Kentucky Tutorials are designed specifically for the Kentucky Academic Standards to prepare students for the K-PREP, EOC exams, ACT, and ACT Plan.

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: Precision, Accuracy, and Literal Equations

- **MONITORING PRECISION AND ACCURACY**
  - KY.HS.N.5: Define appropriate units in context for the purpose of descriptive modeling.
  - KY.HS.N.6: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
  - KY.HS.N.4.a: Use units in context as a way to understand problems and to guide the solution of multi-step problems; Choose and interpret units consistently in formulas;
  - KY.HS.N.4.b: Use units in context as a way to understand problems and to guide the solution of multi-step problems; Choose and interpret the scale and the origin in graphs and data displays.
  - KY.HS.G.8.a: Create and apply geometric constructions. Make formal geometric constructions with a variety of tools and methods.
- **LITERAL EQUATIONS**
  - KY.HS.A.18: Solve linear equations and inequalities in one variable, including literal equations with coefficients represented by letters.
  - KY.HS.A.15: Rearrange formulas to solve a literal equation, highlighting a quantity of interest, using the same reasoning as in solving equations.

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- KY.HS.A.12: Create equations and inequalities in one variable and use them to solve problems.
- KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.

Unit 2: Writing and Solving Equations and Inequalities

- **FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS**
  - KY.HS.F.6.a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
  - KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  - KY.HS.F.11.b: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
  - KY.HS.A.12: Create equations and inequalities in one variable and use them to solve problems.
  - KY.HS.A.18: Solve linear equations and inequalities in one variable, including literal equations with coefficients represented by letters.
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.A.1.a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors and coefficients.
- **FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS**
  - KY.HS.A.18: Solve linear equations and inequalities in one variable, including literal equations with coefficients represented by letters.
  - KY.HS.A.14: Create a system of equations or inequalities to represent constraints within a modeling context. Interpret the solution(s) to the corresponding system as viable or nonviable options within the context.
  - KY.HS.A.12: Create equations and inequalities in one variable and use them to solve problems.

Unit 3: Functions

- **FUNCTIONS AND RELATIONS**
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.F.1.b: Understand properties and key features of functions and the different ways functions can be represented. Using appropriate function notation, evaluate functions for inputs in their domains

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and interpret statements that use function notation in terms of a context.

- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- KY.HS.F.4.f: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph piecewise functions, including step functions.

- **DOMAIN AND RANGE**
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
  - KY.HS.F.1.d: Understand properties and key features of functions and the different ways functions can be represented. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .

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- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .

- **INVERSE FUNCTIONS**
  - KY.HS.F.9.c: Find inverse functions. Read values of an inverse function from a graph or a table, given that the function has an inverse.
  - KY.HS.F.9.d: Find inverse functions. Produce an invertible function from a non-invertible function by restricting the domain.
  - KY.HS.F.9.a: Find inverse functions. Given the equation of an invertible function, find the inverse.

Unit 4: Linear Functions, Equations, and Inequalities

- **SLOPE**
  - KY.HS.F.3.a: Understand average rate of change of a function over an interval. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.
  - KY.HS.F.3.b: Understand average rate of change of a function over an interval. Estimate the rate of change from a graph.
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.G.22: Justify and apply the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
- **GRAPHING AND ANALYZING LINEAR FUNCTIONS**
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
  - KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a

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table).

- KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
- KY.HS.F.4.a: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph linear and quadratic functions and show intercepts, maxima and minima.
- KY.HS.F.1.b: Understand properties and key features of functions and the different ways functions can be represented. Using appropriate function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context.
- KY.HS.F.14: Interpret the parameters in a linear or exponential function in terms of a context.
- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- KY.HS.F.1.d: Understand properties and key features of functions and the different ways functions can be represented. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- KY.HS.A.23: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.
- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- KY.HS.F.4.d: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph exponential and logarithmic functions, showing intercepts and end behavior.
- KY.HS.F.13: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

- **GRAPHING AND MANIPULATING Y = MX + B**
  - KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  - KY.HS.A.13: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
  - KY.HS.F.3.a: Understand average rate of change of a function over an interval. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified

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interval.

- KY.HS.F.4.a: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph linear and quadratic functions and show intercepts, maxima and minima.
- KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
- KY.HS.SP.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- KY.HS.F.14: Interpret the parameters in a linear or exponential function in terms of a context.
- KY.HS.F.11.b: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

Unit 5: Exponential Functions

- **EXPONENTIAL FUNCTIONS**
  - KY.HS.A.1.a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors and coefficients.
  - KY.HS.F.11.a: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize and justify that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
  - KY.HS.F.5.b: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions and classify the exponential function as representing growth or decay.
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  - KY.HS.F.3.a: Understand average rate of change of a function over an interval. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.
  - KY.HS.F.13: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the

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range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .

- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- KY.HS.F.1.d: Understand properties and key features of functions and the different ways functions can be represented. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- KY.HS.F.14: Interpret the parameters in a linear or exponential function in terms of a context.
- KY.HS.F.6.a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- KY.HS.A.13: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- KY.HS.F.11.c: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- KY.HS.A.12: Create equations and inequalities in one variable and use them to solve problems.

- **EXPONENTIAL GROWTH AND DECAY**
  - KY.HS.F.14: Interpret the parameters in a linear or exponential function in terms of a context.
  - KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  - KY.HS.A.1.a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors and coefficients.
  - KY.HS.F.11.a: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize and justify that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
  - KY.HS.F.11.c: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
  - KY.HS.A.1.b: Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions, given a context, by viewing one or more of their parts as a single entity.
  - KY.HS.F.5.b: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions and classify the exponential function as representing growth or decay.

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- KY.HS.F.13: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- KY.HS.A.3.c: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Use the properties of exponents to rewrite exponential expressions.
- KY.HS.F.11.b: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- KY.HS.F.4.d: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph exponential and logarithmic functions, showing intercepts and end behavior.

Unit 6: Logarithmic Expressions, Equations, and Functions

- **LOGARITHMIC FUNCTIONS**
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.F.9.c: Find inverse functions. Read values of an inverse function from a graph or a table, given that the function has an inverse.
  - KY.HS.F.10: Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents with the use of technology.
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
  - KY.HS.F.4.d: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph exponential and logarithmic functions, showing intercepts and end behavior.
- **EVALUATING LOGARITHMIC EXPRESSIONS**
  - KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
  - KY.HS.A.1.a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors and coefficients.
- **SOLVING LOGARITHMIC EQUATIONS**
  - KY.HS.F.10: Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents with the use of technology.

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- KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
- KY.HS.A.16: Understand each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Unit 7: Simplifying, Adding, and Subtracting Polynomial Expressions

- **POLYNOMIAL BASICS**
  - KY.HS.A.3.a: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Write the standard form of a given polynomial and identify the terms, coefficients, degree, leading coefficient and constant term.
  - KY.HS.A.1.a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors and coefficients.
- **ADDITION AND SUBTRACTION OF POLYNOMIALS**
  - KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
  - KY.HS.A.5: Add, subtract and multiply polynomials.

Unit 8: Multiplying Polynomial Expressions and Composing Functions

- **MULTIPLICATION OF POLYNOMIALS**
  - KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
  - KY.HS.A.5: Add, subtract and multiply polynomials.
  - KY.HS.A.3.a: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Write the standard form of a given polynomial and identify the terms, coefficients, degree, leading coefficient and constant term.
- **ARITHMETIC OPERATIONS ON FUNCTIONS**
  - KY.HS.F.6.b: Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations.

Unit 9: Graphs and Representations of Quadratic Functions

- **ANALYZING GRAPHS OF QUADRATIC FUNCTIONS**
  - KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
  - KY.HS.F.1.b: Understand properties and key features of functions and the different ways functions can be represented. Using appropriate function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context.

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- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- KY.HS.F.1.d: Understand properties and key features of functions and the different ways functions can be represented. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
- KY.HS.F.4.a: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph linear and quadratic functions and show intercepts, maxima and minima.
- KY.HS.F.5.a: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Identify zeros, extreme values and symmetry of the graph within the context of a quadratic function.
- KY.HS.A.23: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.
- KY.HS.A.7: Identify roots of polynomials when suitable factorizations are available. Know these roots become the zeros (-intercepts) for the corresponding polynomial function.
- KY.HS.F.1.e: Understand properties and key features of functions and the different ways functions can be represented. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

- **REPRESENTATIONS OF QUADRATIC FUNCTIONS**
  - KY.HS.A.19.b: Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation in into an equation of the form ( ) = that has the same solutions. Derive the quadratic formula from this form.
  - KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.A.23: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.
  - KY.HS.A.13: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

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- KY.HS.F.1.b: Understand properties and key features of functions and the different ways functions can be represented. Using appropriate function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context.
- KY.HS.F.6.a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
- KY.HS.A.3.b: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Factor a quadratic expression to reveal the zeros of the function it defines.

- **MULTIPLE REPRESENTATIONS OF FUNCTIONS**
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  - KY.HS.F.1.b: Understand properties and key features of functions and the different ways functions can be represented. Using appropriate function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context.
  - KY.HS.F.1.e: Understand properties and key features of functions and the different ways functions can be represented. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
  - KY.HS.F.11.a: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize and justify that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.

Unit 10: Solving Quadratic Equations

- **SOLVING QUADRATIC EQUATIONS BY FACTORING**
  - KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
  - KY.HS.F.5.a: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Identify zeros, extreme values and symmetry of the graph within the context of a quadratic function.

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- KY.HS.A.3.b: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Factor a quadratic expression to reveal the zeros of the function it defines.
- KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
- KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
- KY.HS.A.7: Identify roots of polynomials when suitable factorizations are available. Know these roots become the zeros (-intercepts) for the corresponding polynomial function.
- KY.HS.A.8: Prove polynomial identities and use them to describe numerical relationships.
- KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
- KY.HS.A.7: Identify roots of polynomials when suitable factorizations are available. Know these roots become the zeros (-intercepts) for the corresponding polynomial function.
- KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
- KY.HS.A.7: Identify roots of polynomials when suitable factorizations are available. Know these roots become the zeros (-intercepts) for the corresponding polynomial function.
- KY.HS.F.4.a: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph linear and quadratic functions and show intercepts, maxima and minima.
- KY.HS.F.6.a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.

- **COMPLETING THE SQUARE**
  - KY.HS.A.19.b: Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation in into an equation of the form ( ) = that has the same solutions. Derive the quadratic formula from this form.
  - KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .

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- KY.HS.A.3.d: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- KY.HS.A.19.c: Solve quadratic equations in one variable. Solve quadratic equations by completing the square.
- KY.HS.A.19.b: Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation in into an equation of the form ( ) = that has the same solutions. Derive the quadratic formula from this form.
- KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
- KY.HS.A.19.b: Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation in into an equation of the form ( ) = that has the same solutions. Derive the quadratic formula from this form.
- KY.HS.F.4.a: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph linear and quadratic functions and show intercepts, maxima and minima.
- KY.HS.F.5.a: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Identify zeros, extreme values and symmetry of the graph within the context of a quadratic function.

Unit 11: Quadratic Formula and Complex Numbers

- **QUADRATIC FORMULA**
  - KY.HS.A.1.a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors and coefficients.
  - KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
  - KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
  - KY.HS.N.9: Solve quadratic equations with real coefficients that have complex solutions.
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, the quadratic formula and factoring, as appropriate to the initial form of the equation.

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Recognize when the quadratic formula gives complex solutions and write them as for real numbers and .

- KY.HS.F.5.a: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Identify zeros, extreme values and symmetry of the graph within the context of a quadratic function.
- KY.HS.F.6.a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- KY.HS.F.1.b: Understand properties and key features of functions and the different ways functions can be represented. Using appropriate function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context.
- KY.HS.A.14: Create a system of equations or inequalities to represent constraints within a modeling context. Interpret the solution(s) to the corresponding system as viable or nonviable options within the context.
- KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .

- **COMPLEX NUMBERS AND QUADRATIC FUNCTIONS**
  - KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
  - KY.HS.N.9: Solve quadratic equations with real coefficients that have complex solutions.
  - KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .
  - KY.HS.A.19.a: Solve quadratic equations in one variable. Solve quadratic equations by taking square roots, 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 for real numbers and .

Unit 12: Factoring Special Cases and Cubic Polynomials

- **FACTORING SPECIAL CASES**
  - KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
  - KY.HS.A.1.a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors and coefficients.

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- KY.HS.A.1.b: Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions, given a context, by viewing one or more of their parts as a single entity.
- KY.HS.A.8: Prove polynomial identities and use them to describe numerical relationships.

- **FACTORING CUBIC POLYNOMIALS**
  - KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.
  - KY.HS.A.13: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
  - KY.HS.A.8: Prove polynomial identities and use them to describe numerical relationships.

Unit 13: Polynomial Functions and Complex Numbers

- **GRAPHS OF POLYNOMIAL FUNCTIONS**
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.F.4.c: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph polynomial functions, identifying zeros when suitable factorizations are available and showing end behavior.
- **COMPLEX NUMBERS**
  - KY.HS.N.7.a: Understanding properties of complex numbers. Know there is a complex number such that = -1 and every complex number has the form + with and real.
  - KY.HS.N.7.b: Understanding properties of complex numbers. Use the relation = 1 and the commutative, associative and distributive properties to add, subtract and multiply complex numbers.
  - KY.HS.N.10.1: Extend polynomial identities to the complex numbers. When multiplying complex binomials, students recognize and understand the value of i as -1 and fluently simplify each polynomial appropriately navigating between the real number system and complex numbers. One example of this might be that students should understand that it would be appropriate to rewrite + 4 as (+ 2)(2).
  - KY.HS.N.7.b: Understanding properties of complex numbers. Use the relation = 1 and the commutative, associative and distributive properties to add, subtract and multiply complex numbers.
  - KY.HS.N.10.1: Extend polynomial identities to the complex numbers. When multiplying complex binomials, students recognize and understand the value of i as -1 and fluently simplify each polynomial appropriately navigating between the real number system and complex numbers. One example of this might be that students should understand that it would be appropriate to rewrite + 4 as (+ 2)(2).
  - KY.HS.N.7.a: Understanding properties of complex numbers. Know there is a complex number such that = -1 and every complex number has the form + with and real.

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- KY.HS.N.7.b: Understanding properties of complex numbers. Use the relation = 1 and the commutative, associative and distributive properties to add, subtract and multiply complex numbers.
- KY.HS.N.10.1: Extend polynomial identities to the complex numbers. When multiplying complex binomials, students recognize and understand the value of i as -1 and fluently simplify each polynomial appropriately navigating between the real number system and complex numbers. One example of this might be that students should understand that it would be appropriate to rewrite + 4 as (+ 2)(2).
- KY.HS.N.7.b: Understanding properties of complex numbers. Use the relation = 1 and the commutative, associative and distributive properties to add, subtract and multiply complex numbers.
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- KY.HS.N.7.b: Understanding properties of complex numbers. Use the relation = 1 and the commutative, associative and distributive properties to add, subtract and multiply complex numbers.
- KY.HS.N.10.1: Extend polynomial identities to the complex numbers. When multiplying complex binomials, students recognize and understand the value of i as -1 and fluently simplify each polynomial appropriately navigating between the real number system and complex numbers. One example of this might be that students should understand that it would be appropriate to rewrite + 4 as (+ 2)(2).
- KY.HS.N.7.b: Understanding properties of complex numbers. Use the relation = 1 and the commutative, associative and distributive properties to add, subtract and multiply complex numbers.
- KY.HS.N.10.1: Extend polynomial identities to the complex numbers. When multiplying complex binomials, students recognize and understand the value of i as -1 and fluently simplify each polynomial appropriately navigating between the real number system and complex numbers. One example of this might be that students should understand that it would be appropriate to rewrite + 4 as (+ 2)(2).

Unit 14: Radical Expressions, Equations, and Functions

- **ANALYZING GRAPHS OF SQUARE ROOT FUNCTIONS**
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.G.4.c: Understand the effects of transformations of geometric figures. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure. Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

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- KY.HS.F.8.b: Understand the effects of transformations on the graph of a function. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
- KY.HS.F.4.b: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph square root, cube root and absolute value functions.
- KY.HS.F.9.c: Find inverse functions. Read values of an inverse function from a graph or a table, given that the function has an inverse.
- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .

- **SOLVING SQUARE ROOT EQUATIONS**
  - KY.HS.A.17.b: Solve and justify equations in one variable. Justify the solutions and give examples showing how extraneous solutions may arise. Solve radical equations in one variable.
  - KY.HS.A.16: Understand each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
  - KY.HS.F.6.a: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.
  - KY.HS.A.13: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
  - KY.HS.F.1.b: Understand properties and key features of functions and the different ways functions can be represented. Using appropriate function notation, evaluate functions for inputs in their domains and interpret statements that use function notation in terms of a context.

Unit 15: Rational Expressions and Equations

- **OPERATIONS WITH RATIONAL EXPRESSIONS**
  - KY.HS.A.11: Add, subtract, multiply and divide rational algebraic expressions.
  - KY.HS.A.1.a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors and coefficients.
  - KY.HS.A.2: Use the structure of an expression to identify ways to rewrite it and consistently look for opportunities to rewrite expressions in equivalent forms.

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- KY.HS.A.10: Rewrite simple rational expressions in different forms.

- **SOLVING RATIONAL EQUATIONS**
  - KY.HS.A.16: Understand each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
  - KY.HS.A.17.a: Solve and justify equations in one variable. Justify the solutions and give examples showing how extraneous solutions may arise. Solve rational equations written as proportions in one variable.
  - KY.HS.A.14: Create a system of equations or inequalities to represent constraints within a modeling context. Interpret the solution(s) to the corresponding system as viable or nonviable options within the context.

Unit 16: Nonlinear Functions

- **LINEAR VERSUS NONLINEAR FUNCTIONS**
  - KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  - KY.HS.F.11.a: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize and justify that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
  - KY.HS.F.3.a: Understand average rate of change of a function over an interval. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.
  - KY.HS.F.13: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
  - KY.HS.F.3.b: Understand average rate of change of a function over an interval. Estimate the rate of change from a graph.
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.F.11.b: Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

- **ABSOLUTE VALUE FUNCTIONS**
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .

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- KY.HS.F.1.d: Understand properties and key features of functions and the different ways functions can be represented. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- KY.HS.F.4.f: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph piecewise functions, including step functions.
- KY.HS.F.4.b: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph square root, cube root and absolute value functions.

Unit 17: Parent Functions and Transformations

- **PARENT FUNCTIONS**
  - KY.HS.F.1.c: Understand properties and key features of functions and the different ways functions can be represented. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship.
  - KY.HS.F.4.b: Graph functions expressed symbolically and show key features of the graph, with and without using technology (computer, graphing calculator). Graph square root, cube root and absolute value functions.
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
  - KY.HS.F.1.d: Understand properties and key features of functions and the different ways functions can be represented. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
  - KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  - KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- **TRANSFORMATIONS OF PARENT FUNCTIONS**
  - KY.HS.F.8.b: Understand the effects of transformations on the graph of a function. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
  - KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.

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- KY.HS.G.2.b: Representing transformations in the plane. Compare transformations that preserve distance and angle measures to those that do not.
- KY.HS.G.4.c: Understand the effects of transformations of geometric figures. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure. Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
- KY.HS.F.1.a: Understand properties and key features of functions and the different ways functions can be represented. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If is a function and is an element of its domain, then () denotes the output of corresponding to the input .
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.

- **MULTIPLE TRANSFORMATIONS OF PARENT FUNCTIONS**
  - KY.HS.G.4.c: Understand the effects of transformations of geometric figures. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure. Given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
  - KY.HS.F.8.b: Understand the effects of transformations on the graph of a function. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
  - KY.HS.G.2.a: Representing transformations in the plane. Describe transformations as functions that take points in the plane as inputs and give other points as outputs.
  - KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
  - KY.HS.G.2.b: Representing transformations in the plane. Compare transformations that preserve distance and angle measures to those that do not.
  - KY.HS.G.4.b: Understand the effects of transformations of geometric figures. Specify a sequence of transformations that will carry a given figure onto another.

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- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.
- KY.HS.F.8.a: Understand the effects of transformations on the graph of a function. Identify the effect on the graph of replacing () by () + , (), (), and (+) for specific values of (both positive and negative); find the value of given the graphs.

Unit 18: Systems of Equations

- **SOLVING THREE-VARIABLE SYSTEMS OF LINEAR EQUATIONS**
  - KY.HS.A.20.a: Solve systems of linear equations in two variables. Understand a system of two equations in two variables has the same solution as a new system formed by replacing one of the original equations with an equivalent equation.
  - KY.HS.A.13: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
  - KY.HS.A.14: Create a system of equations or inequalities to represent constraints within a modeling context. Interpret the solution(s) to the corresponding system as viable or nonviable options within the context.
  - KY.HS.A.24: Justify that the solutions of the equations () = () are the -coordinates of the points where the graphs of = () and = () intersect. Find the approximate solutions graphically, using technology or tables.
- **SYSTEMS OF NONLINEAR EQUATIONS**
  - KY.HS.A.24: Justify that the solutions of the equations () = () are the -coordinates of the points where the graphs of = () and = () intersect. Find the approximate solutions graphically, using technology or tables.
  - KY.HS.A.21: Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
  - KY.HS.A.20.a: Solve systems of linear equations in two variables. Understand a system of two equations in two variables has the same solution as a new system formed by replacing one of the original equations with an equivalent equation.
  - KY.HS.A.14: Create a system of equations or inequalities to represent constraints within a modeling context. Interpret the solution(s) to the corresponding system as viable or nonviable options within the context.

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- KY.HS.A.24: Justify that the solutions of the equations () = () are the -coordinates of the points where the graphs of = () and = () intersect. Find the approximate solutions graphically, using technology or tables.
- KY.HS.F.12: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- KY.HS.A.24: Justify that the solutions of the equations () = () are the -coordinates of the points where the graphs of = () and = () intersect. Find the approximate solutions graphically, using technology or tables.

Unit 19: Statistics

- **DATA ANALYSIS**
  - KY.HS.SP.1: Represent the distribution of data with plots on the real number line (stem plots, dot plots, histograms and box plots).
  - KY.HS.SP.2: Use statistics appropriate to the shape of the numerical data distribution to compare center (median, mean) and spread (interquartile range when comparing medians and standard deviation when comparing means) of different data distributions.
  - KY.HS.SP.3: Interpret differences in shape, center and spread in the context of the distributions of the numerical data, accounting for the presence and possible effects of extreme data points (outliers).
- **FREQUENCY TABLES**
  - KY.HS.SP.5: Summarize categorical data for two or more categories in frequency tables. Calculate and interpret joint, marginal and conditional relative frequencies (probabilities) in the context of the data, recognizing possible associations and trends in the data.
  - KY.HS.SP.17: Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide whether events are independent and to approximate conditional probabilities.

Unit 20: Statistical Design and Analysis

- **ANALYZING STATISTICAL SAMPLES**
  - KY.HS.SP.9: Understand statistics as a process for making inferences and justifying conclusions about population parameters based on a random sample from that population.
  - KY.HS.SP.10: Decide if a specified model is consistent with the results from a simulation.
  - KY.HS.SP.12: Use data from a sample survey to estimate a population mean or proportion and explain how bias may be involved in the process.
- **EXPERIMENTAL AND OBSERVATIONAL DESIGN**
  - KY.HS.SP.11: Recognize the purposes of and differences among sample surveys, experiments and observational studies; explain how randomization relates to each.
- **CONCLUSIONS IN DATA**

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- KY.HS.SP.13: Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between estimates or statistics are significant.
- KY.HS.SP.9: Understand statistics as a process for making inferences and justifying conclusions about population parameters based on a random sample from that population.

Unit 21: Basic Probability Concepts

- **INTRODUCTION TO PROBABILITY**
  - KY.HS.SP.15.b: Understand the concept of independence. Determine whether two events are independent and provide a justification to support the decision.
  - KY.HS.SP.15.a: Understand the concept of independence. Understand that two events are independent if the probability of and occurring together is the product of their individual probabilities, () ()
  - KY.HS.SP.18: Apply the General Multiplication Rule, ( ) = ()() = ()(), in a uniform probability model and interpret the answer in terms of the model.
  - KY.HS.SP.14.2: Describe events as subsets of a sample space. Use characteristics (or categories) of the outcomes, such as, as unions, , that are non-mutually exclusive events and
  - KY.HS.SP.14.1: Describe events as subsets of a sample space. Use characteristics (or categories) of the outcomes, such as, as unions, , that are mutually exclusive events and
  - KY.HS.SP.14.4: Describe events as subsets of a sample space. Use characteristics (or categories) of the outcomes, such as, as complements of other events, not A.
  - KY.HS.SP.15.a: Understand the concept of independence. Understand that two events are independent if the probability of and occurring together is the product of their individual probabilities, () ()
  - KY.HS.SP.14.3: Describe events as subsets of a sample space. Use characteristics (or categories) of the outcomes, such as, as intersections, , and
  - KY.HS.SP.18: Apply the General Multiplication Rule, ( ) = ()() = ()(), in a uniform probability model and interpret the answer in terms of the model.
  - KY.HS.SP.15.c: Understand the concept of independence. Recognize and explain the concept of independence in everyday language and everyday situations.
  - KY.HS.SP.18: Apply the General Multiplication Rule, ( ) = ()() = ()(), in a uniform probability model and interpret the answer in terms of the model.
  - KY.HS.SP.19.b: Use permutations and combinations to compute probabilities. Perform calculations using the appropriate counting technique, including simple probabilities.
- **COMBINATIONS AND PERMUTATIONS**
  - KY.HS.SP.19.c: Use permutations and combinations to compute probabilities. Use permutations and combinations to compute probabilities of compound events and solve problems.
  - KY.HS.SP.19.a: Use permutations and combinations to compute probabilities. Distinguish between situations that can be modeled using counting techniques, including Fundamental Counting Principle, permutations and combinations.

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- KY.HS.SP.19.b: Use permutations and combinations to compute probabilities. Perform calculations using the appropriate counting technique, including simple probabilities.

- **CONDITIONAL PROBABILITY**
  - KY.HS.SP.16.a: Understand the concept of conditional probability. Understand the conditional probability of given as ( )/().
  - KY.HS.SP.16.d: Understand the concept of conditional probability. Find the conditional probability of given as the fraction of s outcomes that also belong to and interpret the answer in terms of the model.
  - KY.HS.SP.16.c: Understand the concept of conditional probability. Recognize and explain the concept of conditional probability in everyday language and everyday situations.
  - KY.HS.SP.15.b: Understand the concept of independence. Determine whether two events are independent and provide a justification to support the decision.
  - KY.HS.SP.15.a: Understand the concept of independence. Understand that two events are independent if the probability of and occurring together is the product of their individual probabilities, () ()
  - KY.HS.SP.15.c: Understand the concept of independence. Recognize and explain the concept of independence in everyday language and everyday situations.
  - KY.HS.SP.16.a: Understand the concept of conditional probability. Understand the conditional probability of given as ( )/().
  - KY.HS.SP.16.d: Understand the concept of conditional probability. Find the conditional probability of given as the fraction of s outcomes that also belong to and interpret the answer in terms of the model.
  - KY.HS.SP.16.b: Understand the concept of conditional probability. Interpret independence of and as saying that the conditional probability of given is the same as the probability of and the conditional probability of given is the same as the probability of .
  - KY.HS.SP.5: Summarize categorical data for two or more categories in frequency tables. Calculate and interpret joint, marginal and conditional relative frequencies (probabilities) in the context of the data, recognizing possible associations and trends in the data.
  - KY.HS.SP.17: Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide whether events are independent and to approximate conditional probabilities.
  - KY.HS.SP.16.a: Understand the concept of conditional probability. Understand the conditional probability of given as ( )/().
  - KY.HS.SP.16.d: Understand the concept of conditional probability. Find the conditional probability of given as the fraction of s outcomes that also belong to and interpret the answer in terms of the model.
  - KY.HS.SP.16.b: Understand the concept of conditional probability. Interpret independence of and as saying that the conditional probability of given is the same as the probability of and the conditional

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probability of given is the same as the probability of .

- KY.HS.SP.16.a: Understand the concept of conditional probability. Understand the conditional probability of given as ( )/().
- KY.HS.SP.16.d: Understand the concept of conditional probability. Find the conditional probability of given as the fraction of s outcomes that also belong to and interpret the answer in terms of the model.
- KY.HS.SP.16.a: Understand the concept of conditional probability. Understand the conditional probability of given as ( )/().
- KY.HS.SP.16.d: Understand the concept of conditional probability. Find the conditional probability of given as the fraction of s outcomes that also belong to and interpret the answer in terms of the model.

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