Ohio Tutorials are designed specifically for the Ohio Learning Standards to prepare students for the Ohio State Tests and end-of-course exams.

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 through focused content, guided analysis, 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 concentrate 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: Solving Equations

- **ONE-STEP EQUATIONS AND INEQUALITIES**
  - OH.Math.HSA.CED.1: Create equations and inequalities in one variable and use them to solve problems.
  - OH.Math.HSA.CED.1a: 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: Create equations and inequalities in one variable and use them to solve problems. Focus on applying simple quadratic expressions.
  - OH.Math.HSA.REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  - OH.Math.HSA.CED.3a: 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.1: 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.

- **MULTI-STEP EQUATIONS AND INEQUALITIES**
  - OH.Math.HSA.CED.1a: 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: Create equations and inequalities in one variable and use them to solve problems. Focus on applying simple quadratic expressions.
  - OH.Math.HSA.CED.3a: 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.1: 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.
  - OH.Math.HSA.REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  - OH.Math.HSA.CED.3: 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.
  - OH.Math.HSA.CED.1c: Create equations and inequalities in one variable and use them to solve problems. Extend to include more complicated function situations with the option to solve with technology.

Unit 2: Properties of Equality

- **AXIOMS OF EQUALITY**
  - OH.Math.HSA.REI.1: 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.
  - OH.Math.HSA.REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  - OH.Math.HSA.SSE.2: Use the structure of an expression to identify ways to rewrite it.
- **LITERAL EQUATIONS**
  - OH.Math.HSA.CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
  - OH.Math.HSA.REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  - OH.Math.HSA.CED.1a: 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.4b: 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.

- OH.Math.HSA.CED.4c: 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.
- OH.Math.HSA.CED.4d: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.
- OH.Math.HSA.SSE.1b: 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.CED.4a: 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 Equations and Inequalities & Understanding Units

- **FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS**
  - OH.Math.HSA.SSE.1a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
  - OH.Math.HSF.LE.2: 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.LE.1b: 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.HSA.CED.1a: 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: Create equations and inequalities in one variable and use them to solve problems. Focus on applying simple quadratic expressions.
  - OH.Math.HSA.CED.2a: 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.HSF.IF.4a: 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 and exponential functions.
  - OH.Math.HSF.IF.4b: 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.BF.1a.i: 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.HSA.CED.3: 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.
- OH.Math.HSA.CED.3a: 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.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- OH.Math.HSA.CED.1c: Create equations and inequalities in one variable and use them to solve problems. Extend to include more complicated function situations with the option to solve with technology.
- OH.Math.HSA.CED.1: Create equations and inequalities in one variable and use them to solve problems.

- **FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS**
  - OH.Math.HSA.CED.3: 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.
  - OH.Math.HSA.REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  - OH.Math.HSA.CED.1a: 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: Create equations and inequalities in one variable and use them to solve problems. Focus on applying simple quadratic expressions.
  - OH.Math.HSA.CED.1c: Create equations and inequalities in one variable and use them to solve problems. Extend to include more complicated function situations with the option to solve with technology.
  - OH.Math.HSA.CED.3a: 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.SSE.1a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
- **MONITORING PRECISION AND ACCURACY**
  - OH.Math.HSN.Q.1: 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: Define appropriate quantities for the purpose of descriptive modeling.

- OH.Math.HSN.Q.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Unit 4: Functions

- **FUNCTIONS AND RELATIONS**
  - OH.Math.HSF.IF.2: 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.4: 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.
  - OH.Math.HSF.IF.4b: 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.5c: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Emphasize the selection of a type of function for a model based on behavior of data and context.
  - OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
  - OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
  - OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
  - OH.Math.HSF.LE.2: 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.7c: 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 square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- **DOMAIN AND RANGE**
  - OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().

- OH.Math.HSF.IF.5c: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Emphasize the selection of a type of function for a model based on behavior of data and context.
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.5b: 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.HSF.IF.5a: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear and exponential functions.
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().

- **EVALUATING FUNCTIONS**
  - OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().

- OH.Math.HSF.IF.2: 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: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().

Unit 5: Graphing Linear Equations and Inequalities

- **GRAPHING AND ANALYZING LINEAR FUNCTIONS**
  - OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
  - OH.Math.HSF.LE.2: 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.2: 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.4: 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.
  - OH.Math.HSF.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
  - OH.Math.HSF.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
  - OH.Math.HSF.IF.7a: 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: 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.HSF.BF.1a.i: 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.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.4a: 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 and exponential functions.
- OH.Math.HSF.IF.5b: 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.HSF.IF.5a: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear and exponential functions.
- OH.Math.HSA.REI.10: 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.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.4b: 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 MANIPULATING Y = MX + B**
  - OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
  - OH.Math.HSF.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
  - OH.Math.HSF.LE.2: 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: 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: 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.HSF.IF.4b: 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.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
- OH.Math.HSS.ID.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- OH.Math.HSA.REI.10: 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.IF.4: 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.
- OH.Math.HSF.IF.4a: 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 and exponential functions.
- OH.Math.HSF.IF.5a: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear and exponential functions.
- OH.Math.HSF.LE.1b: 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.BF.1a.i: 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.HSA.CED.2b: 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.

- **GRAPHS OF LINEAR INEQUALITIES**
  - OH.Math.HSA.CED.3: 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.
  - OH.Math.HSA.REI.12: 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.
  - OH.Math.HSA.CED.3a: 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.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
  - OH.Math.HSA.CED.1a: Create equations and inequalities in one variable and use them to solve problems. Focus on applying linear and simple exponential expressions.

Unit 6: Linear Equations

- **SLOPE**
  - OH.Math.HSF.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
  - OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
  - OH.Math.HSG.GPE.5: Justify the slope criteria for parallel and perpendicular lines, and use them to solve geometric problems, e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point.
  - OH.Math.HSA.CED.2a: 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.HSF.IF.4b: 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.
- **SLOPE-INTERCEPT FORM OF A LINEAR EQUATION**

- OH.Math.HSS.ID.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- OH.Math.HSA.REI.10: 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.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.LE.2: 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: 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: 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.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSG.GPE.5: Justify the slope criteria for parallel and perpendicular lines, and use them to solve geometric problems, e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point.
- OH.Math.HSA.SSE.1a: Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.
- OH.Math.HSF.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- OH.Math.HSF.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.

- **POINT-SLOPE FORM OF A LINEAR EQUATION**
  - OH.Math.HSA.REI.10: 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.IF.1: 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 . The graph of is the graph of the equation = ().

- OH.Math.HSF.LE.2: 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: 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: 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.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSG.GPE.5: Justify the slope criteria for parallel and perpendicular lines, and use them to solve geometric problems, e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point.

Unit 7: Points, Lines, and Angles

- **POINTS, RAYS, LINE SEGMENTS, LINES, AND FIGURES**
  - OH.Math.HSG.CO.1: Know precise definitions of ray, angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and arc length.
  - OH.Math.HSG.CO.14: Classify two-dimensional figures in a hierarchy based on properties.
  - OH.Math.HSG.MG.1: Use geometric shapes, their measures, and their properties to describe objects, e.g., modeling a tree trunk or a human torso as a cylinder.
- **PARALLEL AND PERPENDICULAR LINES**
  - OH.Math.HSG.GPE.5: Justify the slope criteria for parallel and perpendicular lines, and use them to solve geometric problems, e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point.
  - OH.Math.HSG.CO.1: Know precise definitions of ray, angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and arc length.
- **PERPENDICULAR BISECTOR AND ANGLE BISECTOR THEOREMS**
  - OH.Math.HSG.CO.1: Know precise definitions of ray, angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and arc length.

- OH.Math.HSG.CO.9: Prove and apply theorems about lines and angles.
- OH.Math.HSG.CO.10: Prove and apply theorems about triangles.

Unit 8: Coordinate Geometry

- **LENGTH AND THE DISTANCE FORMULA**
  - OH.Math.HSG.GPE.6: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
  - OH.Math.HSG.GPE.7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
  - OH.Math.HSG.MG.1: Use geometric shapes, their measures, and their properties to describe objects, e.g., modeling a tree trunk or a human torso as a cylinder.
  - OH.Math.HSG.CO.1: Know precise definitions of ray, angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and arc length.
- **PERIMETER ON THE COORDINATE PLANE**
  - OH.Math.HSG.GPE.7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
  - OH.Math.HSG.MG.1: Use geometric shapes, their measures, and their properties to describe objects, e.g., modeling a tree trunk or a human torso as a cylinder.
  - OH.Math.HSG.GPE.4: Use coordinates to prove simple geometric theorems algebraically and to verify geometric relationships algebraically, including properties of special triangles, quadrilaterals, and circles.
- **AREA ON THE COORDINATE PLANE**
  - OH.Math.HSG.GPE.5: Justify the slope criteria for parallel and perpendicular lines, and use them to solve geometric problems, e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point.
  - OH.Math.HSG.GPE.7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
  - OH.Math.HSG.MG.1: Use geometric shapes, their measures, and their properties to describe objects, e.g., modeling a tree trunk or a human torso as a cylinder.

Unit 9: Transformations in Geometry

- **DILATIONS, TRANSLATIONS, ROTATIONS, AND REFLECTIONS**
  - OH.Math.HSG.CO.2: Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not, e.g., translation versus horizontal stretch.
  - OH.Math.HSG.CO.6: 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.

- OH.Math.HSG.CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- OH.Math.HSG.CO.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using items such as graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
- OH.Math.HSG.GMD.5: Understand how and when changes to the measures of a figure (lengths or angles) result in similar and non-similar figures.
- OH.Math.HSG.CO.3b: Identify the symmetries of a figure, which are the rotations and reflections that carry it onto itself. Identify figures that have rotational symmetry; determine the angle of rotation, and use rotational symmetry to analyze properties of shapes.
- OH.Math.HSG.SRT.1a: Verify experimentally the properties of dilations given by a center and a scale factor: A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged.
- OH.Math.HSG.SRT.1b: Verify experimentally the properties of dilations given by a center and a scale factor: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
- OH.Math.HSG.SRT.2: Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

- **TRANSFORMATIONS ON THE COORDINATE PLANE**
  - OH.Math.HSG.CO.2: Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not, e.g., translation versus horizontal stretch.
  - OH.Math.HSG.CO.6: 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.
  - OH.Math.HSG.CO.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using items such as graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
  - OH.Math.HSG.GMD.5: Understand how and when changes to the measures of a figure (lengths or angles) result in similar and non-similar figures.
  - OH.Math.HSG.CO.3b: Identify the symmetries of a figure, which are the rotations and reflections that carry it onto itself. Identify figures that have rotational symmetry; determine the angle of rotation, and use rotational symmetry to analyze properties of shapes.
  - OH.Math.HSG.CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

- OH.Math.HSG.SRT.2: Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
- OH.Math.HSG.SRT.1a: Verify experimentally the properties of dilations given by a center and a scale factor: A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged.
- OH.Math.HSG.CO.3a: Identify the symmetries of a figure, which are the rotations and reflections that carry it onto itself. Identify figures that have line symmetry; draw and use lines of symmetry to analyze properties of shapes.
- OH.Math.HSG.SRT.1b: Verify experimentally the properties of dilations given by a center and a scale factor: The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

Unit 10: Congruence Transformations

- **TRIANGLES AND CONGRUENCE TRANSFORMATIONS**
  - OH.Math.HSG.CO.6: 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.
  - OH.Math.HSG.CO.7: Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
  - OH.Math.HSG.CO.8: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
  - OH.Math.HSG.CO.10: Prove and apply theorems about triangles.
  - OH.Math.HSG.SRT.5: Use congruence and similarity criteria for triangles to solve problems and to justify relationships in geometric figures that can be decomposed into triangles.
- **CONGRUENCE OF OTHER POLYGONS**
  - OH.Math.HSG.MG.1: Use geometric shapes, their measures, and their properties to describe objects, e.g., modeling a tree trunk or a human torso as a cylinder.
  - OH.Math.HSG.CO.6: 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.
  - OH.Math.HSG.CO.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using items such as graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
  - OH.Math.HSG.CO.3a: Identify the symmetries of a figure, which are the rotations and reflections that carry it onto itself. Identify figures that have line symmetry; draw and use lines of symmetry to analyze properties of shapes.

- OH.Math.HSG.CO.2: Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not, e.g., translation versus horizontal stretch.
- OH.Math.HSG.GPE.4: Use coordinates to prove simple geometric theorems algebraically and to verify geometric relationships algebraically, including properties of special triangles, quadrilaterals, and circles.
- OH.Math.HSG.CO.3b: Identify the symmetries of a figure, which are the rotations and reflections that carry it onto itself. Identify figures that have rotational symmetry; determine the angle of rotation, and use rotational symmetry to analyze properties of shapes.

Unit 11: Triangles

- **TRIANGLE ANGLE THEOREMS**
  - OH.Math.HSG.CO.10: Prove and apply theorems about triangles.
  - OH.Math.HSG.SRT.4: Prove and apply theorems about triangles.
- **TRIANGLE BISECTORS**
  - OH.Math.HSG.CO.9: Prove and apply theorems about lines and angles.
  - OH.Math.HSG.CO.10: Prove and apply theorems about triangles.
  - OH.Math.HSG.SRT.4: Prove and apply theorems about triangles.
  - OH.Math.HSG.SRT.5: Use congruence and similarity criteria for triangles to solve problems and to justify relationships in geometric figures that can be decomposed into triangles.
  - OH.Math.HSG.CO.12: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
  - OH.Math.HSG.C.3: Construct the inscribed and circumscribed circles of a triangle; prove and apply the property that opposite angles are supplementary for a quadrilateral inscribed in a circle.
- **MEDIANS AND ALTITUDES OF TRIANGLES**
  - OH.Math.HSG.CO.10: Prove and apply theorems about triangles.

Unit 12: Quadrilaterals

- **PARALLELOGRAMS AND RECTANGLES**
  - OH.Math.HSG.CO.11: Prove and apply theorems about parallelograms.
  - OH.Math.HSG.CO.14: Classify two-dimensional figures in a hierarchy based on properties.
  - OH.Math.HSG.MG.1: Use geometric shapes, their measures, and their properties to describe objects, e.g., modeling a tree trunk or a human torso as a cylinder.
- **SQUARES AND RHOMBI**
  - OH.Math.HSG.CO.11: Prove and apply theorems about parallelograms.

- OH.Math.HSG.CO.14: Classify two-dimensional figures in a hierarchy based on properties.
- OH.Math.HSG.MG.1: Use geometric shapes, their measures, and their properties to describe objects, e.g., modeling a tree trunk or a human torso as a cylinder.

Unit 13: Conjectures and Constructions

- **CONJECTURES IN COORDINATE GEOMETRY**
  - OH.Math.HSG.CO.2: Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not, e.g., translation versus horizontal stretch.
  - OH.Math.HSG.CO.9: Prove and apply theorems about lines and angles.
  - OH.Math.HSG.CO.10: Prove and apply theorems about triangles.
  - OH.Math.HSG.CO.11: Prove and apply theorems about parallelograms.
  - OH.Math.HSG.GPE.4: Use coordinates to prove simple geometric theorems algebraically and to verify geometric relationships algebraically, including properties of special triangles, quadrilaterals, and circles.
- **CONSTRUCTIONS**
  - OH.Math.HSG.CO.12: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
  - OH.Math.HSG.CO.13: Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
  - OH.Math.HSG.CO.14: Classify two-dimensional figures in a hierarchy based on properties.
  - OH.Math.HSG.C.4: Construct a tangent line from a point outside a given circle to the circle.

Unit 14: Circles

- **CIRCLE BASICS**
  - OH.Math.HSG.CO.1: Know precise definitions of ray, angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and arc length.
  - OH.Math.HSG.C.2: Identify and describe relationships among angles, radii, chords, tangents, and arcs and use them to solve problems.
- **CENTRAL ANGLES, INSCRIBED ANGLES, AND CHORDS**
  - OH.Math.HSG.C.2: Identify and describe relationships among angles, radii, chords, tangents, and arcs and use them to solve problems.
  - OH.Math.HSG.CO.1: Know precise definitions of ray, angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and arc length.
  - OH.Math.HSG.CO.9: Prove and apply theorems about lines and angles.

- OH.Math.HSG.C.3: Construct the inscribed and circumscribed circles of a triangle; prove and apply the property that opposite angles are supplementary for a quadrilateral inscribed in a circle.
- OH.Math.HSG.C.5a: Find arc lengths and areas of sectors of circles. Apply similarity to relate the length of an arc intercepted by a central angle to the radius. Use the relationship to solve problems.

Unit 15: Advanced Properties of Circles

- **SECANTS, ANGLES, AND INTERCEPTED ARCS**
  - OH.Math.HSG.CO.1: Know precise definitions of ray, angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and arc length.
  - OH.Math.HSG.CO.9: Prove and apply theorems about lines and angles.
  - OH.Math.HSG.C.2: Identify and describe relationships among angles, radii, chords, tangents, and arcs and use them to solve problems.
- **TANGENTS, ANGLES, AND INTERCEPTED ARCS**
  - OH.Math.HSG.CO.1: Know precise definitions of ray, angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and arc length.
  - OH.Math.HSG.CO.9: Prove and apply theorems about lines and angles.
  - OH.Math.HSG.C.2: Identify and describe relationships among angles, radii, chords, tangents, and arcs and use them to solve problems.

Unit 16: Linear Systems

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: GUESS AND CHECK**
  - OH.Math.HSA.CED.3: 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.
  - OH.Math.HSA.CED.2a: 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.2c: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Extend to include more complicated function situations with the option to graph with technology.
  - OH.Math.HSA.CED.3a: 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.HSF.BF.1a.i: 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.HSA.REI.6a: 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.3: 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.
  - OH.Math.HSA.CED.2a: 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: 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: 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: Explain why the -coordinates of the points where the graphs of the equation = () and = () intersect are the solutions of the equation () = (); 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: Solve systems of linear equations algebraically and graphically. Limit to pairs of linear equations in two variables.
  - OH.Math.HSA.REI.6: Solve systems of linear equations algebraically and graphically.
  - OH.Math.HSA.REI.11: Explain why the -coordinates of the points where the graphs of the equation = () and = () intersect are the solutions of the equation () = (); find the solutions approximately, e.g., using technology to graph the functions, making tables of values, or finding successive approximations.
  - OH.Math.HSA.REI.11: Explain why the -coordinates of the points where the graphs of the equation = () and = () intersect are the solutions of the equation () = (); find the solutions approximately, e.g., using technology to graph the functions, making tables of values, or finding successive approximations.
  - OH.Math.HSA.REI.11: Explain why the -coordinates of the points where the graphs of the equation = () and = () intersect are the solutions of the equation () = (); find the solutions approximately, e.g., using technology to graph the functions, making tables of values, or finding successive approximations.
  - OH.Math.HSA.CED.2c: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Extend to include more complicated function situations with the option to graph with technology.

Unit 17: Solving Linear Systems Algebraically

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: SUBSTITUTION**
  - OH.Math.HSA.CED.3: 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.
  - OH.Math.HSA.CED.2a: 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: 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.2c: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Extend to include more complicated function situations with the option to graph with technology.
- OH.Math.HSA.CED.3a: 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.CED.4b: 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.
- OH.Math.HSA.REI.6: Solve systems of linear equations algebraically and graphically.
- OH.Math.HSA.REI.6a: Solve systems of linear equations algebraically and graphically. Limit to pairs of linear equations in two variables.
- OH.Math.HSA.REI.5: 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.

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: ELIMINATION**
  - OH.Math.HSA.CED.3: 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.
  - OH.Math.HSA.CED.2a: 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: 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.2c: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Extend to include more complicated function situations with the option to graph with technology.
  - OH.Math.HSA.CED.3a: 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: Solve systems of linear equations algebraically and graphically. Limit to pairs of linear equations in two variables.
  - OH.Math.HSA.REI.5: 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.6: Solve systems of linear equations algebraically and graphically.

Unit 18: Working with Functions

- **LINEAR VERSUS NONLINEAR**
  - OH.Math.HSF.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
  - OH.Math.HSF.LE.2: 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.1b: Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations.
  - OH.Math.HSF.BF.1c: Write a function that describes a relationship between two quantities. Compose functions.
  - OH.Math.HSF.LE.1a: 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: 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: 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.4a: 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 and exponential functions.
  - OH.Math.HSF.IF.4b: 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.BF.1a.i: 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.HSA.REI.10: 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.5: Interpret the parameters in a linear or exponential function in terms of a context.
  - OH.Math.HSF.IF.5a: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear and exponential functions.

- OH.Math.HSA.CED.2a: 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.HSF.IF.5c: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Emphasize the selection of a type of function for a model based on behavior of data and context.
- OH.Math.HSF.IF.9: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- OH.Math.HSF.IF.9b: 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.

- **MULTIPLE REPRESENTATIONS OF FUNCTIONS**
  - OH.Math.HSA.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
  - OH.Math.HSF.IF.2: 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.9: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
  - OH.Math.HSF.LE.2: 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.HSA.CED.2c: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Extend to include more complicated function situations with the option to graph with technology.
  - OH.Math.HSF.IF.4a: 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 and exponential functions.
  - OH.Math.HSF.IF.4b: 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.9a: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Focus on linear and exponential functions.
  - OH.Math.HSF.IF.9b: 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.HSA.CED.2a: 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: 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.1a: 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.

- **INVERSE FUNCTIONS**
  - OH.Math.HSF.BF.4b: Find inverse functions. Read values of an inverse function from a graph or a table, given that the function has an inverse.
  - OH.Math.HSF.BF.4c: Find inverse functions. Verify by composition that one function is the inverse of another.
  - OH.Math.HSF.BF.4d: Find inverse functions. Find the inverse of a function algebraically, given that the function has an inverse.
  - OH.Math.HSF.BF.4a: Find inverse functions. Informally determine the input of a function when the output is known.
  - OH.Math.HSF.BF.4e: Find inverse functions. Produce an invertible function from a non-invertible function by restricting the domain.

Unit 19: Linear and Exponential Parent Functions

- **LINEAR AND EXPONENTIAL PARENT FUNCTIONS**
  - OH.Math.HSA.REI.10: 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.IF.5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
  - OH.Math.HSF.LE.2: 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.4a: 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 and exponential functions.
  - OH.Math.HSF.IF.4b: 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: 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.HSF.IF.1: 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 . The graph of is the graph of the equation = ().

- OH.Math.HSF.IF.5a: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear and exponential functions.
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.4: 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.
- OH.Math.HSF.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
- OH.Math.HSF.LE.1c: 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.BF.1a.i: 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.

- **TRANSFORMATIONS OF THE LINEAR AND EXPONENTIAL PARENT FUNCTIONS**
  - OH.Math.HSG.CO.2: Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not, e.g., translation versus horizontal stretch.
  - OH.Math.HSG.CO.6: 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.
  - OH.Math.HSG.SRT.1a: Verify experimentally the properties of dilations given by a center and a scale factor: A dilation takes a line not passing through the center of the dilation to a parallel line and leaves a line passing through the center unchanged.
  - OH.Math.HSF.BF.3a: 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. 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 ().
  - OH.Math.HSA.SSE.3c: 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.BF.3a: 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. 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 ().

- OH.Math.HSA.REI.10: 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.BF.3a: 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. 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 ().
- OH.Math.HSF.LE.2: 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.3a: 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. 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 ().
- OH.Math.HSF.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
- OH.Math.HSF.IF.4a: 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 and exponential functions.
- OH.Math.HSF.BF.1a.i: 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.3a: 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. 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 ().
- OH.Math.HSF.IF.5a: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear and exponential functions.

Unit 20: Exponential Functions, Equations, and Inequalities

- **EXPONENTIAL FUNCTIONS**
  - OH.Math.HSA.SSE.1a: 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.1b: 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: 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.4: 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.
- OH.Math.HSF.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
- OH.Math.HSF.IF.7e: 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.IF.7f: 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 exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- OH.Math.HSF.LE.1a: 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.IF.4a: 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 and exponential functions.
- OH.Math.HSF.IF.8b.i: 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.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- OH.Math.HSF.LE.2: 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.LE.3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
- OH.Math.HSF.IF.8b: 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.
- OH.Math.HSF.LE.1c: 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.4b: 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.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.1: 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 . The graph of is the graph of the equation = ().
- OH.Math.HSF.IF.5b: 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.HSF.IF.5a: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear and exponential functions.
- OH.Math.HSA.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- OH.Math.HSA.REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- OH.Math.HSA.REI.10: 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.IF.7g: 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 rational functions, identifying zeros and asymptotes when factoring is reasonable, and indicating end behavior.
- OH.Math.HSA.CED.1a: 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.1c: Create equations and inequalities in one variable and use them to solve problems. Extend to include more complicated function situations with the option to solve with technology.
- OH.Math.HSA.CED.2a: 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.2c: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Extend to include more complicated function situations with the option to graph with technology.

- OH.Math.HSF.BF.1a.i: 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: 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.

- **EXPONENTIAL GROWTH AND DECAY**
  - OH.Math.HSA.REI.10: 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: 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.LE.3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
  - OH.Math.HSF.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.
  - OH.Math.HSF.LE.1a: 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: 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: 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.4a: 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 and exponential functions.
  - OH.Math.HSF.IF.5a: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear and exponential functions.
  - OH.Math.HSA.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
  - OH.Math.HSA.CED.2c: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Extend to include more complicated function situations with the option to graph with technology.
  - OH.Math.HSF.IF.7e: 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.IF.7f: 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 exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- OH.Math.HSA.CED.2a: 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: 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.BF.1a.i: 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: 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.
- OH.Math.HSA.SSE.1a: 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.1b: 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.IF.8b: 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.
- OH.Math.HSF.IF.8b.i: 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.HSA.SSE.3c: 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.

- **SOLVING EXPONENTIAL INEQUALITIES**
  - OH.Math.HSA.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
  - OH.Math.HSF.LE.2: 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.HSA.CED.2a: 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.2c: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. Extend to include more complicated function situations with the option to graph with technology.
- OH.Math.HSA.CED.3: 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.
- OH.Math.HSA.SSE.1b: 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.CED.3a: 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.CED.4d: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.
- OH.Math.HSF.LE.1c: 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.2b: 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 21: Sequences

- **SEQUENCES**
  - OH.Math.HSF.IF.2: 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.3: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
  - OH.Math.HSF.BF.2: 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: 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: 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: 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: 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.BF.1a.i: 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.IF.3: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
- OH.Math.HSF.LE.2: 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: Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from context.
- OH.Math.HSF.BF.1a.ii: 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 22: Representing Data

- **DATA ANALYSIS**
  - OH.Math.HSS.ID.1: 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: 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: 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: 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.
  - OH.Math.HSS.CP.4: 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 if events are independent and to approximate conditional probabilities.

Unit 23: Scatterplots

- **SCATTERPLOTS**
  - OH.Math.HSS.ID.5: 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.

- OH.Math.HSS.ID.6a: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.
- OH.Math.HSS.ID.6b: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Informally assess the fit of a function by discussing residuals.
- OH.Math.HSS.ID.6c: 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.9: Distinguish between correlation and causation.
- OH.Math.HSS.ID.7: 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.8: Compute (using technology) and interpret the correlation coefficient of a linear fit.
- OH.Math.HSF.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

- **SCATTERPLOTS AND MODELING**
  - OH.Math.HSS.ID.7: 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.6a: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.
  - OH.Math.HSS.ID.6b: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Informally assess the fit of a function by discussing residuals.
  - OH.Math.HSS.ID.6c: 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: Compute (using technology) and interpret the correlation coefficient of a linear fit.
  - OH.Math.HSF.LE.1a: 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.1c: 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.