Unit 1: Foundations of Algebra

Unit Overview: Students will build on their understanding of constants, variables, coefficients, 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. They build algebraic models to represent real-world scenarios and use these models to solve problems in context. Students also expand upon their interpretation of algebraic expressions and equations in both linear and nonlinear contexts to include dimensional analysis and graphical reasoning. They use their knowledge of constants, variables, coefficients, and exponents to develop and interpret algebraic expressions and equations of increasing complexity in order to model real-world problems involving financial decisions (focus on MP.2, MP.4, and MP.8).

Concept 1: Analyze Expressions and Equations

Concept Overview: Students build on their understanding of constants, variables, coefficients, 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 expand upon their interpretation 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.

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

Concept 3: Apply and Evaluate Expressions and Equations

Concept Overview: Students use their knowledge of constants, variables, coefficients, and exponents to develop and interpret algebraic expressions and equations of increasing complexity in order to model real-world problems involving financial decisions. They will define appropriate quantities and units relative to the real world scenario while decontextualizing and contextualizing throughout their analysis.

Unit 1, Concept 3 Standards
- HSA-CED.A.1
- HSA-CED.A.2
- HSN-Q.A.1
- HSA-SSE.A.1
- HSA-SSE.A.1a

Unit 2: Equations and Inequalities

Unit Overview: Students create and solve multistep linear equations and multistep linear inequalities to model and solve a variety of problems. They interpret the solution sets of equations and inequalities in the context of real-world problems, and they distinguish viable from nonviable solutions. Students build on their understanding 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. Students also apply the Pythagorean theorem and the distance formula to calculate the perimeter and area of figures in the coordinate plane. They apply their knowledge of proportional reasoning to identify the midpoint of a line segment and to partition line segments into equal portions. Students use the definitions of a circle and right angles to help create triangles and solve for unknown distances. They use coordinates to prove or disprove that segments on the coordinate plane are congruent or perpendicular (focus on MP.3, MP.4, and MP.8).

Concept 1: Solve Equations and Inequalities

Concept Overview: Students create and solve 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 the symbolic representation $f(x)=g(x)$.

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 on their understanding 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

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

Concept 3: Explore Measurements in the Coordinate Plane

Concept Overview: Students apply the Pythagorean theorem and the distance formula to calculate the perimeter and area of figures in the coordinate plane. They apply their knowledge of proportional reasoning to identify the midpoint of a line segment and to partition line segments into equal portions. Students use the definitions of a circle and right angles to help create triangles and solve for unknown distances. They use coordinates to prove or disprove that segments on the coordinate plane are congruent or perpendicular (also focuses on MP.1 and MP.5).

Unit 2, Concept 3 Standards
- HSG-CO.A.1
- HSG-GPE.B.4
- HSG-GPE.B.6
- HSG- GPE.B.7

Unit 3: Transformations and Constructions

Unit Overview: Students recognize, describe, and construct reflections, rotations, and translations of points, segments, and polygons. They construct these transformations on the coordinate plane. Students discover that congruent figures are created by a finite number of isometries. They also predict and demonstrate a sequence of translations, rotations, and reflections to carry a given figure onto another and then use rigid motions to discover and establish the SSS, SAS, and ASA triangle congruence criteria. Students will make geometric constructions. They will learn to construct various figures, including equilateral triangles, perpendicular bisectors, and angle bisectors using a compass and a straightedge. Students will use the converse of the perpendicular bisector theorem to justify their constructions (focus on MP.1, MP.3, and MP.5).

Concept 1: Explore Transformations

Concept Overview: Students learn to recognize, describe, and construct reflections, rotations, and translations of points, segments, and polygons. They also will construct these transformations on the coordinate plane. In addition, students will recognize line and rotational symmetry of figures and use transformation to create tessellations.

Unit 3, Concept 1 Standards
- HSG-CO.A.2
- HSG-CO.A.3
- HSG-CO.A.4
- HSG-CO.A.5

Concept 2: Investigate and Apply Congruence Definitions

Concept Overview: Students discover that congruent figures are created by a finite number of isometries. In other words, students build on their understanding of congruence of two figures by expressing congruence in terms of rigid motion. They also predict and demonstrate a sequence of translations, rotations, and reflections to carry a given figure onto another and use rigid motions to discover and establish the SSS, SAS, and ASA triangle congruence criteria.

Unit 3, Concept 2 Standards
- HSG-CO.B.6
- HSG-CO.B.7
- HSG-CO.B.8

Concept 3: Construct Special Triangles and Angles

Concept Overview: Students will make geometric constructions. They will learn to construct various figures, including equilateral triangles, perpendicular bisectors, and angle bisectors using a compass and a straightedge. Students will use the converse of the perpendicular bisector theorem to justify their constructions.

Unit 3, Concept 3 Standards
- HSG-CO.C.9
- HSG-CO.D.12
- HSG-CO.D.13

Unit 4: Functions

Unit Overview: Students deepen their understanding of functions, use function notation, and interpret function notation in context. They 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. They 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 create arithmetic sequences from a description of a relationship and interpret the parameters in context. They will identify and write arithmetic sequences as an explicit expression or a recursive process given a context and translate between the two forms. 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. They distinguish between the average rate of change and the growth rate of geometric sequences. Students will create and analyze geometric sequences from real-world contexts (focus on MP.1, MP.7, and MP.8).

Concept 1: Understand and Interpret Functions

Concept Overview: Students extend their understanding of functions, use function notation, and interpret function notation in context. They 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 4, 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 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 identify and write arithmetic sequences as an explicit expression or a recursive process given a context and translate between the two forms.

Unit 4, Concept 2 Standards
- HSF-BF.A.1a
- HSF-BF.A.2
- HSF-IF.A.3
- HSF-IF.B.6
- HSF-IF.C.9
- HSF-LE.A.1a
- HSF-LE.A.1b
- HSF-LE.A.2
- HSF-LE.B.5

Concept 3: Analyze Geometric Sequences and Exponential Functions

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

Unit 4, Concept 3 Standards

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

Unit 5: Graphs of Functions

Unit 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. They apply their prior experience with transformations of plane figures as they investigate transformations of linear and exponential functions. Students extend their understanding of transformations to explore and apply the relationships between the equations of parallel and perpendicular lines. They 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 (focus on MP.2, MP.3, and 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. They extend their understanding of transformations to explore and apply the relationships between the equations of parallel and perpendicular lines.

Unit 5, Concept 1 Standards

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

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 5, 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 6: Linear Systems

Unit Overview: Students will interpret 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 non-viable options in context. They write systems of equations and 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 (focus on MP.1, MP.2, and 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 will create and solve systems of equations and inequalities graphically. Students 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. They also apply their understanding of systems of linear inequalities to represent real-world contexts involving constraints and interpret whether the solutions are viable or non-viable options in context.

Unit 6, 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 equations and 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 6, Concept 2 Standards
- HSA-CED.A.3
- HSN-Q.A.3

Unit 7: Descriptive Statistics

Unit Overview: Students develop their skill in representing data with plots on the real number line and use the appropriate measures of center and spread, extending their understanding of measure of variation to include standard deviation and using more statistical data to make more precise inferences. They learn to formally identify the line of best fit and assess the fit of the line using residuals. They will interpret the slope and *y*-intercept of line of best fit in the context of the data and will use the correlation coefficient to interpret the models. Students will also explore correlation and causation and distinguish between the two. Students also broaden 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 (focus on MP.1, MP.2, and MP.3).

Concept 1: Represent and Analyze Data

Concept Overview: Students build upon their skill in representing data with plots on the real number line and use the appropriate measures of center and spread, extending 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 7, 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 will interpret the slope and *y*-intercept of line of best fit in the context of the data and will use the correlation coefficient to interpret the models. Students will also explore correlation and causation and distinguish between the two.

Unit 7, Concept 2 Standards
- HSS-ID.B.6
- 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 extend 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 will discover that possible associations and trends in data are best determined using conditional relative frequency.

Unit 7, Concept 3 Standards
- HSS-ID.B.5

Unit 8: Exponential Functions

Unit Overview: Students explore exponential functions to model real-world scenarios with greater depth. 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 will continue to recognize situations that can be represented by exponential functions and continue to write and graph the equations to model exponential behavior. They will also see complicated expressions by viewing one or more of their parts as a single entity as they explore compound interest. Students build on their knowledge of exponential functions, equations, and graphs. They study the exponential function family, understanding how a change in parameters affects the graph of a function and they graph simple cases by hand and more-complex ones using technology. They learn to interpret the expressions or parameters for an exponential function in terms of the situation that it models. Students apply their understanding of arithmetic and geometric sequences and series to build and compare linear and exponential function models (focus on MP.2, MP.4, and MP.5).

Concept 1: Represent Exponential Functions

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

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

Concept 3: Graph and Analyze Exponential Functions

Concept Overview: Students build on their knowledge of exponential functions, equations, and graphs. They learn to solve exponential equations by inspection and analyze graphs of exponential functions. Students study the exponential function family, understanding how a change in parameters affects the graph of a function. They graph simple cases by hand and more complex cases using technology. They learn to interpret the expressions or parameters for an exponential function in terms of the situation that it models. Students apply their understanding of arithmetic and geometric sequences and series to build and compare linear and exponential function models.

Unit 9: Quadratic Functions

Unit Overview: Students increase their understanding of functions as they explore a new function family: quadratic functions of the form $y=ax^2+k$. They graph quadratic functions as well as interpret key features and parameters of these functions in context. They identify the reasonable domain and range of quadratic functions that model real-world phenomena. Students broaden their knowledge of linear, exponential, and quadratic functions as they compare functions that belong to different families and are represented in different ways. They use graphs and tables to determine that a quantity displaying exponential growth will eventually exceed a quantity displaying linear or quadratic growth (focus on MP.2, MP.4, and MP.7).

Concept 1: Explore Quadratic Functions

Concept Overview: Students increase their understanding of functions as they explore a new function family: quadratic functions of the form $y=ax^2+k$. They graph quadratic functions, and they interpret key features and parameters of these functions in context. They also identify the reasonable domain and range of quadratic functions that model real-world phenomena.

Unit 9, Concept 1 Standards
- HSF-BF.A.1a
- HSF-BF.B.3
- HSF-IF.B.5
- HSF-IF.C.7a
- HSF-IF-C.9
- HSF-IF.B.4

Concept 2: Compare Quadratics to Other Functions

Unit 9, Concept 2 Standards

- HSF-IF.C.9
- HSF-LE.A.3

Concept Overview: Students broaden their knowledge of linear, exponential, and quadratic functions as they compare functions that belong to different families and are represented in different ways. In addition, students use graphs and tables to determine that a quantity displaying exponential growth will eventually exceed a quantity displaying linear or quadratic growth.