

Tennessee Tutorials are designed specifically for the Tennessee Academic Standards to prepare students for the Tennessee Comprehensive Assessment Program (TCAP) and the TNReady assessments.

Math Tutorials offer targeted instruction, practice and review designed to develop computational fluency, deepen conceptual understanding, and apply mathematical practices. They automatically identify and address learning gaps down to elementary-level content, using adaptive remediation to bring students to grade-level no matter where they start. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing the ability to apply their knowledge in abstract and real world scenarios, students build the depth of knowledge and higher order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students through focused content, modeled logic and process, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

Unit 1: Real Number System

• LAWS OF EXPONENTS

- A1.A.SSE.A.2: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
- A1.A.SSE.B.3.c: Algebra Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Use the properties of exponents to rewrite exponential expressions.
- A1.A.REI.A.1: Algebra Reasoning with Equations and Inequalities Understand solving equations as a process of reasoning and explain the reasoning. Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

• MONITORING PRECISION AND ACCURACY

- A1.N.Q.A.1: Number and Quantity Quantities Reason quantitatively and use units to solve problems. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

- A1.N.Q.A.2: Number and Quantity Quantities Reason quantitatively and use units to solve problems. Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.
- A1.N.Q.A.3: Number and Quantity Quantities Reason quantitatively and use units to solve problems. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Unit 2: Equations and Inequalities

• ONE-STEP EQUATIONS AND INEQUALITIES

- A1.A.CED.A.1: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems.
- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- A1.A.REI.B.2: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- A1.A.REI.A.1: Algebra Reasoning with Equations and Inequalities Understand solving equations as a process of reasoning and explain the reasoning. Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.

• MULTI-STEP EQUATIONS AND INEQUALITIES

- A1.A.CED.A.1: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems.
- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- A1.A.REI.A.1: Algebra Reasoning with Equations and Inequalities Understand solving equations as a process of reasoning and explain the reasoning. Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

- A1.A.REI.B.2: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Unit 3: Applying Properties of Equations and Inequalities

• AXIOMS OF EQUALITY

- A1.A.SSE.A.2: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
- A1.A.REI.A.1: Algebra Reasoning with Equations and Inequalities Understand solving equations as a process of reasoning and explain the reasoning. Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

• LITERAL EQUATIONS

- A1.A.CED.A.1: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems.
- A1.A.REI.B.2: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- A1.A.CED.A.4: Algebra Creating Equations Create equations that describe numbers or relationships. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Unit 4: Writing Expressions and Equations

• FORMULATING AND SIMPLIFYING ALGEBRAIC EXPRESSIONS

- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
- A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- A1.A.SSE.A.2: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
- A1.A.SSE.B.3.c: Algebra Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and

explain properties of the quantity represented by the expression. Use the properties of exponents to rewrite exponential expressions.

- **FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS**

- A1.A.CED.A.1: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems.
- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- A1.F.LE.A.1.b: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.

- **FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS**

- A1.A.CED.A.1: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems.
- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- A1.A.REI.B.2: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Unit 5: Functions

- **FUNCTIONS AND RELATIONS**

- A1.F.IF.A.2: Functions Interpreting Functions Understand the concept of function and use function notation. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.IF.C.6.b: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- **DOMAIN AND RANGE**
 - A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
 - A1.F.IF.B.4: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- **EVALUATING FUNCTIONS**
 - A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
 - A1.F.IF.A.2: Functions Interpreting Functions Understand the concept of function and use function notation. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.

Unit 6: Graphs of Linear Equations and Inequalities 1

• SLOPE

- A1.F.IF.B.5: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.

• GRAPHING AND ANALYZING LINEAR FUNCTIONS

- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.IF.B.4: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.

Unit 7: Graphs of Linear Equations and Inequalities 2**• GRAPHING AND MANIPULATING $Y = MX + B$**

- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.B.5: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- A1.S.ID.C.5: Statistics and Probability Interpreting Categorical and Quantitative Data Interpret linear models. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.LE.A.1.b: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- F.LE.B.4: Functions Linear, Quadratic, and Exponential Models Interpret expressions for functions in terms of the situation they model. Interpret the parameters in a linear or exponential function in terms of a context.

• GRAPHS OF LINEAR INEQUALITIES

- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.

- A1.A.REI.D.7: Algebra Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. 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.
- A1.A.REI.B.2: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Unit 8: Linear Equations

• SLOPE-INTERCEPT FORM OF A LINEAR EQUATION

- A1.S.ID.C.5: Statistics and Probability Interpreting Categorical and Quantitative Data Interpret linear models. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- A1.F.IF.B.5: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.

• POINT-SLOPE FORM OF A LINEAR EQUATION

- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.

- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.

Unit 9: Two-Variable Linear Systems

• SOLVING SYSTEMS OF LINEAR EQUATIONS: GUESS AND CHECK

- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.
- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- A1.A.REI.C.4: Algebra Reasoning with Equations and Inequalities Solve systems of equations. Write and solve a system of linear equations in context.
- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.

• SOLVING SYSTEMS OF LINEAR EQUATIONS: GRAPHING

- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- A1.A.REI.C.4: Algebra Reasoning with Equations and Inequalities Solve systems of equations. Write and solve a system of linear equations in context.
- A1.A.REI.D.6: Algebra Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the approximate solutions using technology.
- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.

Unit 10: Solving Two-Variable Linear Systems Algebraically

• SOLVING SYSTEMS OF LINEAR EQUATIONS: SUBSTITUTION

- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.
- A1.A.REI.C.4: Algebra Reasoning with Equations and Inequalities Solve systems of equations. Write and solve a system of linear equations in context.
- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- **SOLVING SYSTEMS OF LINEAR EQUATIONS: ELIMINATION**
 - A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.
 - A1.A.REI.C.4: Algebra Reasoning with Equations and Inequalities Solve systems of equations. Write and solve a system of linear equations in context.
 - A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- **SOLVING SYSTEMS OF LINEAR INEQUALITIES**
 - A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
 - A1.A.REI.D.7: Algebra Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. 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.

Unit 11: Exponential Functions, Equations, and Inequalities

- **EXPONENTIAL FUNCTIONS**
 - A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
 - A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.

- A1.F.LE.A.1.a: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
- A1.F.IF.B.5: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.LE.A.3: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.IF.B.4: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- A1.A.CED.A.1: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems.
- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- A1.F.LE.A.1.c: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.

- F.LE.B.4: Functions Linear, Quadratic, and Exponential Models Interpret expressions for functions in terms of the situation they model. Interpret the parameters in a linear or exponential function in terms of a context.

- **EXPONENTIAL GROWTH AND DECAY**

- A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
- A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- A1.F.LE.A.1.a: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
- A1.F.LE.A.1.c: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- F.LE.B.4: Functions Linear, Quadratic, and Exponential Models Interpret expressions for functions in terms of the situation they model. Interpret the parameters in a linear or exponential function in terms of a context.
- A1.F.LE.A.3: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- A1.F.LE.A.1.b: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.

- **SOLVING EXPONENTIAL INEQUALITIES**

- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.
- A1.F.LE.A.1.c: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.

Unit 12: Sequences

• SEQUENCES

- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.

• ARITHMETIC AND GEOMETRIC SEQUENCES

- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.

Unit 13: Polynomials

• POLYNOMIAL BASICS

- A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
- A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- **ADDITION AND SUBTRACTION OF POLYNOMIALS**
 - A1.A.APR.A.1: Algebra Arithmetic with Polynomials and Rational Expressions Perform arithmetic operations on polynomials. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
- **MULTIPLICATION OF POLYNOMIALS**
 - A1.A.APR.A.1: Algebra Arithmetic with Polynomials and Rational Expressions Perform arithmetic operations on polynomials. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Unit 14: Factoring Quadratics

- **FACTORING QUADRATIC TRINOMIALS**
 - A1.A.SSE.B.3.a: Algebra Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Factor a quadratic expression to reveal the zeros of the function it defines.
 - A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
 - A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
 - A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
- **FACTORING SPECIAL CASES**
 - A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.

- A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- A1.A.SSE.A.2: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
- A1.A.APR.B.2: Algebra Arithmetic with Polynomials and Rational Expressions Understand the relationship between zeros and factors of polynomials. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

Unit 15: Graphs and Representations of Quadratic Functions

• QUADRATIC FUNCTIONS

- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.
- A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
- A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- A1.A.SSE.B.3.b: Algebra Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression in the form $Ax^2 + Bx + C$ where $A = 1$ to reveal the maximum or minimum value of the function it defines.
- A1.F.IF.C.7.a: Functions Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- **ANALYZING GRAPHS OF QUADRATIC FUNCTIONS**
 - A1.A.SSE.A.2: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
 - A1.F.IF.C.8: Functions Interpreting Functions Analyze functions using different representations. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
 - A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
 - A1.F.IF.B.4: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
 - A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
 - A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.
 - A1.A.APR.B.2: Algebra Arithmetic with Polynomials and Rational Expressions Understand the relationship between zeros and factors of polynomials. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
 - A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
 - A1.F.IF.C.7.a: Functions Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

• REPRESENTATIONS OF QUADRATIC FUNCTIONS

- A1.A.SSE.A.2: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
- A1.A.REI.B.3.a: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Use the method of completing the square to rewrite any quadratic equation in x into an equation of the form $(x - p) = q$ that has the same solutions. Derive the quadratic formula from this form.
- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.IF.C.8: Functions Interpreting Functions Analyze functions using different representations. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- A1.F.IF.C.7.a: Functions Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Unit 16: Solving Quadratic Functions

• SOLVING QUADRATIC EQUATIONS BY FACTORING

- A1.A.SSE.B.3.a: Algebra Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Factor a quadratic expression to reveal the zeros of the function it defines.
- A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the

square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.

- A1.F.IF.C.7.a: Functions Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- A1.A.APR.B.2: Algebra Arithmetic with Polynomials and Rational Expressions Understand the relationship between zeros and factors of polynomials. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
- A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
- A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
- A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.

• COMPLETING THE SQUARE

- A1.A.SSE.B.3.b: Algebra Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression in the form $Ax^2 + Bx + C$ where $A = 1$ to reveal the maximum or minimum value of the function it defines.
- A1.A.REI.B.3.a: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Use the method of completing the square to rewrite any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
- A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
- A1.F.IF.C.7.a: Functions Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- A1.A.SSE.A.2: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
- A1.A.REI.B.3.a: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Use the method of completing the square to rewrite any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
- A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
- A1.A.SSE.B.3.b: Algebra Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression in the form $Ax^2 + Bx + C$ where $A = 1$ to reveal the maximum or minimum value of the function it defines.
- A1.A.REI.B.3.a: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Use the method of completing the square to rewrite any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

- A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
- A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- A1.A.SSE.B.3.b: Algebra Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression in the form $Ax^2 + Bx + C$ where $A = 1$ to reveal the maximum or minimum value of the function it defines.
- **QUADRATIC FORMULA**
 - A1.A.SSE.A.1.a: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
 - A1.A.SSE.A.1.b: Algebra Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
 - A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
 - A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
 - A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
 - A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.

- A1.A.CED.A.3: Algebra Creating Equations Create equations that describe numbers or relationships. 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.
- A1.A.REI.B.3.a: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Use the method of completing the square to rewrite any quadratic equation in x into an equation of the form $(x - p) = q$ that has the same solutions. Derive the quadratic formula from this form.
- A1.A.REI.B.3.b: Algebra Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations and inequalities in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
- A1.F.BF.A.1.a: Functions Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.

Unit 17: Parent Functions

• LINEAR AND EXPONENTIAL PARENT FUNCTIONS

- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.B.4: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.LE.A.1.c: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.

• QUADRATIC PARENT FUNCTION

- A1.F.IF.C.6.a: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.B.4: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

Unit 18: Transformations of Parent Functions

• TRANSFORMATIONS OF THE LINEAR AND EXPONENTIAL PARENT FUNCTIONS

- A1.F.BF.B.2: Functions Building Functions Build new functions from existing functions. 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.

• TRANSFORMATIONS OF THE QUADRATIC PARENT FUNCTION

- A1.F.BF.B.2: Functions Building Functions Build new functions from existing functions. 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.
- A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
- A1.F.IF.B.4: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

Unit 19: Nonlinear Functions

• LINEAR VERSUS NONLINEAR FUNCTIONS

- A1.F.IF.B.5: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.LE.A.1.a: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations

that can be modeled with linear functions and with exponential functions. Recognize that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.

- A1.F.LE.A.1.b: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.IF.C.8: Functions Interpreting Functions Analyze functions using different representations. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.LE.A.1.c: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.
- **ABSOLUTE VALUE FUNCTIONS**
 - A1.F.IF.A.1: Functions Interpreting Functions Understand the concept of function and use function notation. 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 $y = f(x)$.
 - A1.F.IF.B.4: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
 - A1.F.BF.B.2: Functions Building Functions Build new functions from existing functions. 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.
 - A1.F.IF.C.6.b: Functions Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and show key features of the graph, by hand and using technology. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

- **MULTIPLE REPRESENTATIONS OF FUNCTIONS**

- A1.A.CED.A.2: Algebra Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.
- A1.F.IF.B.3: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.F.IF.C.8: Functions Interpreting Functions Analyze functions using different representations. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- A1.F.LE.A.2: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.
- A1.F.LE.A.1.a: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.

Unit 20: Statistics and Scatterplots

- **DATA ANALYSIS**

- A1.S.ID.A.1: Statistics and Probability Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on a single count or measurement variable. Represent single or multiple data sets with dot plots, histograms, stem plots (stem and leaf), and box plots.
- A1.S.ID.A.2: Statistics and Probability Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on a single count or measurement variable. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
- A1.S.ID.A.3: Statistics and Probability Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on a single count or measurement variable. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

- **SCATTERPLOTS**

- A1.S.ID.B.4.a: Statistics and Probability Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables. Represent data on two quantitative variables on a scatter plot, and describe how the variables

are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context.

- A1.S.ID.B.4.b: Statistics and Probability Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a linear function for a scatter plot that suggests a linear association.
- A1.S.ID.C.7: Statistics and Probability Interpreting Categorical and Quantitative Data Interpret linear models. Distinguish between correlation and causation.
- A1.F.IF.B.5: Functions Interpreting Functions Interpret functions that arise in applications in terms of the context. 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.
- A1.S.ID.C.5: Statistics and Probability Interpreting Categorical and Quantitative Data Interpret linear models. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- **SCATTERPLOTS AND MODELING**
 - A1.S.ID.B.4.a: Statistics and Probability Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context.
 - A1.S.ID.B.4.b: Statistics and Probability Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a linear function for a scatter plot that suggests a linear association.
 - A1.S.ID.C.6: Statistics and Probability Interpreting Categorical and Quantitative Data Interpret linear models. Use technology to compute and interpret the correlation coefficient of a linear fit.
 - A1.S.ID.C.5: Statistics and Probability Interpreting Categorical and Quantitative Data Interpret linear models. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
 - A1.F.LE.A.1.a: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
 - A1.F.LE.A.1.c: Functions Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations

that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.
