South Carolina Tutorials are designed specifically for the South Carolina College and Career Readiness Standards and the South Carolina Academic Standards to prepare students for the South Carolina End-of-Course Examination Program (EOCEP), ACT Aspire, and the South Carolina Palmetto Assessment of State Standards (SCPASS).

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.

1. REAL NUMBER SYSTEM

- **LAWS OF EXPONENTS**
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.AREI.1** *Understand and justify that the steps taken when solving simple equations in one variable create new equations that have the same solution as the original.*
  - **A1.ASE.2** *Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.*
  - **A1.NRNS.1** *Rewrite expressions involving simple radicals and rational exponents in different forms.*
  - **A1.NRNS.2** *Use the definition of the meaning of rational exponents to translate between rational exponent and radical forms.*

- **OPERATIONS ON RATIONAL AND IRRATIONAL NUMBERS**
  - **A1.NRNS.3** *Explain why the sum or product of rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.*

- **MONITORING PRECISION AND ACCURACY**
  - **A1.ACE.1** *Create and solve equations and inequalities in one variable that model real-world problems involving linear, quadratic, simple rational, and exponential relationships. Interpret the solutions and determine whether they are reasonable. (Limit to linear; quadratic; exponential with integer exponents.)*
  - **A1.AREI.3** *Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.*
  - **A1.NQ.1** *Use units of measurement to guide the solution of multi-step tasks. Choose and interpret appropriate labels, units, and scales when constructing graphs and other data displays.*
  - **A1.NQ.2** *Label and define appropriate quantities in descriptive modeling contexts.*
  - **A1.NQ.3** *Choose a level of accuracy appropriate to limitations on measurement when reporting quantities in context.*

2. EQUATIONS AND INEQUALITIES

- **ONE-STEP EQUATIONS AND INEQUALITIES**
  - **A1.AREI.1** *Understand and justify that the steps taken when solving simple equations in one variable create new equations that have the same solution as the original.*

- **MULTI-STEP EQUATIONS AND INEQUALITIES**
  - **A1.ACE.1** *Create and solve equations and inequalities in one variable that model real-world problems involving linear, quadratic, simple rational, and exponential relationships. Interpret the solutions and determine whether they are reasonable. (Limit to linear; quadratic; exponential with integer exponents.)*
  - **A1.AREI.1** *Understand and justify that the steps taken when solving simple equations in one variable create new equations that have the same solution as the original.*
  - **A1.AREI.3** *Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.*

- **AXIOMS OF EQUALITY**
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.AREI.1** *Understand and justify that the steps taken when solving simple equations in one variable create new equations that have the same solution as the original.*

- **LITERAL EQUATIONS**
  - **A1.AREI.3** *Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.*
  - **A1.ACE.4** *Solve literal equations and formulas for a specified variable including equations and formulas that arise in a variety of disciplines.*

3. WRITING EXPRESSIONS AND EQUATIONS

- **FORMULATING AND SIMPLIFYING ALGEBRAIC EXPRESSIONS**
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.ASE.2** *Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.*

- **FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS**
  - **A1.ACE.1** *Create and solve equations and inequalities in one variable that model real-world problems involving linear, quadratic, simple rational, and exponential relationships. Interpret the solutions and determine whether they are reasonable. (Limit to linear; quadratic; exponential with integer exponents.)*
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*

- **FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS**
  - **A1.ACE.1** *Create and solve equations and inequalities in one variable that model real-world problems involving linear, quadratic, simple rational, and exponential relationships. Interpret the solutions and determine whether they are reasonable. (Limit to linear; quadratic; exponential with integer exponents.)*
  - **A1.AREI.3** *Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.*
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*

4. FUNCTIONS

- **FUNCTIONS AND RELATIONS**
  - **A1.FIF.2** *Evaluate functions and interpret the meaning of expressions involving function notation from a mathematical perspective and in terms of the context when the function describes a real-world situation.*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y*

=f(x).

- **A1.FIF.1.b** *Represent a function using function notation and explain that f(x) denotes the output of function f that corresponds to the input x.*
- **A1.FIF.1.a** *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.*
- **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
- **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
- **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*

- **DOMAIN AND RANGE**
  - **A1.FIF.1.a** *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.*
  - **A1.FIF.5** *Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
  - **A1.FIF.1.b** *Represent a function using function notation and explain that f(x) denotes the output of function f that corresponds to the input x.*

- **EVALUATING FUNCTIONS**
  - **A1.FIF.2** *Evaluate functions and interpret the meaning of expressions involving function notation from a mathematical perspective and in terms of the context when the function describes a real-world situation.*
  - **A1.FIF.1.b** *Represent a function using function notation and explain that f(x) denotes the output of function f that corresponds to the input x.*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
  - **A1.FIF.1.a** *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.*

5. GRAPHS OF LINEAR EQUATIONS AND INEQUALITIES

- **SLOPE**
  - **A1.FIF.6** *Given a function in graphical, symbolic, or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
  - **A1.FIF.1.b** *Represent a function using function notation and explain that f(x) denotes the output of function f that corresponds to the input x.*

- **GRAPHING AND ANALYZING LINEAR FUNCTIONS**
  - **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and*

periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)

- **A1.FIF.1.b** *Represent a function using function notation and explain that f(x) denotes the output of function f that corresponds to the input x.*
- **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
- **A1.FIF.5** *Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
- **A1.FIF.1.a** *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.*
- **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*

GRAPHING AND MANIPULATING Y = MX + B

- **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
- **A1.FIF.6** *Given a function in graphical, symbolic, or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
- **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
- **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
- **A1.FLQE.5** *Interpret the parameters in a linear or exponential function in terms of the context. (Limit to linear.)*

GRAPHS OF LINEAR INEQUALITIES

- **A1.AREI.12** *Graph the solutions to a linear inequality in two variables.*
- **A1.AREI.3** *Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.*

6. LINEAR EQUATIONS

SLOPE-INTERCEPT FORM OF A LINEAR EQUATION

- **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
- **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
- **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
- **A1.AREI.10** *Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*

- **A1.FIF.6** *Given a function in graphical, symbolic, or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*

- **POINT-SLOPE FORM OF A LINEAR EQUATION**
  - **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
  - **A1.AREI.10** *Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*

7. TWO-VARIABLE LINEAR SYSTEMS

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: GRAPHING**
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
  - **A1.AREI.10** *Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **A1.AREI.11** *Solve an equation of the form f(x) = g(x) graphically by identifying the x - coordinate(s) of the point(s) of intersection of the graphs of y = f (x) and y = g(x). (Limit to linear; quadratic; exponential.)*

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: SUBSTITUTION**
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
  - **A1.AREI.10** *Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **A1.AREI.6.a** *Solve systems of linear equations using the substitution method.*

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: ELIMINATION**
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
  - **A1.AREI.6.b** *Solve systems of linear equations using linear combination.*

8. LINEAR SYSTEMS

- **SOLVING SYSTEMS OF LINEAR INEQUALITIES**
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
  - **A1.AREI.12** *Graph the solutions to a linear inequality in two variables.*

- **SOLVING THREE-VARIABLE SYSTEMS OF LINEAR EQUATIONS**
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
  - **A1.AREI.5** *Justify that the solution to a system of linear equations is not changed when one of the equations is replaced by a linear combination of the other equation.*

9. EXPONENTIAL FUNCTIONS, EQUATIONS, AND INEQUALITIES

- **EXPONENTIAL FUNCTIONS**
  - **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.FLQE.1.a** *Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.*
  - **A1.FIF.6** *Given a function in graphical, symbolic, or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context. (Limit to linear; quadratic; exponential.)*
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
  - **A1.FLQE.3** *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or more generally as a polynomial function.*
  - **A1.FIF.1.b** *Represent a function using function notation and explain that f(x) denotes the output of function f that corresponds to the input x.*
  - **A1.FIF.5** *Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
  - **A1.FIF.1.a** *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.*
  - **A1.ACE.1** *Create and solve equations and inequalities in one variable that model real-world problems involving linear, quadratic, simple rational, and exponential relationships. Interpret the solutions and determine whether they are reasonable. (Limit to linear; quadratic; exponential with integer exponents.)*
  - **A1.FLQE.5** *Interpret the parameters in a linear or exponential function in terms of the context. (Limit to linear.)*

- **EXPONENTIAL GROWTH AND DECAY**
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.FLQE.1.a** *Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.*
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
  - **A1.FLQE.5** *Interpret the parameters in a linear or exponential function in terms of the context. (Limit to linear.)*
  - **A1.FLQE.3** *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or more generally as a polynomial function.*
  - **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*

- **SOLVING EXPONENTIAL INEQUALITIES**

- **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
- **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
- **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
- **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
- **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*

10. SEQUENCES

- **SEQUENCES**
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*

- **ARITHMETIC AND GEOMETRIC SEQUENCES**
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*

11. POLYNOMIALS

- **POLYNOMIAL BASICS**
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*

- **ADDITION AND SUBTRACTION OF POLYNOMIALS**
  - **A1.AAPR.1** *Add, subtract, and multiply polynomials and understand that polynomials are closed under these operations. (Limit to linear; quadratic.)*
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*

- **MULTIPLICATION OF POLYNOMIALS**
  - **A1.AAPR.1** *Add, subtract, and multiply polynomials and understand that polynomials are closed under these operations. (Limit to linear; quadratic.)*
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*

12. FACTORING

- **FACTORING QUADRATIC TRINOMIALS**
  - **A1.AREI.4.b** *Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a + bi for real numbers a and b. (Limit to non-complex roots.)*
  - **A1.ASE.3.a** *Find the zeros of a quadratic function by rewriting it in equivalent factored form and explain the connection between the zeros of the function, its linear factors, the x-intercepts of its graph, and the solutions to the corresponding quadratic equation.*
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret*

complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)

- **FACTORING SPECIAL CASES**
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.ASE.2** *Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.*

- **FACTORING HIGHER-ORDER POLYNOMIALS**
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.ASE.2** *Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.*

13. GRAPHS OF QUADRATIC FUNCTIONS

- **QUADRATIC FUNCTIONS**
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.ASE.3.a** *Find the zeros of a quadratic function by rewriting it in equivalent factored form and explain the connection between the zeros of the function, its linear factors, the x-intercepts of its graph, and the solutions to the corresponding quadratic equation.*
  - **A1.FIF.8.a** *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.*

- **ANALYZING GRAPHS OF QUADRATIC FUNCTIONS**
  - **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.5** *Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
  - **A1.FIF.1.a** *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.*
  - **A1.FIF.1.b** *Represent a function using function notation and explain that f(x) denotes the output of function f that corresponds to the input x.*
  - **A1.ASE.3.a** *Find the zeros of a quadratic function by rewriting it in equivalent factored form and explain the connection between the zeros of the function, its linear factors, the x-intercepts of its graph, and the solutions to the corresponding quadratic equation.*
  - **A1.FIF.8.a** *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.AREI.4.b** *Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions*

and write them as a + bi for real numbers a and b. (Limit to non-complex roots.)

- **REPRESENTATIONS OF QUADRATIC FUNCTIONS**
  - **A1.AREI.4.a** *Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - h)^2 = k$ that has the same solutions. Derive the quadratic formula from this form.*
  - **A1.ASE.2** *Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.*
  - **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.8.a** *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.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation $y = f(x)$.*
  - **A1.ASE.3.a** *Find the zeros of a quadratic function by rewriting it in equivalent factored form and explain the connection between the zeros of the function, its linear factors, the x-intercepts of its graph, and the solutions to the corresponding quadratic equation.*
  - **A1.ACE.1** *Create and solve equations and inequalities in one variable that model real-world problems involving linear, quadratic, simple rational, and exponential relationships. Interpret the solutions and determine whether they are reasonable. (Limit to linear; quadratic; exponential with integer exponents.)*
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*

14. SOLVING QUADRATIC EQUATIONS

- **SOLVING QUADRATIC EQUATIONS BY FACTORING**
  - **A1.FIF.8.a** *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.AREI.4.b** *Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a + bi for real numbers a and b. (Limit to non-complex roots.)*
  - **A1.ASE.3.a** *Find the zeros of a quadratic function by rewriting it in equivalent factored form and explain the connection between the zeros of the function, its linear factors, the x-intercepts of its graph, and the solutions to the corresponding quadratic equation.*
  - **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation $y = f(x)$.*
  - **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*

- **COMPLETING THE SQUARE**
  - **A1.FIF.8.a** *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.AREI.4.a** *Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - h)^2 = k$ that has the same solutions. Derive the quadratic formula from this form.*
- **A1.AREI.4.b** *Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a + bi for real numbers a and b. (Limit to non-complex roots.)*
- **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
- **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
- **A1.ASE.3.a** *Find the zeros of a quadratic function by rewriting it in equivalent factored form and explain the connection between the zeros of the function, its linear factors, the x-intercepts of its graph, and the solutions to the corresponding quadratic equation.*

- **QUADRATIC FORMULA**
  - **A1.ASE.1** *Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions. (Limit to linear; quadratic; exponential.)*
  - **A1.AREI.4.b** *Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a + bi for real numbers a and b. (Limit to non-complex roots.)*
  - **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation $y = f(x)$.*
  - **A1.ASE.3.a** *Find the zeros of a quadratic function by rewriting it in equivalent factored form and explain the connection between the zeros of the function, its linear factors, the x-intercepts of its graph, and the solutions to the corresponding quadratic equation.*
  - **A1.AREI.4.a** *Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - h)^2 = k$ that has the same solutions. Derive the quadratic formula from this form.*

15. PARENT FUNCTIONS AND TRANSFORMATIONS

- **LINEAR AND EXPONENTIAL PARENT FUNCTIONS**
  - **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.AREI.10** *Explain that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric*

sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)

- **A1.FIF.5** *Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.1.a** *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.*
- **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*

QUADRATIC PARENT FUNCTION

- **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
- **A1.FIF.5** *Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.1.a** *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.*

TRANSFORMATIONS OF THE LINEAR AND EXPONENTIAL PARENT FUNCTIONS

- **A1.FBF.3** *Describe the effect of the transformations kf (x), f(x) + k, f(x + k), and combinations of such transformations on the graph of y = f(x) for any real number k. Find the value of k given the graphs and write the equation of a transformed parent function given its graph. (Limit to linear; quadratic; exponential with integer exponents; vertical shift and vertical stretch.)*
- **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*

TRANSFORMATIONS OF THE QUADRATIC PARENT FUNCTION

- **A1.FBF.3** *Describe the effect of the transformations kf (x), f(x) + k, f(x + k), and combinations of such transformations on the graph of y = f(x) for any real number k. Find the value of k given the graphs and write the equation of a transformed parent function given its graph. (Limit to linear; quadratic; exponential with integer exponents; vertical shift and vertical stretch.)*
- **A1.FIF.5** *Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
- **A1.FIF.1.a** *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.*

16. WORKING WITH FUNCTIONS

LINEAR VERSUS NONLINEAR FUNCTIONS

- **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
- **A1.FIF.6** *Given a function in graphical, symbolic, or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context. (Limit to linear; quadratic; exponential.)*
- **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
- **A1.FLQE.1.a** *Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.*

- **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*

- **MULTIPLE REPRESENTATIONS OF FUNCTIONS**
  - **A1.FIF.9** *Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal. (Limit to linear; quadratic; exponential.)*
  - **A1.FIF.7** *Graph functions from their symbolic representations. Indicate key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. Graph simple cases by hand and use technology for complicated cases. (Limit to linear; quadratic; exponential only in the form $y = a^x + k$.)*
  - **A1.FIF.4** *Interpret key features of a function that models the relationship between two quantities when given in graphical or tabular form. Sketch the graph of a function from a verbal description showing key features. Key features include intercepts; intervals where the function is increasing, decreasing, constant, positive, or negative; relative maximums and minimums; symmetries; end behavior and periodicity. (Limit to linear; quadratic; exponential.)*
  - **A1.ACE.2** *Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales. (Limit to linear; quadratic; exponential with integer exponents; direct and indirect variation.)*
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*
  - **A1.FLQE.1.a** *Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.*

- **ABSOLUTE VALUE FUNCTIONS**
  - **A1.FIF.1.b** *Represent a function using function notation and explain that f(x) denotes the output of function f that corresponds to the input x.*
  - **A1.FIF.1.a** *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.*
  - **A1.FIF.1.c** *Understand that the graph of a function labeled as f is the set of all ordered pairs (x,y) that satisfy the equation y =f(x).*
  - **A1.FBF.3** *Describe the effect of the transformations kf (x), f(x) + k, f(x + k), and combinations of such transformations on the graph of y = f(x) for any real number k. Find the value of k given the graphs and write the equation of a transformed parent function given its graph. (Limit to linear; quadratic; exponential with integer exponents; vertical shift and vertical stretch.)*

- **SYSTEMS OF NONLINEAR EQUATIONS**
  - **A1.AREI.11** *Solve an equation of the form f(x) = g(x) graphically by identifying the x - coordinate(s) of the point(s) of intersection of the graphs of y = f (x) and y = g(x). (Limit to linear; quadratic; exponential.)*
  - **A1.FLQE.2** *Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables. (Limit to linear; exponential.)*

17. STATISTICS

- **SCATTERPLOTS**
  - **A1.SPID.6** *Using technology, create scatterplots and analyze those plots to compare the fit of linear, quadratic, or exponential models to a given data set. Select the appropriate model, fit a function to the data set, and use the function to solve problems in the context of the data.*
  - **A1.SPID.7** *Create a linear function to graphically model data from a real-world problem and interpret the meaning of the slope and intercept(s) in the context of the given problem.*
  - **A1.FIF.6** *Given a function in graphical, symbolic, or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context. (Limit to linear; quadratic; exponential.)*

- **SCATTERPLOTS AND MODELING**
  - **A1.SPID.6** *Using technology, create scatterplots and analyze those plots to compare the fit of linear, quadratic, or exponential models to a given data set. Select the appropriate model, fit a function to the data set, and use the function to solve problems in the context of the data.*

- **A1.SPID.8** *Using technology, compute and interpret the correlation coefficient of a linear fit.*
- **A1.SPID.7** *Create a linear function to graphically model data from a real-world problem and interpret the meaning of the slope and intercept(s) in the context of the given problem.*
- **A1.FLQE.1.a** *Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.*