Georgia Tutorials are designed specifically for the Georgia Standards of Excellence and the Georgia Performance Standards to prepare students for the Georgia Milestones.

Math Tutorials offer targeted instruction, practice and review designed to develop computational fluency, deepen conceptual understanding, and apply mathematical practices. They automatically identify and address learning gaps down to elementary-level content, using adaptive remediation to bring students to grade-level no matter where they start. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing the ability to apply their knowledge in abstract and real world scenarios, students build the depth of knowledge and higher order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible to students through focused content, modeled logic and process, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

1. REAL NUMBER SYSTEM

- **LAWS OF EXPONENTS**
  - **MGSE9-12.A.SSE.2** *Use the structure of an expression to rewrite it in different equivalent forms.*
  - **MGSE9-12.N.RN.2** *Rewrite expressions involving radicals (i.e., simplify and/or use the operations of addition, subtraction, and multiplication, with radicals within expressions limited to square roots).*
  - **MGSE9-12.A.REI.1** *Using algebraic properties and the properties of real numbers, justify the steps of a simple, one-solution equation. Students should justify their own steps, or if given two or more steps of an equation, explain the progression from one step to the next using properties.*

- **OPERATIONS ON RATIONAL AND IRRATIONAL NUMBERS**
  - **MGSE9-12.N.RN.3** *Explain why the sum or product of rational numbers is rational; why the sum of a rational number and an irrational number is irrational; and why the product of a nonzero rational number and an irrational number is irrational.*

- **MONITORING PRECISION AND ACCURACY**
  - **MGSE9-12.N.Q.2** *Define appropriate quantities for the purpose of descriptive modeling. Given a situation, context, or problem, students will determine, identify, and use appropriate quantities for representing the situation.*
  - **MGSE9-12.N.Q.3** *Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*
  - **MGSE9-12.N.Q.1c** *Use units within multi-step problems and formulas; interpret units of input and resulting units of output.*
  - **MGSE9-12.N.Q.1a** *Identify, use, and record appropriate units of measure within context, within data displays, and on graphs;*

2. RATES AND UNIT RATES

- **RATES AND UNIT RATES**
  - **MGSE9-12.N.Q.1c** *Use units within multi-step problems and formulas; interpret units of input and resulting units of output.*

- **UNIT CONVERSIONS**
  - **MGSE9-12.N.Q.1b** *Convert units and rates using dimensional analysis (English-to-English and Metric-to-Metric without conversion factor provided and between English and Metric with conversion factor);*

3. EQUATIONS AND INEQUALITIES

- **ONE-STEP EQUATIONS AND INEQUALITIES**
  - **MGSE9-12.A.CED.1** *Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions (integer inputs only).*
  - **MGSE9-12.A.REI.1** *Using algebraic properties and the properties of real numbers, justify the steps of a simple, one-solution equation. Students should justify their own steps, or if given two or more steps of an equation, explain the progression from one step to the next using properties.*
  - **MGSE9-12.A.REI.3** *Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*
  - **MGSE9-12.A.REI.11** *Using graphs, tables, or successive approximations, show that the solution to the equation f(x) = g(x) is the x-value where the y-values of f(x) and g(x) are the same.*

- **MULTI-STEP EQUATIONS AND INEQUALITIES**
  - **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*
  - **MGSE9-12.A.REI.1** *Using algebraic properties and the properties of real numbers, justify the steps of a simple, one-solution equation. Students should justify their own steps, or if given two or more steps of an equation, explain the progression from one step to the next using properties.*
  - **MGSE9-12.A.REI.3** *Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.*
  - **MGSE9-12.A.CED.1** *Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions (integer inputs only).*
  - **MGSE9-12.A.REI.11** *Using graphs, tables, or successive approximations, show that the solution to the equation f(x) = g(x) is the x-value where the y-values of f(x) and g(x) are the same.*

4. WORKING WITH EQUATIONS

- **AXIOMS OF EQUALITY**
  - **MGSE9-12.A.SSE.2** *Use the structure of an expression to rewrite it in different equivalent forms.*
  - **MGSE9-12.A.REI.1** *Using algebraic properties and the properties of real numbers, justify the steps of a simple, one-solution equation. Students should justify their own steps, or if given two or more steps of an equation, explain the progression from one step to the next using properties.*

- **LITERAL EQUATIONS**
  - **MGSE9-12.A.CED.1** *Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions (integer inputs only).*
  - **MGSE9-12.A.REI.3** *Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.*
  - **MGSE9-12.A.CED.4** *Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations.*

5. WRITING EXPRESSIONS AND EQUATIONS

- **FORMULATING AND SIMPLIFYING ALGEBRAIC EXPRESSIONS**
  - **MGSE9-12.N.Q.2** *Define appropriate quantities for the purpose of descriptive modeling. Given a situation, context, or problem, students will determine, identify, and use appropriate quantities for representing the situation.*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*
  - **MGSE9-12.A.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients, in context.*
  - **MGSE9-12.A.SSE.1b** *Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.*
  - **MGSE9-12.A.SSE.2** *Use the structure of an expression to rewrite it in different equivalent forms.*

- **FORMULATING AND SOLVING EQUATIONS FROM WORD PROBLEMS**

- **MGSE9-12.A.CED.1** *Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions (integer inputs only).*
- **MGSE9-12.F.BF.2** *Write arithmetic and geometric sequences recursively and explicitly, use them to model situations, and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.*
- **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*
- **MGSE9-12.F.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).*
- **MGSE9-12.F.LE.1b** *Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.*
- **MGSE9-12.A.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients, in context.*

FORMULATING AND SOLVING INEQUALITIES FROM WORD PROBLEMS

- **MGSE9-12.A.CED.1** *Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions (integer inputs only).*
- **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*
- **MGSE9-12.A.REI.3** *Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.*

6. FUNCTIONS

FUNCTIONS AND RELATIONS

- **MGSE9-12.F.IF.2** *Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.*
- **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
- **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
- **MGSE9-12.F.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).*

DOMAIN AND RANGE

- **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
- **MGSE9-12.F.IF.5** *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*

EVALUATING FUNCTIONS

- **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
- **MGSE9-12.F.IF.2** *Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.*
- **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*

7. GRAPHS OF LINEAR EQUATIONS AND INEQUALITIES 1

SLOPE

- **MGSE9-12.F.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.*
- **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
- **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*

- **GRAPHING AND ANALYZING LINEAR FUNCTIONS**
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.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).*
  - **MGSE9-12.F.IF.5** *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.IF.7a** *Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).*

8. GRAPHS OF LINEAR EQUATIONS AND INEQUALITIES 2

- **GRAPHING AND MANIPULATING Y = MX + B**
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.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.*
  - **MGSE9-12.F.IF.7a** *Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).*
  - **MGSE9-12.F.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).*
  - **MGSE9-12.S.ID.7** *Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.LE.1b** *Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.*
  - **MGSE9-12.F.LE.5** *Interpret the parameters in a linear (f(x) = mx + b) and exponential (f(x) = a x d^x) function in terms of context. (In the functions above, “m” and “b” are the parameters of the linear function, and “a” and “d” are the parameters of the exponential function.) In context, students should describe what these parameters mean in terms of change and starting value.*

- **GRAPHS OF LINEAR INEQUALITIES**
  - **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*

- **MGSE9-12.A.REI.3** *Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.*
- **MGSE9-12.A.REI.12** *Graph the solution set to a linear inequality in two variables.*

9. LINEAR EQUATIONS

- **SLOPE-INTERCEPT FORM OF A LINEAR EQUATION**
  - **MGSE9-12.S.ID.7** *Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*
  - **MGSE9-12.A.REI.10** *Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.IF.7a** *Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).*
  - **MGSE9-12.F.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).*
  - **MGSE9-12.F.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.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.BF.2** *Write arithmetic and geometric sequences recursively and explicitly, use them to model situations, and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.*

- **POINT-SLOPE FORM OF A LINEAR EQUATION**
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.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).*
  - **MGSE9-12.A.REI.10** *Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **MGSE9-12.F.IF.7a** *Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).*
  - **MGSE9-12.A.REI.11** *Using graphs, tables, or successive approximations, show that the solution to the equation f(x) = g(x) is the x-value where the y-values of f(x) and g(x) are the same.*
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*

10. TWO-VARIABLE LINEAR SYSTEMS

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: GUESS AND CHECK**
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*
  - **MGSE9-12.A.REI.6** *Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.*

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

- **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*
- **MGSE9-12.A.REI.6** *Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.*

11. SOLVING TWO-VARIABLE LINEAR SYSTEMS ALGEBRAICALLY

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: SUBSTITUTION**
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*
  - **MGSE9-12.A.REI.6** *Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.*
  - **MGSE9-12.A.REI.5** *Show and explain why the elimination method works to solve a system of two-variable equations.*

- **SOLVING SYSTEMS OF LINEAR EQUATIONS: ELIMINATION**
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*
  - **MGSE9-12.A.REI.6** *Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.*
  - **MGSE9-12.A.REI.5** *Show and explain why the elimination method works to solve a system of two-variable equations.*

12. LINEAR SYSTEMS

- **SOLVING SYSTEMS OF LINEAR INEQUALITIES**
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*
  - **MGSE9-12.A.REI.12** *Graph the solution set to a linear inequality in two variables.*

- **SOLVING THREE-VARIABLE SYSTEMS OF LINEAR EQUATIONS**
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.A.CED.3** *Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e. a solution) or not possible (i.e. a non-solution) under the established constraints.*
  - **MGSE9-12.A.REI.5** *Show and explain why the elimination method works to solve a system of two-variable equations.*

13. EXPONENTIAL FUNCTIONS, EQUATIONS, AND INEQUALITIES

- **EXPONENTIAL FUNCTIONS**
  - **MGSE9-12.A.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients, in context.*
  - **MGSE9-12.A.SSE.1b** *Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.*
  - **MGSE9-12.A.REI.10** *Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **MGSE9-12.F.LE.1a** *Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. (This can be shown by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals).*
  - **MGSE9-12.F.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.*

- **MGSE9-12.F.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).*
- **MGSE9-12.F.LE.3** *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.*
- **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
- **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
- **MGSE9-12.F.IF.5** *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*
- **MGSE9-12.F.IF.7e** *Graph exponential functions, showing intercepts and end behavior.*
- **MGSE9-12.A.CED.1** *Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, and exponential functions (integer inputs only).*
- **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*
- **MGSE9-12.F.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*
- **MGSE9-12.F.LE.5** *Interpret the parameters in a linear (f(x) = mx + b) and exponential (f(x) = a x d^x) function in terms of context. (In the functions above, “m” and “b” are the parameters of the linear function, and “a” and “d” are the parameters of the exponential function.) In context, students should describe what these parameters mean in terms of change and starting value.*

- **EXPONENTIAL GROWTH AND DECAY**
  - **MGSE9-12.A.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients, in context.*
  - **MGSE9-12.A.SSE.1b** *Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.*
  - **MGSE9-12.F.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).*
  - **MGSE9-12.F.LE.1a** *Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. (This can be shown by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals).*
  - **MGSE9-12.F.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*
  - **MGSE9-12.F.LE.5** *Interpret the parameters in a linear (f(x) = mx + b) and exponential (f(x) = a x d^x) function in terms of context. (In the functions above, “m” and “b” are the parameters of the linear function, and “a” and “d” are the parameters of the exponential function.) In context, students should describe what these parameters mean in terms of change and starting value.*
  - **MGSE9-12.F.LE.3** *Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.*
  - **MGSE9-12.S.ID.6a** *Decide which type of function is most appropriate by observing graphed data, charted data, or by analysis of context to generate a viable (rough) function of best fit. Use this function to solve problems in context. Emphasize linear, quadratic and exponential models.*
  - **MGSE9-12.F.LE.1b** *Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.*
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.A.REI.10** *Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*

- **SOLVING EXPONENTIAL INEQUALITIES**
  - **MGSE9-12.F.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).*
  - **MGSE9-12.A.SSE.1b** *Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.*
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships*

between quantities; graph equations on coordinate axes with labels and scales.

- **MGSE9-12.F.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*

14. SEQUENCES

- **SEQUENCES**
  - **MGSE9-12.F.IF.3** *Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (Generally, the scope of high school math defines this subset as the set of natural numbers 1,2,3,4...) By graphing or calculating terms, students should be able to show how the recursive sequence $a_1=7$, $a_n=a_{n-1}+2$; the sequence $s_n = 2(n - 1) + 7$; and the function $f(x) = 2x + 5$ (when x is a natural number) all define the same sequence.*
  - **MGSE9-12.F.BF.2** *Write arithmetic and geometric sequences recursively and explicitly, use them to model situations, and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*
  - **MGSE9-12.F.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**
  - **MGSE9-12.F.BF.2** *Write arithmetic and geometric sequences recursively and explicitly, use them to model situations, and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.*
  - **MGSE9-12.F.IF.3** *Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (Generally, the scope of high school math defines this subset as the set of natural numbers 1,2,3,4...) By graphing or calculating terms, students should be able to show how the recursive sequence $a_1=7$, $a_n=a_{n-1}+2$; the sequence $s_n = 2(n - 1) + 7$; and the function $f(x) = 2x + 5$ (when x is a natural number) all define the same sequence.*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*
  - **MGSE9-12.F.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).*

15. POLYNOMIALS

- **ADDITION AND SUBTRACTION OF POLYNOMIALS**
  - **MGSE9-12.A.APR.1** *Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.*

- **MULTIPLICATION OF POLYNOMIALS**
  - **MGSE9-12.A.APR.1** *Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.*

16. FACTORING

- **FACTORING QUADRATIC TRINOMIALS**
  - **MGSE9-12.A.SSE.3a** *Factor any quadratic expression to reveal the zeros of the function defined by the expression.*
  - **MGSE9-12.A.SSE.2** *Use the structure of an expression to rewrite it in different equivalent forms.*
  - **MGSE9-12.A.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients, in context.*
  - **MGSE9-12.A.SSE.1b** *Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.*
  - **MGSE9-12.A.REI.4b** *Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).*

- **FACTORING SPECIAL CASES**
  - **MGSE9-12.A.SSE.2** *Use the structure of an expression to rewrite it in different equivalent forms.*
  - **MGSE9-12.A.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients, in context.*

- **MGSE9-12.A.SSE.1b** *Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.*

17. GRAPHS OF QUADRATIC FUNCTIONS

- **QUADRATIC FUNCTIONS**
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.A.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients, in context.*
  - **MGSE9-12.A.SSE.1b** *Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.*
  - **MGSE9-12.A.SSE.3b** *Complete the square in a quadratic expression to reveal the maximum or minimum value of the function defined by the expression.*
  - **MGSE9-12.F.IF.8a** *Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*

- **ANALYZING GRAPHS OF QUADRATIC FUNCTIONS**
  - **MGSE9-12.A.SSE.2** *Use the structure of an expression to rewrite it in different equivalent forms.*
  - **MGSE9-12.F.IF.9** *Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.IF.5** *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.IF.7a** *Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).*
  - **MGSE9-12.A.REI.11** *Using graphs, tables, or successive approximations, show that the solution to the equation f(x) = g(x) is the x-value where the y-values of f(x) and g(x) are the same.*
  - **MGSE9-12.A.REI.4b** *Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).*
  - **MGSE9-12.F.IF.8a** *Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.*

- **REPRESENTATIONS OF QUADRATIC FUNCTIONS**
  - **MGSE9-12.A.SSE.2** *Use the structure of an expression to rewrite it in different equivalent forms.*
  - **MGSE9-12.A.REI.4a** *Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from $ax^2 + bx + c = 0$.*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.IF.9** *Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).*
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*

- **MGSE9-12.F.IF.8a** *Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.*

18. SOLVING QUADRATIC FUNCTIONS

- **SOLVING QUADRATIC EQUATIONS BY FACTORING**
  - **MGSE9-12.A.SSE.3a** *Factor any quadratic expression to reveal the zeros of the function defined by the expression.*
  - **MGSE9-12.A.REI.4b** *Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).*
  - **MGSE9-12.F.IF.8a** *Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.*
  - **MGSE9-12.A.REI.11** *Using graphs, tables, or successive approximations, show that the solution to the equation $f(x) = g(x)$ is the x-value where the y-values of $f(x)$ and $g(x)$ are the same.*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and $f(x)$ is the output (an element of the range). Graphically, the graph is $y = f(x)$.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.IF.7a** *Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*

- **COMPLETING THE SQUARE**
  - **MGSE9-12.A.SSE.3b** *Complete the square in a quadratic expression to reveal the maximum or minimum value of the function defined by the expression.*
  - **MGSE9-12.A.REI.4a** *Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from $ax^2 + bx + c = 0$.*
  - **MGSE9-12.A.REI.4b** *Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).*
  - **MGSE9-12.F.IF.8a** *Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.*
  - **MGSE9-12.A.SSE.2** *Use the structure of an expression to rewrite it in different equivalent forms.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.IF.7a** *Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).*

- **QUADRATIC FORMULA**
  - **MGSE9-12.A.SSE.1a** *Interpret parts of an expression, such as terms, factors, and coefficients, in context.*
  - **MGSE9-12.A.SSE.1b** *Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.*
  - **MGSE9-12.A.REI.4b** *Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).*
  - **MGSE9-12.A.REI.4a** *Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from $ax^2 + bx + c = 0$.*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and $f(x)$ is the output (an element of the range). Graphically, the graph is $y = f(x)$.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.BF.1a** *Determine an explicit expression and the recursive process (steps for calculation) from context.*

19. PARENT FUNCTIONS

- **LINEAR AND EXPONENTIAL PARENT FUNCTIONS**
  - **MGSE9-12.A.REI.10** *Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **MGSE9-12.F.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).*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.IF.5** *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.IF.7e** *Graph exponential functions, showing intercepts and end behavior.*
  - **MGSE9-12.F.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*

- **QUADRATIC PARENT FUNCTION**
  - **MGSE9-12.A.REI.10** *Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.*
  - **MGSE9-12.F.IF.7a** *Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.IF.5** *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*

20. TRANSFORMATIONS OF PARENT FUNCTIONS

- **TRANSFORMATIONS OF THE LINEAR AND EXPONENTIAL PARENT FUNCTIONS**
  - **MGSE9-12.F.BF.3** *Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*

- **TRANSFORMATIONS OF THE QUADRATIC PARENT FUNCTION**
  - **MGSE9-12.F.BF.3** *Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.*
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.IF.5** *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*

21. WORKING WITH FUNCTIONS

- **LINEAR VERSUS NONLINEAR FUNCTIONS**
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.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.*
  - **MGSE9-12.F.IF.9** *Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).*
  - **MGSE9-12.F.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).*
  - **MGSE9-12.F.LE.1a** *Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. (This can be shown by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals).*
  - **MGSE9-12.F.LE.1b** *Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.*
  - **MGSE9-12.F.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*

- **MULTIPLE REPRESENTATIONS OF FUNCTIONS**
  - **MGSE9-12.F.IF.9** *Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).*
  - **MGSE9-12.F.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).*
  - **MGSE9-12.A.CED.2** *Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
  - **MGSE9-12.F.LE.1a** *Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. (This can be shown by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals).*

22. NONLINEAR FUNCTIONS

- **ABSOLUTE VALUE FUNCTIONS**
  - **MGSE9-12.F.IF.1** *Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).*
  - **MGSE9-12.F.IF.5** *Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.*
  - **MGSE9-12.F.IF.4** *Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.*
  - **MGSE9-12.F.BF.3** *Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

- **SYSTEMS OF NONLINEAR EQUATIONS**
  - **MGSE9-12.A.REI.6** *Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.*
  - **MGSE9-12.A.REI.5** *Show and explain why the elimination method works to solve a system of two-variable equations.*
  - **MGSE9-12.A.REI.11** *Using graphs, tables, or successive approximations, show that the solution to the equation f(x) = g(x) is the x-value where the y-values of f(x) and g(x) are the same.*
  - **MGSE9-12.F.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).*

23. STATISTICS

- **DATA ANALYSIS**
  - **MGSE9-12.S.ID.1** *Represent data with plots on the real number line (dot plots, histograms, and box plots).*
  - **MGSE9-12.S.ID.2** *Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, mean absolute deviation) of two or more different data sets.*
  - **MGSE9-12.S.ID.3** *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**
  - **MGSE9-12.S.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.*
  - **MGSE9-12.S.ID.3** *Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).*

24. TWO-VARIABLE DATA

- **SCATTERPLOTS**
  - **MGSE9-12.S.ID.6a** *Decide which type of function is most appropriate by observing graphed data, charted data, or by analysis of context to generate a viable (rough) function of best fit. Use this function to solve problems in context. Emphasize linear, quadratic and exponential models.*
  - **MGSE9-12.S.ID.6c** *Using given or collected bivariate data, fit a linear function for a scatter plot that suggests a linear association.*
  - **MGSE9-12.S.ID.9** *Distinguish between correlation and causation.*
  - **MGSE9-12.F.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.*
  - **MGSE9-12.S.ID.7** *Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*

- **SCATTERPLOTS AND MODELING**
  - **MGSE9-12.S.ID.6a** *Decide which type of function is most appropriate by observing graphed data, charted data, or by analysis of context to generate a viable (rough) function of best fit. Use this function to solve problems in context. Emphasize linear, quadratic and exponential models.*
  - **MGSE9-12.S.ID.6c** *Using given or collected bivariate data, fit a linear function for a scatter plot that suggests a linear association.*
  - **MGSE9-12.S.ID.8** *Compute (using technology) and interpret the correlation coefficient "r" of a linear fit. (For instance, by looking at a scatterplot, students should be able to tell if the correlation coefficient is positive or negative and give a reasonable estimate of the "r" value.) After calculating the line of best fit using technology, students should be able to describe how strong the goodness of fit of the regression is, using "r".*
  - **MGSE9-12.S.ID.7** *Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*
  - **MGSE9-12.F.LE.1a** *Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. (This can be shown by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals).*
  - **MGSE9-12.F.LE.1c** *Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.*