

OHEOC Tutorials for Ohio are designed specifically for the Ohio Learning Standards to prepare students for the Ohio End Of Course assessments. EOC Categories are at the heart of OHEOC Tutorial structure – bringing category-based learning to the student experience, and category-based performance and progress tracking to the teacher experience.

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.

Test-Taking Strategies for EOC Tutorials allow students to practice and apply learning approaches that will hone their test-taking skills and focus them for success on the day of their EOC test.

### Unit 1: Real Number System

#### • MONITORING PRECISION AND ACCURACY

- OH.Math.HSN.Q.1: Quantities Reason quantitatively and use units to solve problems. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- OH.Math.HSN.Q.2: Quantities Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.
- OH.Math.HSN.Q.3: Quantities Reason quantitatively and use units to solve problems. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

### Unit 2: Equations and Inequalities

- **ONE-STEP EQUATIONS AND INEQUALITIES**

- OH.Math.HSA.CED.1a: Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.1b: Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems. Focus on applying simple quadratic expressions.
- OH.Math.HSA.REI.3: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

- **MULTI-STEP EQUATIONS AND INEQUALITIES**

- OH.Math.HSA.CED.1a: Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.1b: Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems. Focus on applying simple quadratic expressions.
- OH.Math.HSA.REI.3: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

- **AXIOMS OF EQUALITY**

- OH.Math.HSA.REI.1: Reasoning with Equations and Inequalities Understand solving equations as a process of reasoning and explain the reasoning. Explain 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.

- **LITERAL EQUATIONS**

- OH.Math.HSA.REI.3: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- OH.Math.HSA.CED.4a: Creating Equations Create equations that describe numbers or relationships. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. Focus on formulas in which the variable of interest is linear or square.

### Unit 3: Writing Expressions and Equations

- **FORMULATING AND SIMPLIFYING ALGEBRAIC EXPRESSIONS**

- OH.Math.HSA.SSE.1a: Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.

- OH.Math.HSA.SSE.2: Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
- **FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS**
- OH.Math.HSA.CED.1a: Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.1b: Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems. Focus on applying simple quadratic expressions.
- **FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS**
- OH.Math.HSA.CED.1a: Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.1b: Creating Equations Create equations that describe numbers or relationships. Create equations and inequalities in one variable and use them to solve problems. Focus on applying simple quadratic expressions.

#### Unit 4: Functions

- **FUNCTIONS AND RELATIONS**
- OH.Math.HSF.IF.2: Interpreting Functions Understand the concept of a function, and use function notation. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- OH.Math.HSF.IF.1: Interpreting Functions Understand the concept of a function, and use function notation. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .
- **DOMAIN AND RANGE**
- OH.Math.HSF.IF.5b: Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear, quadratic, and exponential functions.
- **EVALUATING FUNCTIONS**
- OH.Math.HSF.IF.2: Interpreting Functions Understand the concept of a function, and use function notation. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

#### Unit 5: Graphs of Linear Functions

- **SLOPE**

- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.
- **GRAPHING AND ANALYZING LINEAR FUNCTIONS**
- OH.Math.HSF.LE.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.

## Unit 6: Linear Functions

- **GRAPHING AND MANIPULATING  $Y = MX + B$**
- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.
- OH.Math.HSF.LE.5: Linear, Quadratic, and Exponential Models Interpret expressions for functions in terms of the situation they model. Interpret the parameters in a linear or exponential function in terms of a context.
- OH.Math.HSF.LE.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- OH.Math.HSF.IF.7a: Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. Graph linear functions and indicate intercepts.
- OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.

## Unit 7: Linear Equations

- **SLOPE-INTERCEPT FORM OF A LINEAR EQUATION**

- OH.Math.HSA.REI.10: Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
- OH.Math.HSF.LE.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- OH.Math.HSF.IF.7a: Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. Graph linear functions and indicate intercepts.

- **POINT-SLOPE FORM OF A LINEAR EQUATION**

- OH.Math.HSA.REI.10: Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
- OH.Math.HSF.LE.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- OH.Math.HSF.IF.7a: Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. Graph linear functions and indicate intercepts.

## Unit 8: Two-Variable Linear Systems

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: GUESS AND CHECK**

- OH.Math.HSA.CED.3a: Creating Equations Create equations that describe numbers or relationships. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.
- OH.Math.HSA.REI.6a: Reasoning with Equations and Inequalities Solve systems of equations. Solve systems of linear equations algebraically and graphically. Limit to pairs of linear equations in two variables.

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: GRAPHING**

- OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.
- OH.Math.HSA.CED.3a: Creating Equations Create equations that describe numbers or relationships. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.
- OH.Math.HSA.REI.11: Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. Explain why the  $x$ -coordinates of the points where the graphs of the equation  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, making tables of values, or finding successive approximations.
- OH.Math.HSA.REI.6a: Reasoning with Equations and Inequalities Solve systems of equations. Solve systems of linear equations algebraically and graphically. Limit to pairs of linear equations in two variables.
- **SOLVING SYSTEMS OF LINEAR EQUATIONS: SUBSTITUTION**
  - OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.
  - OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.
  - OH.Math.HSA.CED.3a: Creating Equations Create equations that describe numbers or relationships. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.
  - OH.Math.HSA.REI.6a: Reasoning with Equations and Inequalities Solve systems of equations. Solve systems of linear equations algebraically and graphically. Limit to pairs of linear equations in two variables.
- **SOLVING SYSTEMS OF LINEAR EQUATIONS: ELIMINATION**
  - OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph

equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.

- OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.
- OH.Math.HSA.CED.3a: Creating Equations Create equations that describe numbers or relationships. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.
- OH.Math.HSA.REI.5: Reasoning with Equations and Inequalities Solve systems of equations. Verify that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
- OH.Math.HSA.REI.6a: Reasoning with Equations and Inequalities Solve systems of equations. Solve systems of linear equations algebraically and graphically. Limit to pairs of linear equations in two variables.

## Unit 9: Linear Inequalities

### • GRAPHS OF LINEAR INEQUALITIES

- OH.Math.HSA.CED.3a: Creating Equations Create equations that describe numbers or relationships. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.
- OH.Math.HSA.REI.12: Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

### • SOLVING SYSTEMS OF LINEAR INEQUALITIES

- OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.
- OH.Math.HSA.CED.3a: Creating Equations Create equations that describe numbers or relationships. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. While functions will

often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.

- OH.Math.HSA.REI.12: Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

## Unit 10: Exponential Functions, Equations, and Inequalities

### • EXPONENTIAL FUNCTIONS

- OH.Math.HSA.SSE.1b: Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.
- OH.Math.HSA.SSE.3c: Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Use the properties of exponents to transform expressions for exponential functions.
- OH.Math.HSF.IF.8b.i: Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions. Focus on exponential functions evaluated at integer inputs.
- OH.Math.HSF.LE.5: Linear, Quadratic, and Exponential Models Interpret expressions for functions in terms of the situation they model. Interpret the parameters in a linear or exponential function in terms of a context.
- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.
- OH.Math.HSF.IF.7e: Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. Graph simple exponential functions, indicating intercepts and end behavior.
- OH.Math.HSF.LE.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

### • EXPONENTIAL GROWTH AND DECAY

- OH.Math.HSA.SSE.1b: Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.



- OH.Math.HSF.LE.5: Linear, Quadratic, and Exponential Models Interpret expressions for functions in terms of the situation they model. Interpret the parameters in a linear or exponential function in terms of a context.
- OH.Math.HSF.IF.8b.i: Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions. Focus on exponential functions evaluated at integer inputs.
- OH.Math.HSF.LE.3: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
- OH.Math.HSF.LE.1a: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
- OH.Math.HSF.LE.1b: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- OH.Math.HSF.LE.1c: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.
- OH.Math.HSF.LE.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **SOLVING EXPONENTIAL INEQUALITIES**
- OH.Math.HSF.LE.1c: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

- OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.

## Unit 11: Sequences

### • SEQUENCES

- OH.Math.HSF.IF.3: Interpreting Functions Understand the concept of a function, and use function notation. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
- OH.Math.HSF.BF.2: Building Functions Build a function that models a relationship between two quantities. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
- OH.Math.HSF.LE.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- OH.Math.HSF.BF.1a.i: Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from context. Focus on linear and exponential functions.
- OH.Math.HSF.BF.1a.ii: Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from context. Focus on situations that exhibit quadratic or exponential relationships.

### • ARITHMETIC AND GEOMETRIC SEQUENCES

- OH.Math.HSF.BF.2: Building Functions Build a function that models a relationship between two quantities. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
- OH.Math.HSF.IF.3: Interpreting Functions Understand the concept of a function, and use function notation. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
- OH.Math.HSF.LE.2: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

- OH.Math.HSF.BF.1a.i: Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from context. Focus on linear and exponential functions.
- OH.Math.HSF.BF.1a.ii: Building Functions Build a function that models a relationship between two quantities. Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from context. Focus on situations that exhibit quadratic or exponential relationships.

## Unit 12: Polynomials

- **POLYNOMIAL BASICS**

- OH.Math.HSA.SSE.1a: Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.

- **ADDITION AND SUBTRACTION OF POLYNOMIALS**

- OH.Math.HSA.APR.1a: Arithmetic with Polynomials and Rational Expressions Perform arithmetic operations on polynomials. Understand that polynomials form a system analogous to the integers, namely, that they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Focus on polynomial expressions that simplify to forms that are linear or quadratic.

- **MULTIPLICATION OF POLYNOMIALS**

- OH.Math.HSA.APR.1a: Arithmetic with Polynomials and Rational Expressions Perform arithmetic operations on polynomials. Understand that polynomials form a system analogous to the integers, namely, that they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. Focus on polynomial expressions that simplify to forms that are linear or quadratic.

## Unit 13: Factoring

- **FACTORING QUADRATIC TRINOMIALS**

- OH.Math.HSA.SSE.3a: Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Factor a quadratic expression to reveal the zeros of the function it defines.
- OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for  $x = 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.
- OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for  $x = 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.

- **FACTORING SPECIAL CASES**

- OH.Math.HSA.SSE.2: Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.
- OH.Math.HSA.SSE.1b: Seeing Structure in Expressions Interpret the structure of expressions. Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity.

- **FACTORING HIGHER-ORDER POLYNOMIALS**

- OH.Math.HSA.SSE.2: Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.

### Unit 14: Quadratic Functions

- **QUADRATIC FUNCTIONS**

- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.

### Unit 15: Graphs of Quadratic Functions

- **ANALYZING GRAPHS OF QUADRATIC FUNCTIONS**

- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.
- OH.Math.HSF.IF.5b: Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear, quadratic, and exponential functions.
- OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for  $x = 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.
- OH.Math.HSF.IF.7b: Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. Graph quadratic functions and indicate intercepts, maxima, and minima.

- **REPRESENTATIONS OF QUADRATIC FUNCTIONS**

- OH.Math.HSA.SSE.2: Seeing Structure in Expressions Interpret the structure of expressions. Use the structure of an expression to identify ways to rewrite it.

- OH.Math.HSA.REI.4a: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. 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  $(x - h)^2 = k$  that has the same solutions.
- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.
- OH.Math.HSF.IF.8a.i: Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. Focus on completing the square to quadratic functions with the leading coefficient of 1.
- OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.
- OH.Math.HSA.SSE.3a: Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Factor a quadratic expression to reveal the zeros of the function it defines.

## Unit 16: Solving Quadratic Equations

### • SOLVING QUADRATIC EQUATIONS BY FACTORING

- OH.Math.HSA.SSE.3a: Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Factor a quadratic expression to reveal the zeros of the function it defines.
- OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for  $x^2 = 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.
- OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for  $x^2 = 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.
- OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to

the initial form of the equation by inspection, e.g., for  $x^2 + 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.

- OH.Math.HSF.IF.8a.i: Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. Focus on completing the square to quadratic functions with the leading coefficient of 1.
- OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for  $x^2 + 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.
- **COMPLETING THE SQUARE**
  - OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for  $x^2 + 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.
  - OH.Math.HSA.SSE.3b: Seeing Structure in Expressions Write expressions in equivalent forms to solve problems. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
  - OH.Math.HSF.IF.7b: Interpreting Functions Analyze functions using different representations. Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate. Graph quadratic functions and indicate intercepts, maxima, and minima.
  - OH.Math.HSF.IF.8a.i: Interpreting Functions Analyze functions using different representations. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. Focus on completing the square to quadratic functions with the leading coefficient of 1.
  - OH.Math.HSA.REI.4a: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation in  $ax^2 + bx + c = 0$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions.
- **QUADRATIC FORMULA**
  - OH.Math.HSA.REI.4a: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation in  $ax^2 + bx + c = 0$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions.
  - OH.Math.HSA.REI.4b: Reasoning with Equations and Inequalities Solve equations and inequalities in one variable. Solve quadratic equations in one variable. Solve quadratic equations as appropriate to

the initial form of the equation by inspection, e.g., for  $a = 49$ ; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.

- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.

## Unit 17: Parent Functions and Transformations

### • LINEAR AND EXPONENTIAL PARENT FUNCTIONS

- OH.Math.HSF.IF.5b: Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear, quadratic, and exponential functions.
- OH.Math.HSA.REI.10: Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

### • QUADRATIC PARENT FUNCTION

- OH.Math.HSF.IF.5b: Interpreting Functions Interpret functions that arise in applications in terms of the context. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear, quadratic, and exponential functions.

### • TRANSFORMATIONS OF THE QUADRATIC PARENT FUNCTION

- OH.Math.HSF.BF.3a: Building Functions Build new functions from existing functions. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $f(x) - k$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. Focus on transformations of graphs of quadratic functions, except for  $f(x) = a(x - h)^2 + k$ .

## Unit 18: Advanced Systems of Equations

### • SOLVING THREE-VARIABLE SYSTEMS OF LINEAR EQUATIONS

- OH.Math.HSA.CED.3a: Creating Equations Create equations that describe numbers or relationships. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.
- OH.Math.HSA.REI.5: Reasoning with Equations and Inequalities Solve systems of equations. Verify that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

### • SYSTEMS OF NONLINEAR EQUATIONS

- OH.Math.HSA.REI.7: Reasoning with Equations and Inequalities Solve systems of equations. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically

and graphically.

- OH.Math.HSA.REI.11: Reasoning with Equations and Inequalities Represent and solve equations and inequalities graphically. Explain why the  $x$ -coordinates of the points where the graphs of the equation  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, making tables of values, or finding successive approximations.

## Unit 19: Working with Functions

### • INVERSE FUNCTIONS

- OH.Math.HSF.BF.4a: Building Functions Build new functions from existing functions. Find inverse functions. Informally determine the input of a function when the output is known.

### • LINEAR VERSUS NONLINEAR FUNCTIONS

- OH.Math.HSF.LE.1a: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
- OH.Math.HSF.LE.1b: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- OH.Math.HSF.LE.1c: Linear, Quadratic, and Exponential Models Construct and compare linear, quadratic, and exponential models, and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- OH.Math.HSF.IF.9b: Interpreting Functions Analyze functions using different representations. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Focus on linear, quadratic, and exponential functions.
- OH.Math.HSF.IF.4b: Interpreting Functions Interpret functions that arise in applications in terms of the context. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Focus on linear, quadratic, and exponential functions.

## Unit 20: Representations of Functions

### • MULTIPLE REPRESENTATIONS OF FUNCTIONS

- OH.Math.HSA.CED.2a: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Focus on applying linear and simple exponential expressions.
- OH.Math.HSA.CED.2b: Creating Equations Create equations that describe numbers or relationships. Create equations in two or more variables to represent relationships between quantities; graph



equations on coordinate axes with labels and scales. Focus on applying simple quadratic expressions.

- OH.Math.HSF.IF.9b: Interpreting Functions Analyze functions using different representations. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Focus on linear, quadratic, and exponential functions.

## Unit 21: Statistics

### • DATA ANALYSIS

- OH.Math.HSS.ID.1: Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on a single count or measurement variable. Represent data with plots on the real number line (dot plots, histograms, and box plots) in the context of real-world applications using the GAISE model.
- OH.Math.HSS.ID.2: Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on a single count or measurement variable. In the context of real-world applications by using the GAISE model, use statistics appropriate to the shape of the data distribution to compare center (median and mean) and spread (mean absolute deviation, interquartile range, and standard deviation) of two or more different data sets.
- OH.Math.HSS.ID.3: Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on a single count or measurement variable. In the context of real-world applications by using the GAISE model, interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

### • FREQUENCY TABLES

- OH.Math.HSS.ID.5: Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

## Unit 22: Scatterplots

### • SCATTERPLOTS

- OH.Math.HSS.ID.7: Interpreting Categorical and Quantitative Data Interpret linear models. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- OH.Math.HSS.ID.6c: Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a linear function for a scatterplot that suggests a linear association.
- OH.Math.HSS.ID.8: Interpreting Categorical and Quantitative Data Interpret linear models. Compute (using technology) and interpret the correlation coefficient of a linear fit.

### • SCATTERPLOTS AND MODELING

- OH.Math.HSS.ID.6c: Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a linear function for a scatterplot that suggests a linear association.
- OH.Math.HSS.ID.8: Interpreting Categorical and Quantitative Data Interpret linear models. Compute (using technology) and interpret the correlation coefficient of a linear fit.
- OH.Math.HSS.ID.7: Interpreting Categorical and Quantitative Data Interpret linear models. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

### Unit 23: Test-Taking Strategies

- **STUDY HABITS**
- **BEING PREPARED AND GETTING STARTED**
- **WORDING IN TEST QUESTIONS**
- **WORDING IN ANSWER CHOICES**
- **QUESTIONS WITH PASSAGES AND VISUAL DATA**
- **ESSAY AND SHORT ANSWER QUESTIONS**
- **WORD PROBLEMS**