

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.

## Unit 1: Expressions, Equations, and Inequalities

### • LITERAL EQUATIONS

- A2.ACE.4: Creating Equations Solve literal equations and formulas for a specified variable including equations and formulas that arise in a variety of disciplines.

### • FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS

- A2.ACE.1: Creating Equations 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.
- A2.FLQE.1.b: Linear, Quadratic, and Exponential Distinguish between situations that can be modeled with linear functions or exponential functions by recognizing situations in which one quantity changes at a constant rate per unit interval as opposed to those in which a quantity changes by a constant percent rate per unit interval. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.

- A2.FIF.4: Interpreting Functions 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.
- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- **FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS**
- A2.ACE.1: Creating Equations 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.

## Unit 2: Functions

- **FUNCTIONS AND RELATIONS**
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.
- **DOMAIN AND RANGE**
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.

## Unit 3: Linear Functions, Equations, and Inequalities

- **SLOPE**
- A2.FIF.6: Interpreting Functions 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.
- A2.FIF.4: Interpreting Functions 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.

- **GRAPHING AND ANALYZING LINEAR FUNCTIONS**

- A2.FIF.7: Interpreting Functions 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.
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
- A2.FIF.4: Interpreting Functions 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.

- **GRAPHING AND MANIPULATING  $Y = MX + B$**

- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.6: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.
- A2.FLQE.1.b: Linear, Quadratic, and Exponential Distinguish between situations that can be modeled with linear functions or exponential functions by recognizing situations in which one quantity changes at a constant rate per unit interval as opposed to those in which a quantity

changes by a constant percent rate per unit interval. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

- A2.FLQE.5: Linear, Quadratic, and Exponential Interpret the parameters in a linear or exponential function in terms of the context.

#### Unit 4: Exponential and Logarithmic Functions

##### • EXPONENTIAL FUNCTIONS

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.ASE.3.c: Structure and Expressions 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 transform expressions for exponential functions.
- A2.FIF.8.b: Interpreting Functions Translate between different but equivalent forms of a function equation to reveal and explain different properties of the function. Interpret expressions for exponential functions by using the properties of exponents.
- A2.FIF.6: Interpreting Functions 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.
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
- A2.ACE.1: Creating Equations 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.
- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
- A2.FLQE.5: Linear, Quadratic, and Exponential Interpret the parameters in a linear or exponential function in terms of the context.

##### • EXPONENTIAL GROWTH AND DECAY

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.FIF.8.b: Interpreting Functions Translate between different but equivalent forms of a function equation to reveal and explain different properties of the function. Interpret expressions for exponential functions by using the properties of exponents.
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.
- A2.FLQE.5: Linear, Quadratic, and Exponential Interpret the parameters in a linear or exponential function in terms of the context.
- A2.FLQE.1.b: Linear, Quadratic, and Exponential Distinguish between situations that can be modeled with linear functions or exponential functions by recognizing situations in which one quantity changes at a constant rate per unit interval as opposed to those in which a quantity changes by a constant percent rate per unit interval. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.

- **LOGARITHMIC FUNCTIONS**

- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.

## Unit 5: Exponential Equations and Inequalities

- **SOLVING EXPONENTIAL EQUATIONS**

- A2.ASE.3.c: Structure and Expressions 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 transform expressions for exponential functions.
- A2.FIF.8.b: Interpreting Functions Translate between different but equivalent forms of a function equation to reveal and explain different properties of the function. Interpret expressions for exponential functions by using the properties of exponents.
- A2.FIF.4: Interpreting Functions 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.

- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.

### • SOLVING EXPONENTIAL INEQUALITIES

- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.
- A2.ACE.3: Creating Equations Use systems of equations and inequalities to represent constraints arising in real-world situations. Solve such systems using graphical and analytical methods, including linear programming. Interpret the solution within the context of the situation. (Limit to linear programming.)
- A2.ACE.1: Creating Equations 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.
- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
- A2.FIF.4: Interpreting Functions 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.

## Unit 6: Polynomials

### • POLYNOMIAL BASICS

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.

### • ADDITION AND SUBTRACTION OF POLYNOMIALS

- A2.AAPR.1: Arithmetic with Polynomials and Rational Expressions Add, subtract, and multiply polynomials and understand that polynomials are closed under these operations.
- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.

### • MULTIPLICATION OF POLYNOMIALS

- A2.AAPR.1: Arithmetic with Polynomials and Rational Expressions Add, subtract, and multiply polynomials and understand that polynomials are closed under these operations.
- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.

- **DIVISION OF POLYNOMIALS**

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.

## Unit 7: Comparing and Combining Functions

- **ARITHMETIC OPERATIONS ON FUNCTIONS**

- A2.FBF.1.a: Building Functions Write a function that describes a relationship between two quantities. Write a function that models a relationship between two quantities using both explicit expressions and a recursive process and by combining standard forms using addition, subtraction, multiplication and division to build new functions.
- A2.FBF.1.b: Building Functions Write a function that describes a relationship between two quantities. Combine functions using the operations addition, subtraction, multiplication, and division to build new functions that describe the relationship between two quantities in mathematical and real-world situations.

- **LINEAR VERSUS NONLINEAR FUNCTIONS**

- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.6: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.FLQE.1.b: Linear, Quadratic, and Exponential Distinguish between situations that can be modeled with linear functions or exponential functions by recognizing situations in which one

quantity changes at a constant rate per unit interval as opposed to those in which a quantity changes by a constant percent rate per unit interval. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.

- **MULTIPLE REPRESENTATIONS OF FUNCTIONS**

- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
- A2.FIF.7: Interpreting Functions 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.
- A2.FIF.9: Interpreting Functions Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal.
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.

## Unit 8: Graphs and Representations of Quadratic Functions

- **ANALYZING GRAPHS OF QUADRATIC FUNCTIONS**

- A2.FIF.7: Interpreting Functions 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.
- A2.FIF.9: Interpreting Functions Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
- A2.FIF.4: Interpreting Functions 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.
- A2.AAPR.3: Arithmetic with Polynomials and Rational Expressions Graph polynomials identifying zeros when suitable factorizations are available and indicating end behavior. Write a polynomial function of least degree corresponding to a given graph. (Limit to polynomials with degrees 3 or less.)



- A2.AREI.4.b: Reasoning with Equations and Inequalities Solve mathematical and real-world problems involving quadratic equations in one variable. 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  $b$ .

- **REPRESENTATIONS OF QUADRATIC FUNCTIONS**

- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.FIF.9: Interpreting Functions Compare properties of two functions given in different representations such as algebraic, graphical, tabular, or verbal.
- A2.AAPR.3: Arithmetic with Polynomials and Rational Expressions Graph polynomials identifying zeros when suitable factorizations are available and indicating end behavior. Write a polynomial function of least degree corresponding to a given graph. (Limit to polynomials with degrees 3 or less.)
- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
- A2.ACE.3: Creating Equations Use systems of equations and inequalities to represent constraints arising in real-world situations. Solve such systems using graphical and analytical methods, including linear programming. Interpret the solution within the context of the situation. (Limit to linear programming.)

## Unit 9: Solving Quadratic Equations

- **SOLVING QUADRATIC FUNCTIONS WITH FACTORING**

- A2.AREI.4.b: Reasoning with Equations and Inequalities Solve mathematical and real-world problems involving quadratic equations in one variable. 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  $b$ .
- A2.AAPR.3: Arithmetic with Polynomials and Rational Expressions Graph polynomials identifying zeros when suitable factorizations are available and indicating end behavior. Write a polynomial function of least degree corresponding to a given graph. (Limit to polynomials with degrees 3 or less.)

- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
- A2.FBF.1.a: Building Functions Write a function that describes a relationship between two quantities. Write a function that models a relationship between two quantities using both explicit expressions and a recursive process and by combining standard forms using addition, subtraction, multiplication and division to build new functions.
- **QUADRATIC FORMULA**
  - A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
  - A2.AREI.4.b: Reasoning with Equations and Inequalities Solve mathematical and real-world problems involving quadratic equations in one variable. 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  $b$ .
  - A2.FIF.4: Interpreting Functions 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.
  - A2.FIF.7: Interpreting Functions 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.
- **COMPLETING THE SQUARE**
  - A2.AREI.4.b: Reasoning with Equations and Inequalities Solve mathematical and real-world problems involving quadratic equations in one variable. 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  $b$ .

- A2.ASE.3.b: Structure and Expressions Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Determine the maximum or minimum value of a quadratic function by completing the square.
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.

#### • **COMPLEX NUMBERS AND QUADRATIC FUNCTIONS**

- A2.AREI.4.b: Reasoning with Equations and Inequalities Solve mathematical and real-world problems involving quadratic equations in one variable. 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  $b$ .
- A2.NCNS.1: Complex Number System Know there is a complex number such that  $i = \sqrt{-1}$ , and every complex number has the form  $a + bi$  with  $a$  and  $b$  real.
- A2.NCNS.1: Complex Number System Know there is a complex number such that  $i = \sqrt{-1}$ , and every complex number has the form  $a + bi$  with  $a$  and  $b$  real.

### Unit 10: Factoring Polynomials and the Factor Theorem

#### • **FACTORING SPECIAL CASES**

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.
- A2.AAPR.3: Arithmetic with Polynomials and Rational Expressions Graph polynomials identifying zeros when suitable factorizations are available and indicating end behavior. Write a polynomial function of least degree corresponding to a given graph. (Limit to polynomials with degrees 3 or less.)

#### • **FACTORING CUBIC POLYNOMIALS**

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being

composed of simpler expressions.

- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.
- A2.AAPR.3: Arithmetic with Polynomials and Rational Expressions Graph polynomials identifying zeros when suitable factorizations are available and indicating end behavior. Write a polynomial function of least degree corresponding to a given graph. (Limit to polynomials with degrees 3 or less.)

#### • **FACTORING HIGHER-ORDER POLYNOMIALS**

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.AAPR.3: Arithmetic with Polynomials and Rational Expressions Graph polynomials identifying zeros when suitable factorizations are available and indicating end behavior. Write a polynomial function of least degree corresponding to a given graph. (Limit to polynomials with degrees 3 or less.)
- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.

### Unit 11: Polynomial Functions and Polynomial Identities

#### • **GRAPHS OF POLYNOMIAL FUNCTIONS**

- A2.AAPR.3: Arithmetic with Polynomials and Rational Expressions Graph polynomials identifying zeros when suitable factorizations are available and indicating end behavior. Write a polynomial function of least degree corresponding to a given graph. (Limit to polynomials with degrees 3 or less.)
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.

#### • **COMPLEX NUMBERS**

- A2.NCNS.1: Complex Number System Know there is a complex number such that  $i = \sqrt{-1}$ , and every complex number has the form  $a + bi$  with  $a$  and  $b$  real.

#### • **POLYNOMIAL IDENTITIES**

- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.

- A2.AREI.4.b: Reasoning with Equations and Inequalities Solve mathematical and real-world problems involving quadratic equations in one variable. 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  $b$ .

- **POLYNOMIAL IDENTITIES AND COMPLEX NUMBERS**

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.
- A2.AREI.4.b: Reasoning with Equations and Inequalities Solve mathematical and real-world problems involving quadratic equations in one variable. 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  $b$ .
- A2.NCNS.1: Complex Number System Know there is a complex number such that  $i = \sqrt{-1}$ , and every complex number has the form  $a + bi$  with  $a$  and  $b$  real.

## Unit 12: Radical and Rational Expressions, Equations, and Functions

- **ANALYZING GRAPHS OF SQUARE ROOT FUNCTIONS**

- A2.FBF.3: Building Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.

- **SOLVING SQUARE ROOT EQUATIONS**

- A2.AREI.2: Reasoning with Equations and Inequalities Solve simple rational and radical equations in one variable and understand how extraneous solutions may arise.

- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.

### Unit 13: Rational Expressions, Equations, and Functions

#### • OPERATIONS WITH RATIONAL EXPRESSIONS

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.ASE.2: Structure and Expressions Analyze the structure of binomials, trinomials, and other polynomials in order to rewrite equivalent expressions.

#### • ANALYZING GRAPHS OF RATIONAL FUNCTIONS

- A2.FBF.3: Building Functions 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.
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.

#### • SOLVING RATIONAL EQUATIONS

- A2.FIF.4: Interpreting Functions 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.

- A2.AREI.2: Reasoning with Equations and Inequalities Solve simple rational and radical equations in one variable and understand how extraneous solutions may arise.

- **MODELING SITUATIONS WITH RATIONAL FUNCTIONS**

- A2.ASE.1: Structure and Expressions Interpret the meanings of coefficients, factors, terms, and expressions based on their real-world contexts. Interpret complicated expressions as being composed of simpler expressions.
- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
- A2.ACE.3: Creating Equations Use systems of equations and inequalities to represent constraints arising in real-world situations. Solve such systems using graphical and analytical methods, including linear programming. Interpret the solution within the context of the situation. (Limit to linear programming.)
- A2.AREI.2: Reasoning with Equations and Inequalities Solve simple rational and radical equations in one variable and understand how extraneous solutions may arise.
- A2.FIF.4: Interpreting Functions 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.

## Unit 14: Parent Functions and Transformations

- **PARENT FUNCTIONS**

- A2.FBF.3: Building Functions 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.
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.

- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.

- **TRANSFORMATIONS OF PARENT FUNCTIONS**

- A2.FBF.3: Building Functions 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.
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.7: Interpreting Functions 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.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.

- **MULTIPLE TRANSFORMATIONS OF PARENT FUNCTIONS**

- A2.FBF.3: Building Functions 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.
- A2.FIF.4: Interpreting Functions 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.
- A2.FIF.5: Interpreting Functions Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
- A2.FIF.7: Interpreting Functions 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.

## Unit 15: Systems of Equations

- **SOLVING THREE-VARIABLE SYSTEMS OF LINEAR EQUATIONS**



- A2.ACE.2: Creating Equations Create equations in two or more variables to represent relationships between quantities. Graph the equations on coordinate axes using appropriate labels, units, and scales.
- A2.ACE.3: Creating Equations Use systems of equations and inequalities to represent constraints arising in real-world situations. Solve such systems using graphical and analytical methods, including linear programming. Interpret the solution within the context of the situation. (Limit to linear programming.)

- **SYSTEMS OF NONLINEAR EQUATIONS**

- A2.ACE.3: Creating Equations Use systems of equations and inequalities to represent constraints arising in real-world situations. Solve such systems using graphical and analytical methods, including linear programming. Interpret the solution within the context of the situation. (Limit to linear programming.)
- A2.AREI.7: Reasoning with Equations and Inequalities Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. Understand that such systems may have zero, one, two, or infinitely many solutions. (Limit to linear equations and quadratic functions.)
- A2.AREI.11: Reasoning with Equations and Inequalities 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  $y = g(x)$ .
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.

## Unit 16: Sequences

- **SEQUENCES**

- A2.FBF.2: Building Functions Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
- A2.FBF.1.a: Building Functions Write a function that describes a relationship between two quantities. Write a function that models a relationship between two quantities using both explicit expressions and a recursive process and by combining standard forms using addition, subtraction, multiplication and division to build new functions.
- A2.FIF.3: Interpreting Functions Define functions recursively and recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
- A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.

- **ARITHMETIC AND GEOMETRIC SEQUENCES**

- A2.FBF.2: Building Functions Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

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- A2.FBF.1.a: Building Functions Write a function that describes a relationship between two quantities. Write a function that models a relationship between two quantities using both explicit expressions and a recursive process and by combining standard forms using addition, subtraction, multiplication and division to build new functions.
  - A2.FIF.3: Interpreting Functions Define functions recursively and recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
  - A2.FLQE.2: Linear, Quadratic, and Exponential Create symbolic representations of linear and exponential functions, including arithmetic and geometric sequences, given graphs, verbal descriptions, and tables.
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