square to rewrite quadratic functions into vertex form. Students interpret quadratic functions in both standard form and vertex form, identifying the key features by analyzing the characteristics of the functions. They graph quadratic functions and interpret intercepts, maxima, and minima.

Unit 11, Concept 1 Standards

- HSA-CED.A1
- HSF-IF.B.4
- HSF-IF.B.5
- HSF-IF.C.7a
- HSF-IF.C.7c
- HSF-IF.C.8a
- HSF-IF.C.9
- HSF-BF.A.1
- HSF-BF.B.3
- HSF-LE.A.3