

Milestones EOC Tutorials for Georgia are designed specifically for the Georgia Standards of Excellence to prepare students for the Georgia Milestones end-of-course assessments. EOC Categories are at the heart of Milestones EOC Tutorial structure – bringing category-based learning to the student experience, and category-based performance and progress tracking to the teacher experience.

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

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

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

Unit 1: Real Number System

- **LAWS OF EXPONENTS**

- MGSE9-12.N.RN.2: Extend the properties of exponents to rational exponents 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).

- **OPERATIONS ON RATIONAL AND IRRATIONAL NUMBERS**

- MGSE9-12.N.RN.3: Use properties of rational and irrational numbers 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.

Unit 2: Rates and Unit Rates

- **MONITORING PRECISION AND ACCURACY**

- MGSE9-12.N.Q.2: Reason quantitatively and use units to solve problems 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.1a: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: Identify, use, and record appropriate units of measure within context, within data displays, and on graphs;
 - MGSE9-12.N.Q.1c: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: Use units within multi-step problems and formulas; interpret units of input and resulting units of output.
 - MGSE9-12.N.Q.1b: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: 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);
 - MGSE9-12.N.Q.3: Reason quantitatively and use units to solve problems Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **RATES AND UNIT RATES**
 - MGSE9-12.N.Q.1a: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: Identify, use, and record appropriate units of measure within context, within data displays, and on graphs;
 - MGSE9-12.N.Q.1c: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: Use units within multi-step problems and formulas; interpret units of input and resulting units of output.
 - MGSE9-12.N.Q.1b: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: 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);
- **UNIT CONVERSIONS**
 - MGSE9-12.N.Q.1a: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: Identify, use, and record appropriate units of measure within context, within data displays, and on graphs;
 - MGSE9-12.N.Q.1c: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: Use units within multi-step problems and formulas; interpret units of input and resulting units of output.
 - MGSE9-12.N.Q.1b: Reason quantitatively and use units to solve problems Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: 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);

Unit 3: Equations and Inequalities

- **ONE-STEP EQUATIONS AND INEQUALITIES**

- MGSE9-12.A.CED.1: Create equations that describe numbers or relationships 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 equations and inequalities in one variable Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.

- **MULTI-STEP EQUATIONS AND INEQUALITIES**

- MGSE9-12.A.CED.1: Create equations that describe numbers or relationships 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 equations and inequalities in one variable Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.

Unit 4: Working with Equations

- **AXIOMS OF EQUALITY**

- MGSE9-12.A.REI.1: Understand solving equations as a process of reasoning and explain the reasoning 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.REI.3: Solve equations and inequalities in one variable Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.
- MGSE9-12.A.CED.4: Create equations that describe numbers or relationships Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations.

Unit 5: Writing Expressions

- **FORMULATING AND SIMPLIFYING ALGEBRAIC EXPRESSIONS**

- MGSE9-12.A.SSE.1a: Interpret the structure of expressions Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients, in context.

Unit 6: Writing Equations and Inequalities

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

- MGSE9-12.A.CED.1: Create equations that describe numbers or relationships 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).

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

- MGSE9-12.A.CED.1: Create equations that describe numbers or relationships 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).

Unit 7: Functions

• FUNCTIONS AND RELATIONS

- MGSE9-12.F.IF.2: Understand the concept of a function and use function notation Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- MGSE9-12.F.IF.1: Understand the concept of a function and use function notation 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 $y = f(x)$.

• DOMAIN AND RANGE

- MGSE9-12.F.IF.5: Interpret functions that arise in applications in terms of the context Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

• EVALUATING FUNCTIONS

- MGSE9-12.F.IF.2: Understand the concept of a function and use function notation Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Unit 8: Slope

• SLOPE

- MGSE9-12.F.IF.6: Interpret functions that arise in applications in terms of the context 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: Interpret functions that arise in applications in terms of the context 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.

Unit 9: Graphs of Linear Equations

• GRAPHING AND ANALYZING LINEAR FUNCTIONS

- MGSE9-12.A.CED.2: Create equations that describe numbers or relationships 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.2: Construct and compare linear, quadratic, and exponential models and solve problems Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

- MGSE9-12.F.IF.4: Interpret functions that arise in applications in terms of the context 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 MANIPULATING $Y = MX + B$**
- MGSE9-12.F.LE.5: Interpret expressions for functions in terms of the situation they model Interpret the parameters in a linear ($y = mx + b$) and exponential ($y = a(b)^x$) function in terms of context. (In the functions above, m and b are the parameters of the linear function, and a and b 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.A.CED.2: Create equations that describe numbers or relationships 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.

Unit 10: Graphs of Linear Inequalities

- **GRAPHS OF LINEAR INEQUALITIES**

- MGSE9-12.A.CED.3: Create equations that describe numbers or relationships 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: Represent and solve equations and inequalities graphically Graph the solution set to a linear inequality in two variables.

Unit 11: Linear Equations

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

- MGSE9-12.F.IF.7a: Analyze functions using different representations Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. 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 and compare linear, quadratic, and exponential models and solve problems Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- MGSE9-12.A.REI.10: Represent and solve equations and inequalities graphically Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.

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

- MGSE9-12.F.IF.7a: Analyze functions using different representations Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. 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 and compare linear, quadratic, and exponential models and solve problems Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Unit 12: Two-Variable Linear Systems

• SOLVING SYSTEMS OF LINEAR EQUATIONS: GUESS AND CHECK

- MGSE9-12.A.CED.3: Create equations that describe numbers or relationships 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 equations 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.2: Create equations that describe numbers or relationships 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: Create equations that describe numbers or relationships 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.11: Represent and solve equations and inequalities graphically Using graphs, tables, or successive approximations, show that the solution to the equation $() = ()$ is the $-$ value where the $-$ values of $()$ and $()$ are the same.
- MGSE9-12.A.REI.6: Solve systems of equations 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.11: Represent and solve equations and inequalities graphically Using graphs, tables, or successive approximations, show that the solution to the equation $() = ()$ is the $-$ value where the $-$ values of $()$ and $()$ are the same.

• SOLVING SYSTEMS OF LINEAR EQUATIONS: SUBSTITUTION

- MGSE9-12.A.CED.2: Create equations that describe numbers or relationships 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: Create equations that describe numbers or relationships 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 equations 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: ELIMINATION**
- MGSE9-12.A.CED.2: Create equations that describe numbers or relationships 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: Create equations that describe numbers or relationships 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 equations 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: Solve systems of equations Show and explain why the elimination method works to solve a system of two-variable equations.

Unit 13: Linear Systems

- **SOLVING THREE-VARIABLE SYSTEMS OF LINEAR EQUATIONS**
- MGSE9-12.A.CED.3: Create equations that describe numbers or relationships 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.
- **SOLVING SYSTEMS OF LINEAR INEQUALITIES**
- MGSE9-12.A.CED.3: Create equations that describe numbers or relationships 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: Represent and solve equations and inequalities graphically Graph the solution set to a linear inequality in two variables.

Unit 14: Exponential Functions, Equations, and Inequalities

- **EXPONENTIAL FUNCTIONS**
- MGSE9-12.A.SSE.1b: Interpret the structure of expressions Interpret expressions that represent a quantity in terms of its context. 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.IF.4: Interpret functions that arise in applications in terms of the context 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.5: Interpret expressions for functions in terms of the situation they model Interpret the parameters in a linear $(f(x) = mx + b)$ and exponential $(f(x) = a(b)^x)$ function in terms of context. (In the functions above, m and b are the parameters of the linear function, and a and b 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.5: Interpret expressions for functions in terms of the situation they model Interpret the parameters in a linear $(f(x) = mx + b)$ and exponential $(f(x) = a(b)^x)$ function in terms of context. (In the functions above, m and b are the parameters of the linear function, and a and b 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.IF.7e: Analyze functions using different representations Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. Graph exponential functions, showing intercepts and end behavior.
- MGSE9-12.F.LE.2: Construct and compare linear, quadratic, and exponential models and solve problems Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **EXPONENTIAL GROWTH AND DECAY**
 - MGSE9-12.A.SSE.1b: Interpret the structure of expressions Interpret expressions that represent a quantity in terms of its context. 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.IF.4: Interpret functions that arise in applications in terms of the context 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.5: Interpret expressions for functions in terms of the situation they model Interpret the parameters in a linear $(f(x) = mx + b)$ and exponential $(f(x) = a(b)^x)$ function in terms of context. (In the functions above, m and b are the parameters of the linear function, and a and b 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: Construct and compare linear, quadratic, and exponential models and solve problems Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
 - MGSE9-12.F.LE.5: Interpret expressions for functions in terms of the situation they model Interpret the parameters in a linear $(f(x) = mx + b)$ and exponential $(f(x) = a(b)^x)$ function in terms of context. (In the functions above, m and b are the parameters of the linear function, and a and b 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.5: Interpret expressions for functions in terms of the situation they model Interpret the parameters in a linear ($f(x) = mx + b$) and exponential ($f(x) = a(b)^x$) function in terms of context. (In the functions above, m and b are the parameters of the linear function, and a and b 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.2: Construct and compare linear, quadratic, and exponential models and solve problems Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

• SOLVING EXPONENTIAL INEQUALITIES

- MGSE9-12.A.CED.2: Create equations that describe numbers or relationships 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.SSE.1b: Interpret the structure of expressions Interpret expressions that represent a quantity in terms of its context. Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.

Unit 15: Sequences

• SEQUENCES

- MGSE9-12.F.IF.3: Understand the concept of a function and use function notation Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (Generally, the scope of high school math defines this subset as the set of natural numbers $1, 2, 3, 4, \dots$) By graphing or calculating terms, students should be able to show how the recursive sequence $a_n = 7, a_n = a_{n-1} + 2$; the sequence $a_n = 2(1) + 7$; and the function $f(n) = 2 + 5n$ (when n is a natural number) all define the same sequence.
- MGSE9-12.F.BF.2: Build a function that models a relationship between two quantities 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: Build a function that models a relationship between two quantities Write a function that describes a relationship between two quantities. Determine an explicit expression and the recursive process (steps for calculation) from context.
- MGSE9-12.F.IF.3: Understand the concept of a function and use function notation Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (Generally, the scope of high school math defines this subset as the set of natural numbers $1, 2, 3, 4, \dots$) By graphing or calculating terms, students should be able to show how the recursive sequence $a_n = 7, a_n = a_{n-1} + 2$; the sequence $a_n = 2(1) + 7$; and the function $f(n) = 2 + 5n$ (when n is a natural number) all define the same sequence.
- MGSE9-12.F.LE.2: Construct and compare linear, quadratic, and exponential models and solve problems Construct linear and exponential functions, including arithmetic and geometric

sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

- MGSE9-12.F.IF.3: Understand the concept of a function and use function notation Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (Generally, the scope of high school math defines this subset as the set of natural numbers $1, 2, 3, 4, \dots$) By graphing or calculating terms, students should be able to show how the recursive sequence $a_n = 7, a_n = a_{n-1} + 2$; the sequence $a_n = 2(1) + 7$; and the function $f(n) = 2n + 5$ (when n is a natural number) all define the same sequence.

• ARITHMETIC AND GEOMETRIC SEQUENCES

- MGSE9-12.F.BF.2: Build a function that models a relationship between two quantities 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: Build a function that models a relationship between two quantities Write a function that describes a relationship between two quantities. Determine an explicit expression and the recursive process (steps for calculation) from context.

Unit 16: Polynomials

• ADDITION AND SUBTRACTION OF POLYNOMIALS

- MGSE9-12.A.APR.1: Perform arithmetic operations on polynomials 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: Perform arithmetic operations on polynomials Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.

Unit 17: Factoring Special Cases

• FACTORING SPECIAL CASES

- MGSE9-12.A.SSE.2: Interpret the structure of expressions Use the structure of an expression to rewrite it in different equivalent forms.
- MGSE9-12.A.SSE.1b: Interpret the structure of expressions Interpret expressions that represent a quantity in terms of its context. Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret the meaning (in context) of individual terms or factors.

Unit 18: Factoring Quadratic Trinomials

• FACTORING QUADRATIC TRINOMIALS

- MGSE9-12.A.REI.4b: Solve equations and inequalities in one variable Solve quadratic equations in one variable. 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.SSE.2: Interpret the structure of expressions Use the structure of an expression to rewrite it in different equivalent forms.
- MGSE9-12.A.REI.4b: Solve equations and inequalities in one variable Solve quadratic equations in one variable. 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).

Unit 19: Quadratic Functions

• QUADRATIC FUNCTIONS

- MGSE9-12.F.IF.4: Interpret functions that arise in applications in terms of the context 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.

Unit 20: Graphing Quadratic Functions

• ANALYZING GRAPHS OF QUADRATIC FUNCTIONS

- MGSE9-12.F.IF.1: Understand the concept of a function and use function notation 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: Interpret functions that arise in applications in terms of the context Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
- MGSE9-12.F.IF.4: Interpret functions that arise in applications in terms of the context 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: Analyze functions using different representations Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).
- MGSE9-12.A.REI.4b: Solve equations and inequalities in one variable Solve quadratic equations in one variable. 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).

• REPRESENTATIONS OF QUADRATIC FUNCTIONS

- MGSE9-12.A.REI.4a: Solve equations and inequalities in one variable Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation

in into an equation of the form $() =$ that has the same solutions. Derive the quadratic formula from $+ + = 0$.

- MGSE9-12.F.IF.9: Analyze functions using different representations Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
- MGSE9-12.F.IF.4: Interpret functions that arise in applications in terms of the context 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.CED.2: Create equations that describe numbers or relationships 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.

Unit 21: Solving Quadratic Equations

• SOLVING QUADRATIC EQUATIONS BY FACTORING

- MGSE9-12.A.SSE.3a: Write expressions in equivalent forms to solve problems Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Factor any quadratic expression to reveal the zeros of the function defined by the expression.

• COMPLETING THE SQUARE

- MGSE9-12.A.REI.4b: Solve equations and inequalities in one variable Solve quadratic equations in one variable. Solve quadratic equations by inspection (e.g., for $= 49$), 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: Solve equations and inequalities in one variable Solve quadratic equations in one variable. Use the method of completing the square to transform any quadratic equation in into an equation of the form $() =$ that has the same solutions. Derive the quadratic formula from $+ + = 0$.
- MGSE9-12.A.SSE.3b: Write expressions in equivalent forms to solve problems Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function defined by the expression.
- MGSE9-12.F.IF.8a: Analyze functions using different representations Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- MGSE9-12.F.IF.7a: Analyze functions using different representations Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. Graph

linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).

Unit 22: Quadratic Formula

• QUADRATIC FORMULA

- MGSE9-12.F.IF.4: Interpret functions that arise in applications in terms of the context 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.REI.4b: Solve equations and inequalities in one variable Solve quadratic equations in one variable. Solve quadratic equations by inspection (e.g., for $x = 49$), 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).

Unit 23: Parent Functions

• LINEAR AND EXPONENTIAL PARENT FUNCTIONS

- MGSE9-12.F.IF.5: Interpret functions that arise in applications in terms of the context Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

• QUADRATIC PARENT FUNCTION

- MGSE9-12.F.IF.5: Interpret functions that arise in applications in terms of the context Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

• MULTIPLE REPRESENTATIONS OF FUNCTIONS

- MGSE9-12.F.IF.9: Analyze functions using different representations Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Unit 24: Transformations of Parent Functions

• TRANSFORMATIONS OF THE LINEAR AND EXPONENTIAL PARENT FUNCTIONS

- MGSE9-12.F.BF.3: Build new functions from existing functions Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $f(x) - k$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

• TRANSFORMATIONS OF THE QUADRATIC PARENT FUNCTION

- MGSE9-12.F.BF.3: Build new functions from existing functions Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $f(x) - k$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects

on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Unit 25: Nonlinear Functions

• LINEAR VERSUS NONLINEAR FUNCTIONS

- MGSE9-12.F.LE.1a: Construct and compare linear, quadratic, and exponential models and solve problems Distinguish between situations that can be modeled with linear functions and with exponential functions. Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.
- MGSE9-12.F.IF.4: Interpret functions that arise in applications in terms of the context 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: Construct and compare linear, quadratic, and exponential models and solve problems Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- MGSE9-12.F.LE.1c: Construct and compare linear, quadratic, and exponential models and solve problems Distinguish between situations that can be modeled with linear functions and with exponential functions. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

• ABSOLUTE VALUE FUNCTIONS

- MGSE9-12.F.BF.3: Build new functions from existing functions Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $f(x) - k$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Unit 26: Systems of Nonlinear Equations

• SYSTEMS OF NONLINEAR EQUATIONS

- MGSE9-12.A.REI.11: Represent and solve equations and inequalities graphically 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.

Unit 27: Statistics

• DATA ANALYSIS

- MGSE9-12.S.ID.1: Summarize, represent, and interpret data on a single count or measurement variable Represent data with plots on the real number line (dot plots, histograms, and box plots).

- MGSE9-12.S.ID.2: Summarize, represent, and interpret data on a single count or measurement variable 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: Summarize, represent, and interpret data on a single count or measurement variable 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, represent, and interpret data on two categorical and quantitative variables Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
- **SCATTERPLOTS**
 - MGSE9-12.S.ID.9: Interpret linear models Distinguish between correlation and causation.
 - MGSE9-12.S.ID.7: Interpret linear models 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.8: Interpret linear models Compute (using technology) and interpret the correlation coefficient 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 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 .
 - MGSE9-12.S.ID.6a: Summarize, represent, and interpret data on two categorical and quantitative variables Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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: Summarize, represent, and interpret data on two categorical and quantitative variables Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Using given or collected bivariate data, fit a linear function for a scatter plot that suggests a linear association.

Unit 28: Test-Taking Strategies

- **STUDY HABITS**
- **BEING PREPARED AND GETTING STARTED**
- **WORDING IN TEST QUESTIONS**
- **WORDING IN ANSWER CHOICES**

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- **QUESTIONS WITH PASSAGES AND VISUAL DATA**
 - **ESSAY AND SHORT ANSWER QUESTIONS**
 - **WORD PROBLEMS**
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