Georgia
Standards of Excellence
Curriculum Map

Mathematics

GSE Algebra I

Georgia Department of Education

Richard Woods, Georgia's School Superintendent
"Educating Georgia's Future"

Georgia Department of Education

Georgia Standards of Excellence Algebra I Curriculum Map

1st Semester			2nd Semester		
Unit 1 *(4 – 5 weeks)*	**Unit 2** *(4 – 5 weeks)*	**Unit 3** *(6 – 7 weeks)*	**Unit 4** *(5 – 6 weeks)*	**Unit 5** *(4 – 5 weeks)*	**Unit 6** *(4 – 5 weeks)*
Relationships Between Quantities and Expressions	**Reasoning with Linear Equations and Inequalities**	**Modeling and Analyzing Quadratic Functions**	**Modeling and Analyzing Exponential Functions**	**Comparing and Contrasting Functions**	**Describing Data**
MCC9-12.N.RN.2	**MCC9-12.A.CED.1**	**MCC9-12.A.SSE.2**	**MCC9-12.A.CED.1**	**MCC9-12.F.LE.1**	**MCC9-12.S.ID.1**
MCC9-12.N.RN.3	**MCC9-12.A.CED.2**	**MCC9-12.A.SSE.3**	**MCC9-12.A.CED.2**	**MCC9-12.F.LE.1a**	**MCC9-12.S.ID.2**
MCC9-12.N.Q.1	**MCC9-12.A.CED.3**	**MCC9-12.A.SSE.3a**	**MCC9-12.A.REI.1**	**MCC9-12.F.LE.1b**	**MCC9-12.S.ID.3**
MCC9-12.N.Q.2	**MCC9-12.A.CED.4**	**MCC9-12.A.SSE.3b**	**MCC9-12.F.BF.1**	**MCC9-12.F.LE.1c**	**MCC9-12.S.ID.5**
MCC9-12.N.Q.3	**MCC9-12.A.REI.1**	**MCC9-12.A.CED.1**	**MCC9-12.F.BF.1a**	**MCC9-12.F.LE.2**	**MCC9-12.S.ID.6**
MCC9-12.A.SSE.1	**MCC9-12.A.REI.3**	**MCC9-12.A.CED.2**	**MCC9-12.F.BF.2**	**MCC9-12.F.LE.3**	**MCC9-12.S.ID.6a**
MCC9-12.A.SSE.1a	**MCC9-12.A.REI.5**	**MCC9-12.A.CED.4**	**MCC9-12.F.BF.3**	**MCC9-12.F.LE.5**	**MCC9-12.S.ID.6c**
MCC9-12.A.SSE.1b	**MCC9-12.A.REI.6**	**MCC9-12.A.REI.1**	**MCC9-12.F.IF.1**	**MCC9-12.F.BF.3**	**MCC9-12.S.ID.7**
MCC9-12.A.APR.1	**MCC9-12.A.REI.10**	**MCC9-12.A.REI.4**	**MCC9-12.F.IF.2**	**MCC9-12.F.IF.1**	**MCC9-12.S.ID.8**
	MCC9-12.A.REI.11	**MCC9-12.A.REI.4a**	**MCC9-12.F.IF.3**	**MCC9-12.F.IF.2**	**MCC9-12.S.ID.9**
	MCC9-12.A.REI.12	**MCC9-12.A.REI.4b**	**MCC9-12.F.IF.4**	**MCC9-12.F.IF.4**	
	MCC9-12.F.BF.1	**MCC9-12.F.BF.1**	**MCC9-12.F.IF.5**	**MCC9-12.F.IF.5**	
	MCC9-12.F.BF.1a	**MCC9-12.F.BF.3**	**MCC9-12.F.IF.6**	**MCC9-12.F.IF.6**	
	MCC9-12.F.BF.2	**MCC9-12.F.IF.1**	**MCC9-12.F.IF.7**	**MCC9-12.F.IF.7**	
	MCC9-12.F.IF.1	**MCC9-12.F.IF.2**	**MCC9-12.F.IF.7e**	**MCC9-12.F.IF.9**	
	MCC9-12.F.IF.2	**MCC9-12.F.IF.4**	**MCC9-12.F.IF.9**		
	MCC9-12.F.IF.3	**MCC9-12.F.IF.5**			
	MCC9-12.F.IF.4	**MCC9-12.F.IF.6**			
	MCC9-12.F.IF.5	**MCC9-12.F.IF.7**			
	MCC9-12.F.IF.6	**MCC9-12.F.IF.7a**			
	MCC9-12.F.IF.7	**MCC9-12.F.IF.8**			
	MCC9-12.F.IF.7a	**MCC9-12.F.IF.8a**			
	MCC9-12.F.IF.9	**MCC9-12.F.IF.9**			

These units were written to build upon concepts from prior units, so later units contain tasks that depend upon the concepts addressed in earlier units.
All units will include the Mathematical Practices and indicate skills to maintain.
***Revised standards indicated in bold red font.**

NOTE: Mathematical standards are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical topics.

Grade 9-12 Key:

Number and Quantity Strand: RN = The Real Number System, Q = Quantities, CN = Complex Number System, VM = Vector and Matrix Quantities
Algebra Strand: SSE = Seeing Structure in Expressions, APR = Arithmetic with Polynomial and Rational Expressions, CED = Creating Equations, REI = Reasoning with Equations and Inequalities
Functions Strand: IF = Interpreting Functions, LE = Linear and Exponential Models, BF = Building Functions, TF = Trigonometric Functions
Geometry Strand: CO = Congruence, SRT = Similarity, Right Triangles, and Trigonometry, C = Circles, GPE = Expressing Geometric Properties with Equations, GMD = Geometric Measurement and Dimension, MG = Modeling with Geometry
Statistics and Probability Strand: ID = Interpreting Categorical and Quantitative Data, IC = Making Inferences and Justifying Conclusions, CP = Conditional Probability and the Rules of Probability, MD = Using Probability to Make Decisions

Richard Woods, State School Superintendent
July 2015

Georgia Department of Education

Georgia Standards of Excellence Algebra I
Curriculum Map Rationale

Unit 1: As in Coordinate Algebra, students will interpret the structure of expressions and solve problems related to unit analysis**.** The properties of rational and irrational numbers and operations with polynomials have been added as a preparation for working with quadratic functions later in the course. This content will provide a solid foundation for all subsequent units.

Unit 2: Students will analyze linear functions only. Students will (1) investigate key features of graphs; (2) create, solve, and model graphically linear equations and inequalities in one and two variables; (3) create, solve, and model graphically systems of linear equations and inequalities in two variables; (4) rearrange formulas to highlight a quantity of interest (5) recognize arithmetic sequences as linear functions. Some standards will be repeated in units 3, 4, and 5 as they apply to quadratics and exponentials. (Recall that many of the standards are extensions of middle school standards.)

Unit 3: Students will analyze quadratic functions only. Students will (1) investigate key features of graphs; (2) solve quadratic equations by taking square roots, factoring ($x^2 + bx + c$ AND $ax^2 + bx + c$), completing the square, and using the quadratic formula; (3) compare and contrast graphs in standard, vertex, and intercept forms. Students will only work with real number solutions.

Unit 4: Students will analyze exponential functions only. Students will (1) investigate key features of graphs; (2) create, solve, and model graphically exponential equations; (3) recognize geometric sequences as exponential functions.

Unit 5: Students will compare and contrast linear, quadratic, and exponential functions in this unit.

Unit 6: Students will summarize, represent, and interpret data on a single count or measurement variable. Students will summarize, represent, and interpret data on two categorical and quantitative variables. Students will interpret linear models.

The pacing suggested above will allow students to gain a foundation in linear, quadratic, and exponential functions before they are brought together to be compared/contrasted in Unit 5. Although units 2, 3, and 4 look lengthy in terms of the number of standards, only their application to one function type per unit will be addressed. As key characteristics of functions are introduced in unit 2 and revisited within units 3, 4, and 5, students will gain a deeper understanding of such concepts as domain and range, intercepts, increasing/decreasing, relative maximum/minimum, symmetry, end behavior, and the effect of function parameters. Unit 5 will provide an excellent opportunity for review of many concepts in preparation for the administration of the Georgia Milestones EOC assessment.

Richard Woods, State School Superintendent
July 2015

Georgia Standards of Excellence Algebra I Expanded Curriculum Map – 1st Semester

Standards for Mathematical Practice

1 Make sense of problems and persevere in solving them.	**5** Use appropriate tools strategically.
2 Reason abstractly and quantitatively.	**6** Attend to precision.
3 Construct viable arguments and critique the reasoning of others.	**7** Look for and make use of structure.
4 Model with mathematics.	**8** Look for and express regularity in repeated reasoning.

1st Semester

Unit 1	Unit 2	Unit 3
Relationships Between Quantities and Expressions	**Reasoning with Linear Equations and Inequalities**	**Modeling and Analyzing Quadratic Functions**
Use properties of rational and irrational numbers. **MCC9-12.N.RN.2** Rewrite expressions involving radicals ~~and rational exponents using the properties of exponents.~~ **MCC9-12.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. **Reason quantitatively and use units to solve problems.** **MCC9-12.N.Q.1** Use units of measure (linear, area, capacity, rates, and time) as a way to understand problems: a. Identify, use, and record appropriate units of measure within context, within data displays, and on graphs; b. 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); c. Use units within multi-step problems and formulas; interpret units of input and resulting units of output. **MCC9-12.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. **MCC9-12.N.Q.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *For example, money situations are generally reported to the nearest cent (hundredth). Also, an answers' precision is limited to the precision of the data given.* **Interpret the structure of expressions.** **MCC9-12.A.SSE.1** Interpret expressions that represent a quantity in terms of its context. **MCC9-12.A.SSE.1a** Interpret parts of an expression, such as terms, factors, and coefficients, in context. **MCC9-12.A.SSE.1b** Given situations which utilize formulas or expressions with multiple terms and/or factors, interpret	**Create equations that describe numbers or relationships.** **MCC9-12.A.CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, ~~simple rational,~~ and exponential functions (integer inputs only). **MCC9-12.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. (The phrase "in two or more variables" refers to formulas like the compound interest formula, in which $A = P(1 + r/n)^{nt}$ has multiple variables.) **MCC9-12.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. **MCC9-12.A.CED.4** Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations. *Examples: Rearrange Ohm's law $V = IR$ to highlight resistance R; Rearrange area of a circle formula $A = \pi r^2$ to highlight the radius r.* **Understand solving equations as a process of reasoning and explain the reasoning.** **MCC9-12.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. **Solve equations and inequalities in one variable.** **MCC9-12.A.REI.3** Solve linear equations and inequalities in one variable including equations with coefficients represented by letters. *For example, given $ax + 3 = 7$, solve for x.*	**Interpret the structure of expressions.** **MCC9-12.A.SSE.2** Use the structure of an expression to rewrite it in different equivalent forms. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$. **Write expressions in equivalent forms to solve problems.** **MCC9-12.A.SSE.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. **MCC9-12.A.SSE.3a** Factor any quadratic expression to reveal the zeros of the function defined by the expression. **MCC9-12.A.SSE.3b** Complete the square in a quadratic expression to reveal the maximum and minimum value of the function defined by the expression. **Create equations that describe numbers or relationships.** **MCC9-12.A.CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, ~~simple rational,~~ and exponential functions (integer inputs only). **MCC9-12.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. (The phrase "in two or more variables" refers to formulas like the compound interest formula, in which $A = P(1 + r/n)^{nt}$ has multiple variables.) **MCC9-12.A.CED.4** Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations. *Examples: Rearrange Ohm's law $V = IR$ to highlight resistance R; Rearrange area of a circle formula $A = \pi r^2$ to highlight the radius r.* **Understand solving equations as a process of reasoning and explain the reasoning.** **MCC9-12.A.REI.1** Using algebraic properties and the properties of real numbers, justify the steps of a simple,

the meaning (in context) of individual terms or factors. **Perform arithmetic operations on polynomials.** **MCC9-12.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.**	**Solve systems of equations.** **MCC9-12.A.REI.5 Show and explain why the elimination method works to solve a system of two-variable equations.** **MCC9-12.A.REI.6** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. **Represent and solve equations and inequalities graphically.** **MCC9-12.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.** **MCC9-12.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.** **MCC9-12.A.REI.12 Graph the solution set to a linear inequality in two variables.** **Build a function that models a relationship between two quantities.** **MCC9-12.F.BF.1** Write a function that describes a relationship between two quantities. **MCC9-12.F.BF.1a Determine an explicit expression and the recursive process (steps for calculation) from context.** ***For example, if Jimmy starts out with $15 and earns $2 a day, the explicit expression "2x+15" can be described recursively (either in writing or verbally) as "to find out how much money Jimmy will have tomorrow, you add $2 to his total today."*** $J_n = J_{n-1} + 2, J_0 = 15$ **MCC9-12.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.** **Understand the concept of a function and use function notation.** **MCC9-12.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).** **MCC9-12.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. **MCC9-12.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**	**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.** **Solve equations and inequalities in one variable.** **MCC9-12.A.REI.4** Solve quadratic equations in one variable. **MCC9-12.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 $ax^2 + bx + c = 0$.** **MCC9-12.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).** **Build a function that models a relationship between two quantities.** **MCC9-12.F.BF.1** Write a function that describes a relationship between two quantities. **Build new functions from existing functions.** **MCC9-12.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. **Understand the concept of a function and use function notation.** **MCC9-12.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).** **MCC9-12.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. **Interpret functions that arise in applications in terms of the context.** **MCC9-12.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; end behavior; ~~and periodicity.~~**

	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. **Interpret functions that arise in applications in terms of the context.** **MCC9-12.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; end behavior; ~~and periodicity.~~** **MCC9-12.F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* **MCC9-12.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. **Analyze functions using different representations.** **MCC9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.** **MCC9-12.F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).** **MCC9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.***	**MCC9-12.F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* **MCC9-12.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. **Analyze functions using different representations.** **MCC9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.** **MCC9-12.F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).** **MCC9-12.F.IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. **MCC9-12.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. *For example, compare and contrast quadratic functions in standard, vertex, and intercept forms.*** **MCC9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.***

Georgia Standards of Excellence Algebra I Expanded Curriculum Map – 2nd Semester

Standards for Mathematical Practice

1 Make sense of problems and persevere in solving them.	**5** Use appropriate tools strategically.
2 Reason abstractly and quantitatively.	**6** Attend to precision.
3 Construct viable arguments and critique the reasoning of others.	**7** Look for and make use of structure.
4 Model with mathematics.	**8** Look for and express regularity in repeated reasoning.

2nd Semester

Unit 4

Modeling and Analyzing Exponential Functions

Create equations that describe numbers or relationships.

MCC9-12.A.CED.1 **Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, ~~simple rational,~~ and exponential functions (integer inputs only).**

MCC9-12.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. (The phrase "in two or more variables" refers to formulas like the compound interest formula, in which $A = P(1 + r/n)^{nt}$ has multiple variables.)**

Understand solving equations as a process of reasoning and explain the reasoning.

MCC9-12.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.**

Build a function that models a relationship between two quantities.

MCC9-12.F.BF.1 Write a function that describes a relationship between two quantities.

MCC9-12.F.BF.1a **Determine an explicit expression and the recursive process (steps for calculation) from context. *For example, if Jimmy starts out with $15 and earns $2 a day, the explicit expression "2x+15" can be described recursively (either in writing or verbally) as "to find out how much money Jimmy will have tomorrow, you add $2 to his total today."*** $J_n = J_{n-1} + 2, J_0 = 15$

MCC9-12.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.**

Unit 5

Comparing and Contrasting Functions

Construct and compare linear, quadratic, and exponential models and solve problems.

MCC9-12.F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

MCC9-12.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).**

MCC9-12.F.LE.1b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

MCC9-12.F.LE.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

MCC9-12.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).

MCC9-12.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.

Interpret expressions for functions in terms of the situation they model.

MCC9-12.F.LE.5 **Interpret the parameters in a linear ($f(x) = mx + b$) and exponential ($f(x) = a \cdot d^x$) 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.**

Build new functions from existing functions.

MCC9-12.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

Unit 6

Describing Data

Summarize, represent, and interpret data on a single count or measurement variable.

MCC9-12.S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).

MCC9-12.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, ~~standard deviation~~) of two or more different data sets.**

MCC9-12.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).

Summarize, represent, and interpret data on two categorical and quantitative variables.

MCC9-12.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.

MCC9-12.S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

MCC9-12.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.**

MCC9-12.S.ID.6c **Using given or collected bivariate data, fit a linear function for a scatter plot that suggests a linear association.**

Interpret linear models.

MCC9-12.S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

MCC9-12.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**

Build new functions from existing functions.

MCC9-12.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.

Understand the concept of a function and use function notation.

MCC9-12.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).

MCC9-12.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.

MCC9-12.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.

Interpret functions that arise in applications in terms of the context.

MCC9-12.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; end behavior; ~~and periodicity.~~

MCC9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

MCC9-12.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.

Analyze functions using different representations.

MCC9-12.F.IF.7 Graph functions expressed algebraically 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.

Understand the concept of a function and use function notation.

MCC9-12.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).

MCC9-12.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.

Interpret functions that arise in applications in terms of the context.

MCC9-12.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; end behavior; ~~and periodicity.~~

MCC9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

MCC9-12.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.

Analyze functions using different representations.

MCC9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.

MCC9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.*

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".

MCC9-12.S.ID.9 Distinguish between correlation and causation.

and show key features of the graph both by hand and by using technology. **MCC9-12.F.IF.7e** Graph exponential ~~and logarithmic~~ functions, showing intercepts and end behavior, ~~and trigonometric functions, showing period, midline, and amplitude.~~ **MCC9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).** ***For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.***		