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.

1. EXPRESSIONS, EQUATIONS, AND INEQUALITIES

- **ONE-STEP EQUATIONS AND INEQUALITIES**
  - **OH.Math.HSA.CED.1a** *Focus on applying linear and simple exponential 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.1b** *Focus on applying simple quadratic expressions.*
  - **OH.Math.HSA.CED.3a** *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.3a** *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.1c** *Extend to include more complicated function situations with the option to solve with technology.*

- **AXIOMS OF EQUALITY**
  - **OH.Math.HSA.SSE.2** *Use the structure of an expression to identify ways to rewrite it.*
  - **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.*

- **LITERAL EQUATIONS**

- **LITERAL 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** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.4b** *Focus on formulas in which the variable of interest is linear.*
  - **OH.Math.HSA.CED.4c** *Focus on formulas in which the variable of interest is linear or square.*
  - **OH.Math.HSA.CED.4d** *While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.*
  - **OH.Math.HSA.CED.4a** *Focus on formulas in which the variable of interest is linear or square.*

2. WRITING EQUATIONS AND INEQUALITIES

- **FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS**
  - **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** *Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.*
  - **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSF.IF.4a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.4b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.BF.1a.i** *Focus on linear and exponential functions.*
  - **OH.Math.HSA.CED.1c** *Extend to include more complicated function situations with the option to solve with technology.*
  - **OH.Math.HSA.CED.3a** *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 parts of an expression, such as terms, factors, and coefficients.*

- **FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS**
  - **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** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.1c** *Extend to include more complicated function situations with the option to solve with technology.*
  - **OH.Math.HSA.CED.3a** *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 parts of an expression, such as terms, factors, and coefficients.*

3. 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.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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.*
  - **OH.Math.HSF.BF.4a** *Informally determine the input of a function when the output is known.*
  - **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 square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.*
  - **OH.Math.HSF.IF.9a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.9b** *Focus on linear, quadratic, and exponential 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 f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).*
  - **OH.Math.HSF.IF.5c** *Emphasize the selection of a type of function for a model based on behavior of data and context.*
  - **OH.Math.HSF.IF.5b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.IF.5a** *Focus on linear and exponential functions.*

- **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 f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).*
  - **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.BF.4a** *Informally determine the input of a function when the output is known.*

4. 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 f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).*
  - **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.4a** *Informally determine the input of a function when the output is known.*
  - **OH.Math.HSF.IF.5b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.IF.5a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.4a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.4b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.IF.9a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.9b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.IF.7a** *Graph linear functions and indicate intercepts.*

- **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 f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).*
  - **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 linear functions and indicate intercepts.*
  - **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSF.IF.4a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.4b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.LE.5** *Interpret the parameters in a linear or exponential function in terms of a context.*
  - **OH.Math.HSF.LE.1b** *Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.*

- **GRAPHS OF LINEAR INEQUALITIES**

- **GRAPHS OF LINEAR INEQUALITIES**
  - **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.REI.3** *Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.*
  - **OH.Math.HSA.CED.1a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.3a** *While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.*

5. 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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.*
  - **OH.Math.HSF.BF.4a** *Informally determine the input of a function when the output is known.*
  - **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.*

- **SLOPE-INTERCEPT FORM OF A LINEAR 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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.*
  - **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 linear functions and indicate intercepts.*
  - **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.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **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.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.9a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.9b** *Focus on linear, quadratic, and exponential functions.*

- **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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.*
  - **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 linear functions and indicate intercepts.*
  - **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **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.*

6. 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.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.*

7. 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.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.*

- **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.*

8. TRANSFORMATIONS AND CONGRUENCE

- **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.CO.3b** *Identify figures that have rotational symmetry; determine the angle of rotation, and use rotational symmetry to analyze properties of shapes.*
  - **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** *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** *The dilation of a line segment is longer or shorter in the ratio given by the scale factor.*

- **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.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** *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.4** *Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.*
  - **OH.Math.HSG.CO.3a** *Identify figures that have line symmetry; draw and use lines of symmetry to analyze properties of shapes.*
  - **OH.Math.HSG.SRT.1b** *The dilation of a line segment is longer or shorter in the ratio given by the scale factor.*

- **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 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 figures that have rotational symmetry; determine the angle of rotation, and use rotational symmetry to analyze properties of shapes.*

9. LINEAR SYSTEMS

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: GUESS AND CHECK**
  - **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.2c** *Extend to include more complicated function situations with the option to graph with technology.*
  - **OH.Math.HSA.CED.3a** *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** *Focus on linear and exponential functions.*
  - **OH.Math.HSA.REI.6a** *Limit to pairs of linear equations in two variables.*

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: GRAPHING**
  - **OH.Math.HSA.CED.3a** *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 x-coordinates of the points where the graphs of the equation $y = f(x)$ and $y = (x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, making tables of values, or finding successive approximations.*
  - **OH.Math.HSA.REI.6a** *Limit to pairs of linear equations in two variables.*
  - **OH.Math.HSA.CED.2c** *Extend to include more complicated function situations with the option to graph with technology.*

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: SUBSTITUTION**
  - **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.2c** *Extend to include more complicated function situations with the option to graph with technology.*
  - **OH.Math.HSA.REI.6a** *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.CED.3a** *While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.*

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: ELIMINATION**
  - **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.2c** *Extend to include more complicated function situations with the option to graph with technology.*
  - **OH.Math.HSA.REI.6a** *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.CED.3a** *While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.*

10. 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** *Combine standard function types using arithmetic operations.*
  - **OH.Math.HSF.BF.1c** *Compose functions.*
  - **OH.Math.HSF.LE.1a** *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** *Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.*
  - **OH.Math.HSF.LE.1c** *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** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.4b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSF.IF.9b** *Focus on linear, quadratic, and exponential 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.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** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.4b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.IF.5b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.IF.9a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.9b** *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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.*
  - **OH.Math.HSF.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*

- **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.HSF.BF.3a** *Focus on transformations of graphs of quadratic functions, except for $f(kx)$.*

11. EXPONENTIAL FUNCTIONS, EQUATIONS, AND INEQUALITIES

- **EXPONENTIAL FUNCTIONS**
  - **OH.Math.HSA.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients.*
  - **OH.Math.HSA.SSE.1b** *Interpret complicated expressions by viewing one or more of their parts as a single entity.*
  - **OH.Math.HSA.SSE.3c** *Use the properties of exponents to transform expressions for exponential functions.*
  - **OH.Math.HSF.IF.7e** *Graph simple exponential functions, indicating intercepts and end behavior.*
  - **OH.Math.HSF.LE.1a** *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.9a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.9b** *Focus on linear, quadratic, and exponential functions.*
  - **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.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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.*
  - **OH.Math.HSF.BF.4a** *Informally determine the input of a function when the output is known.*
  - **OH.Math.HSF.IF.4a** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.IF.4b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.IF.5b** *Focus on linear, quadratic, and exponential functions.*
  - **OH.Math.HSF.IF.5a** *Focus on linear and exponential functions.*
  - **OH.Math.HSA.REI.3** *Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.*
  - **OH.Math.HSF.LE.5** *Interpret the parameters in a linear or exponential function in terms of a context.*
  - **OH.Math.HSF.IF.7f** *Graph exponential functions, indicating intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.*
  - **OH.Math.HSF.IF.7g** *Graph rational functions, identifying zeros and asymptotes when factoring is reasonable, and indicating end behavior.*
  - **OH.Math.HSF.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*
  - **OH.Math.HSA.CED.1a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.1c** *Extend to include more complicated function situations with the option to solve with technology.*
  - **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.2c** *Extend to include more complicated function situations with the option to graph with technology.*
  - **OH.Math.HSF.BF.1a.i** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.BF.1a.ii** *Focus on situations that exhibit quadratic or exponential relationships.*

- **EXPONENTIAL GROWTH AND DECAY**
  - **OH.Math.HSA.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients.*
  - **OH.Math.HSA.SSE.1b** *Interpret complicated expressions by viewing one or more of their parts as a single entity.*
  - **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.5** *Interpret the parameters in a linear or exponential function in terms of a context.*
- **OH.Math.HSF.LE.1a** *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** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*
- **OH.Math.HSA.CED.2a** *Focus on applying linear and simple exponential expressions.*
- **OH.Math.HSA.SSE.3c** *Use the properties of exponents to transform expressions for exponential functions.*
- **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.1b** *Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.*
- **OH.Math.HSA.CED.2c** *Extend to include more complicated function situations with the option to graph with technology.*
- **OH.Math.HSF.IF.9a** *Focus on linear and exponential functions.*
- **OH.Math.HSF.IF.9b** *Focus on linear, quadratic, and exponential functions.*
- **OH.Math.HSF.BF.1a.i** *Focus on linear and exponential functions.*
- **OH.Math.HSF.BF.1a.ii** *Focus on situations that exhibit quadratic or exponential relationships.*

- **SOLVING EXPONENTIAL INEQUALITIES**
  - **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** *Focus on applying linear and simple exponential expressions.*
  - **OH.Math.HSA.CED.2c** *Extend to include more complicated function situations with the option to graph with technology.*
  - **OH.Math.HSA.SSE.1b** *Interpret complicated expressions by viewing one or more of their parts as a single entity.*
  - **OH.Math.HSA.CED.3a** *While functions will often be linear, exponential, or quadratic, the types of problems should draw from more complicated situations.*
  - **OH.Math.HSF.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*

12. SEQUENCES

- **SEQUENCES**
  - **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).*

- **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.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.i** *Focus on linear and exponential functions.*
  - **OH.Math.HSF.BF.1a.ii** *Focus on situations that exhibit quadratic or exponential relationships.*

13. STATISTICS

- **DATA ANALYSIS**
- **FREQUENCY TABLES**
- **SCATTERPLOTS**
    - **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.HSF.LE.1a** *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** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*

14. TOPICS IN GEOMETRY

- **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.*
- **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.*