Common Core Georgia Performance Standards
High School Mathematics
CCGPS Coordinate Algebra - At a Glance

Common Core Georgia Performance Standards: Curriculum Map						
1st Semester			2nd Semester			
Unit 1	**Unit 2**	**Unit 3a**	**Unit 3b**	**Unit 4**	**Unit 5**	**Unit 6**
Relationships Between Quantities	**Reasoning with Equations and Inequalities**	**Characteristics of Linear and Exponential Functions**	**Applications of Linear and Exponential Functions**	**Describing Data**	**Transformations in the Coordinate Plane**	**Connecting Algebra and Geometry Through Coordinates**
4 weeks	**7 weeks**	**5 weeks**	**3 weeks**	**4 weeks**	**4 weeks**	**5 weeks**
MCC9-12.N.Q.1 MCC9-12.N.Q.2 MCC9-12.N.Q.3 MCC9-12.A.SSE.1a,b MCC9-12.A.CED.1 MCC9-12.A.CED.2 MCC9-12.A.CED.3 MCC9-12.A.CED.4	MCC9-12.A.REI.1 MCC9-12.A.REI.3 MCC9-12.A.REI.5 MCC9-12.A.REI.6 MCC9-12.A.REI.12	MCC9-12.A.REI.10 MCC9-12.A.REI.11 MCC9-12.F.IF.1 MCC9-12.F.IF.2 MCC9-12.F.IF.3 MCC9-12.F.IF.4 MCC9-12.F.IF.5 MCC9-12.F.IF.6 MCC9-12.F.IF.7a,e MCC9-12.F.IF.9 MCC9-12.F.LE.1b	MCC9-12.F.BF.1a,b MCC9-12.F.BF.2 MCC9-12.F.BF.3 MCC9-12.F.LE.1a,b,c MCC9-12.F.LE.2 MCC9-12.F.LE.3 MCC9-12.F.LE.5	MCC9-12.S.ID.1 MCC9-12.S.ID.2 MCC9-12.S.ID.3 MCC9-12.S.ID.5 MCC9-12.S.ID.6a,b,c MCC9-12.S.ID.7 MCC9-12.S.ID.8 MCC9-12.S.ID.9 **Transition Standards (12-15 only)** MCC6.SP.5c	MCC9-12.G.CO.1 MCC9-12.G.CO.2 MCC9-12.G.CO.3 MCC9-12.G.CO.4 MCC9-12.G.CO.5	MCC9-12.G.GPE.4 MCC9-12.G.GPE.5 MCC9-12.G.GPE.6 MCC9-12.G.GPE.7 **Transition Standards (12-13 only)** MCC8.G.8
Power Standards are highlighted above and are linked to the Unwrapped Standard. ***2 Buffer Days are included after each Unit for Remediation and Enrichment*** ★ ***Making Mathematical Models***						
Standards for Mathematical Practice						
1 Make sense of problems and persevere in solving them. 2 Reason abstractly and quantitatively. 3 Construct viable arguments and critique the reasoning of others. 4 Model with mathematics			5 Use appropriate tools strategically. 6 Attend to precision. 7 Look for and make use of structure. 8 Look for and express regularity in repeated reasoning.			

Adapted from GA DOE by
FORSYTH COUNTY SCHOOLS

1st Semester

Unit 1: Relationships Between Quantities

Reason quantitatively and use units to solve problems.

MCC9-12.N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.★

MCC9-12.N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.★

MCC9-12.N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.★

Interpret the structure of expressions

MCC9-12.A.SSE.1 Interpret expressions that represent a quantity in terms of its context.★ *(Emphasis on linear expressions and exponential expressions with integer exponents.)*

MCC9-12.A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients.★ *(Emphasis on linear expressions and exponential expressions with integer exponents.)*

MCC9-12.A.SSE.1b Interpret complicated expressions by viewing one or more of their parts as a single entity.★ *(Emphasis on linear expressions and exponential expressions with integer exponents.)*

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 ~~and quadratic functions, and simple rational~~ and exponential functions.★

MCC9-12.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.★ *(Limit to linear and exponential equations, and, in the case of exponential equations, limit to situations requiring evaluation of exponential functions at integer inputs.)*

MCC9-12.A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.★ *(Limit to linear equations and inequalities.)*

MCC9-12.A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.★ *(Limit to formulas with a linear focus.)*

Unit 2: Reasoning with Equations and Inequalities

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

MCC9-12.A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. *(Students should focus on and master linear equations and be able to extend and apply their reasoning to other types of equations in future courses.)*

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. *(Extend earlier work with solving linear equations to solving linear inequalities in on variable and to solving literal equations that are linear in the variable being solved for. Include simple exponential equations that rely only on application of the laws of exponents, such as $5^x = 125$ or $2^x = \frac{1}{16}$.)*

Solve systems of equations

MCC9-12.A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. *(Limit to linear systems.)*

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.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Unit 3a: Characteristics of Linear and Exponential Functions

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, often forming a curve (which could be a line). *(Focus on linear and exponential equations and be able to adapt and apply that learning to other types of equations in future courses.)*

MCC9-12.A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, ~~polynomial, rational, absolute value,~~ exponential, ~~and logarithmic~~ functions.★

Understand the concept of a function and use function notation

MCC9-12.F.IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x isan element of its domain, then f(x) denotes the output of corresponding to the input x. The graph of f is the graph of the equation y = f(x). *(Draw examples from linear and exponential functions.)*

MCC9-12.F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation terms of a context. (*Draw examples from linear and exponential functions.)*

MCC9-12.F.IF.3 Recognize that sequences are functions, sometimesdefined recursively, whose domain is a subset of the integers. *(Draw connection to F.BF.2, which requires students to write arithmetic and geometric sequences.)*

Interpret functions that arise in applications in terms of the context

MCC9-12.F.IF.4 For a function that models a relationship betweentwo quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, ornegative; relative maximums and minimums; symmetries; end behavior; ~~and periodicity~~.★ *(Focus on linear and exponential functions.)*

MCC9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.★ *(Focus on linear and exponential functions.)*

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.★ *(Focus on linear functions and intervals for exponential functions whose domain is a subset of the integers.)*

Analyze functions using different representations

MCC9-12.F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ *(Focus on linear and exponential functions. Include comparisons of two functions presented algebraically.)***MCC9-12.F.IF.7a** Graph linear ~~and quadratic~~ functions and show intercepts, maxima, and minima.★

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). *(Focus on linear and exponential functions. Include comparisons of two functions presented algebraically.)*

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

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

2nd Semester

Unit 3b: Applications of Linear and Exponential Functions

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.★ *(Limit to linear and exponential functions.)*

MCC9-12.F.BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context. *(Limit to linear and exponential functions.)*

MCC9-12.F.BF.1b Combine standard function types using arithmetic operations. *(Limit to linear and exponential functions.)*

MCC9-12.F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★

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 onthe graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. *(Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept.)*

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 Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals.★

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 or exponential function in terms of a context.★ *(Limit exponential functions to those of the form f(x) = b^x + k.)*

Unit 4: 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, ~~standard deviation~~) of two or more different data sets.★ *(Standard deviation is left for Advanced Algebra; use MAD as a measure of spread.)*

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 Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Uses given functions or choose a function suggested by the context. Emphasize linear, ~~quadratic~~, and exponential models.★

MCC9-12.S.ID.6b Informally assess the fit of a function by plotting and analyzing residuals.★

MCC9-12.S.ID.6c 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 of a linear fit.★

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

Transition Standard (Teach 2012-2015 only):

MCC6.SP.5c (Mean absolute deviation only)

Unit 5: Transformations in the Coordinate Plane	
Experiment with transformations in the plane **MCC9-12.G.CO.1** Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. **MCC9-12.G.CO.2** Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). **MCC9-12.G.CO.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	**MCC9-12.G.CO.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. **MCC9-12.G.CO.5** Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
Unit 6: Connecting Algebra and Geometry Through Coordinates	
Use coordinates to prove simple geometric theorems algebraically **MCC9-12.G.GPE.4** Use coordinates to prove simple geometric theorems algebraically. *(Restrict contexts that use distance and slope.)* **MCC9-12.G.GPE.5** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	**MCC9-12.G.GPE.6** Find the point on a directed line segment between two given points that partitions the segment in a given ratio. **MCC9-12.G.GPE.7** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.★ **Transition Standard (Teach 2012-2013 only):** **MCC8.G.8** Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra , 11/Advanced Algebra
Unit of Study	Unit 3: Linear and Exponential Functions , Unit 3:Rational and Radical Relationships
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x)=g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and /or g(x) are linear, ~~polynomial, rational, absolute value~~, exponential, ~~and logarithmic~~ functions.

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Explain (solutions graphically). **Approximate** (solutions using technology).	**Points of Intersection** **Solutions**	**Analysis (2)** **Analysis (3)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Create a table of values (with and without technology) to solve systems of equations. **Analyze graphs to determine solutions.**	**What does the point of intersection on a graph represent?** **What do x-intercepts represent?**

Explanations and Examples
Students need to understand that numerical solution methods (data in a table used to approximate an algebraic function) and graphical solution methods may produce approximate solutions, and algebraic solution methods produce precise solutions that can be represented graphically or numerically. Students may use graphing calculators or programs to generate tables of values, graph, or solve a variety of functions. **Example:** • **Given the following equations determine the *x* value that results in an equal output for both functions.** $f(x) = 3x - 2$ $g(x) = (x + 3)^2 - 1$ **Use technology to graph and compare a beginning salary of $30 per day increased by $5 each day and a beginning salary of $0.01 per day, which doubles each day. When are the salaries equal? How do you know?** **Explain why a company has to sell 100 soccer balls before they will make a profit. The cost of producing a soccer ball is modeled by C = 10*x* + 1000. The sales price of a soccer ball is $20.**
Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra
Unit of Study	Unit 2: Reasoning with Equations and Inequalities
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

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.

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Solve(systems of equations in two variables)	**Systems of Linear Equations (in two variables)**	**Synthesis (2)** **Applications (2)**

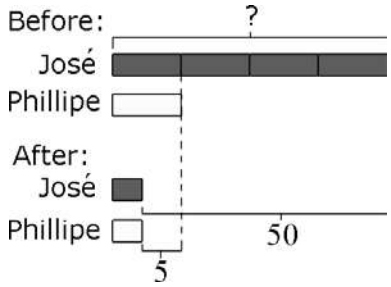
Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Solve a system of equations exactly (with algebra) and approximately (with graphs). **Test a solution to the system in both original equations (both graphically and algebraically).** **Analyze a system of equations using slope to predict one, infinitely many or no solutions.**	**What is an example of a system of linear equations with no solution?** **What is an example of a system of linear equations with infinitely many solutions?** **What is an example of a system of linear equations with one solution?** **How do you solve a system of equations algebraically?** **How do you solve a system of equations graphically?** **How can you determine if an ordered pair is a solution for a system of linear equations?**

Explanations and Examples

The system solution methods can include but are not limited to graphical, elimination/linear combination, substitution, and modeling. Systems can be written algebraically or can be represented in context. Students may use graphing calculators, programs, or applets to model and find approximate solutions for systems of equations.

Examples:

- **José had 4 times as many trading cards as Phillipe. After José gave away 50 cards to his little brother and Phillipe gave 5 cards to his friend for this birthday, they each had an equal amount of cards. Write a system to describe the situation and solve the system.**



- **Solve the system of equations: $x + y = 11$ and $3x - y = 5$.**
  Use a second method to check your answer.

- **Solve the system of equations:**
  $x - 2y + 3z = 5$, $x + 3z = 11$, $5y - 6z = 9$.

The opera theater contains 1,200 seats, with three different prices. The seats cost $45 dollars per seat, $50 per seat, and $60 per seat. The opera needs to gross $63,750 on seat sales. There are twice as many $60 seats as $45 seats. How many seats in each level need to be sold?

Approximate the solution to the system of equations graphically. Then verify the solution algebraically.
3 - 5y = -15
2x - y = 2

The high school is putting on the musical *Footloose*. The auditorium has 300 seats. Student tickets are $3 and adult tickets are $5. The royalty for the musical is $1300. What combination of student and adult tickets do you need to fill the house and pay the royalty? How could you change the price of tickets so more students can go?

Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra – 10/Analytic Geometry
Unit of Study	Unit 1: Relationships Between Quantities (Coordinate Algebra), Unit 5: Quadratic Functions (Analytic Geometry)
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Coordinate Algebra – Unit 1 • Create linear equations. • Create exponential equations. **Analytic Geometry – Unit 5** • Create quadratic functions. • Compare quadratic functions to linear functions.	**Coordinate Algebra – Unit 1** • Linear Equations • Exponential Equations **Analytic Geometry – Unit 5** • Quadratic Equations	**Synthesis (2)** **Applications (2)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Equations in two or more variables can be used to represent relationships. **Represent equations graphically on a labeled and scaled coordinate axes.** **Manipulate formulas to solve for indicated variables.** **The relationship of two or more variables can be represented graphically.**	**How do you represent relationships between quantities?** **How do I create equations in two or more variables to represent relationships between quantities?** **What the different ways to graph equations on a coordinate axes?** **What is the difference in the equations of a horizontal, vertical, and diagonal line?**

Explanations and Examples
Students may collect data from water that is cooling using two thermometers, one measuring Celsius, the other Fahrenheit. From this they can identify the relationship and show that it can be modeled with a linear function. **Lava coming from the eruption of a volcano follows a parabolic path. The height *h* in feet of a piece of lava *t* seconds after it is ejected from the volcano is given by $h(t) = -16t^2 + 64t + 936$.** **After how many seconds does the lava reach its maximum height of 1000 feet?** **Write and graph an equation that models the cost of buying and running an air conditioner with a purchase price of $250 which costs $0.38/hr to run.** **Jeanette can invest $2000 at 3% interest compounded annually or she can invest $1500 at 3.2% interest compounded annually. Which is the better investment and why?**
Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra
Unit of Study	Unit 2: Relationships Between Quantities
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.A.CED3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Represent(systems of equations/inequalities) **Interpret** (Solutions)	**Constraints** (systems of equations/inequalities) **Solutions** (systems of equations/inequalities)	**Synthesis (2)** **Applications (2)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Represent and interpret systems of equations/inequalities algebraically. **Represent and interpret systems of equations/inequalities graphically.** **Knows how to interpret solutions in an equation or inequality- is the solution viable or non-viable in the context of a problem.**	**How do you represent and interpret a system of equations/inequalities algebraically?** **How do you represent and interpret a system of equations/inequalities graphically?** **What is a constraint?** **How do I write and use a system of equations and/or inequalities to solve real world problems?**

Explanations and Examples

Example:

- **A club is selling hats and jackets as a fundraiser. Their budget is $1500 and they want to order at least 250 items. They must buy at least as many hats as they buy jackets. Each hat costs $5 and each jacket costs $8.**
  - **Write a system of inequalities to represent the situation.**
  - **Graph the inequalities.**
  - **If the club buys 150 hats and 100 jackets, will the conditions be satisfied?**
  - **What is the maximum number of jackets they can buy and still meet the conditions?**

Example: Given two sets of data that can be modeled with linear functions, find the intersection of the two trend lines, if it exists, and interpret the solution. For instance, if these trends continue, when will the women catch the men and what percentage of women will be earning $50,000 - $74,999?

Number of years since 2000	% of men earning $50,000 - $74,999	% of women earning $50,000 - $74,999
3	20.2	13.3
4	20.5	14.2
5	20.7	15.1

Iced tea costs $1.50 a glass and lemonade costs $2. If you have $12, what can you buy?

Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra, 10/ Analytic Geometry
Unit of Study	Unit 1: Relationships Between Quantities, Unit 5: Quadratic Functions
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.A.SSE.1. Interpret expressions that represent a quantity in terms of its context.

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Coordinate Algebra – Unit 1 • Recognize different parts of an expression • Interpret linear and exponential expressions with integer exponents **Analytic Geometry – Unit 5** • Interpret quadratic functions • Compare quadratic functions to linear functions	**Coordinate Algebra – Unit 1** • Linear Expressions • Exponential Expressions **Analytic Geometry – Unit 5** • Quadratic Functions	**Knowledge(1)** **Comprehension(1)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Quantities are represented by algebraic expressions. **Identify the different parts of the expression and explain their meaning within the context of a problem.**	**What are algebraic expressions?** **What is a coefficient?** **What are the terms of a polynomial?** **How can you classify a polynomial by number of terms?** **How can you classify a polynomial by degree?**

Explanations and Examples
Students should understand the vocabulary for the parts that make up the whole expression and be able to identify those parts and interpret there meaning in terms of a context. **For example in the expression $P(1+r)^n$, r may be the interest rate and $1 + r$ may be described as the "growth factor."** **Understanding the order of operations is essential to unpacking the meaning of a complex algebraic expression and to develop a strategy for solving an equation.** **Using the commutative, associative and distributive properties enables students to find equivalent expressions, which are helpful in solving equations.** **Consider the formula Surface Area=2B+Ph** • **What are the terms of this formula?** • **What are the coefficients?** **Interpret the expression: . Explain the output values possible.**
Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra
Unit of Study	Unit 3b: Applications of Linear and Exponential Functions
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.F.BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Write **Use** **Translate**	**Arithmetic Sequences** **Geometric Sequences** **Recursive and explicit formulas** **Model situations**	**Comprehension (2)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Write arithmetic sequences recursively and explicitly, use the two forms to model a situation, and translate between the two forms. **Write geometric sequences recursively and explicitly, use the two forms to model a situation, and translate between the two forms.** **Understand that linear functions are the explicit form of recursively-defined arithmetic sequences and that exponential functions are the explicit form of recursively-defined geometric sequences.**	**How do you write an arithmetic sequence both recursively and with an explicit formula?** **How do you write a geometric sequence both recursively and with an explicit formula?** **How do you know if a contextual situations models an arithmetic or geometric sequences?**

Explanations and Examples

An explicit rule for the *n*th term of a sequence gives a_n as an expression in the term's position *n*; a recursive rule gives the first term of a sequence, and a recursive equation relates a_n to the preceding term(s). Both methods of presenting a sequence describe a_n as a function of *n*.

Examples:

- **Generate the 5th-11th terms of a sequence if $A_1 = 2$ and $A_{(n+1)} = (A_n)^2 - 1$**
- **Use the formula: $A_n = A_1 + d(n - 1)$ where d is the common difference to generate a sequence whose first three terms are: -7, -4, and -1.**
- **There are 2,500 fish in a pond. Each year the population decreases by 25 percent, but 1,000 fish are added to the pond at the end of the year. Find the population in five years. Also, find the long-term population.**
- **Given the formula $A_n = 2n - 1$, find the 17th term of the sequence. What is the 9th term in the sequence 3, 5, 7, 9, …?**

Given $a_1 = 4$ and $a_n = a_{n-1} + 3$, write the explicit formula.

Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

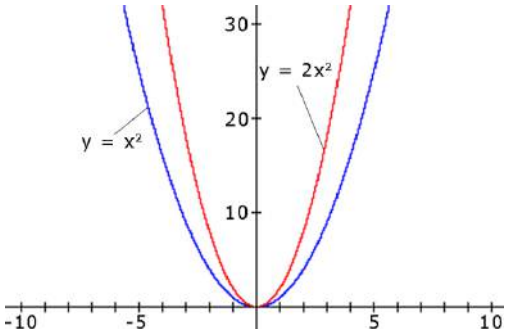
Content Area	Mathematics
Grade/Course	9/Coordinate Algebra
Unit of Study	Unit 3b: Applications of Linear and Exponential Functions
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

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. ***(Focus on vertical translations of graphs of linear and exponential functions. Relate the vertical translation of a linear function to its y-intercept.)***

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Identify **Find** **Experiment** **Illustrate** **Recognize**	**Effect on graphs** **Values of k** **Cases** **Explanations with technology** **Even and Odd Functions**	**Comprehension (2)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Identify, through experimenting with technology, the effect on the graph of a function by replacing f(x) with f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative). **Given the graphs of the original function and a transformation, determine the value of (k).** **Recognize even and odd functions from their graphs and equations.**	**What will happen to a function when it is replaced with different values of k?** **How does the vertical translation of a linear function relate to the y-intercept?** **How do you find the value of k given f(x) replaced by f(x) + k on a graph of a linear or exponential function?** **How do you determine whether a function is even or odd given a graph and/or algebraic expression?**

Explanations and Examples
Students will apply transformations to functions and recognize functions as even and odd. Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to graph functions. **Examples:** • **Is *f*(*x*) = $x^3 - 3x^2 + 2x + 1$ even, odd, or neither? Explain your answer orally or in written format..** • **Compare the shape and position of the graphs of $f(x) = x^2$ and $g(x) = 2x^2$, and explain the differences in terms of the algebraic expressions for the functions**      • **Describe effect of varying the parameters *a, h,* and *k* have on the shape and position of the graph of f(x) = $a(x-h)^2 + k$.**
Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard Forsyth County Schools

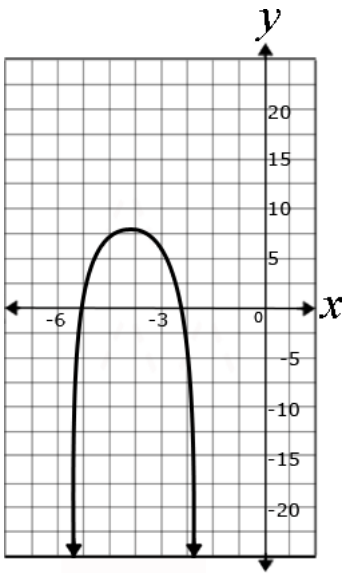
Content Area	High School Math Functions
Grade/Course	9/Coordinate Algebra; 10/Analytic Geometry
Unit of Study	Unit 3: Linear and Exponential Function, Unit 5: Quadratic Functions
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

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 quadratic function and an algebraic expression for another, say which has the larger maximum.*

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Analyze one function **Compare** algebraically, graphically, numerically in table, or by verbal descriptions	Coordinate Algebra-Unit 3 **Linear Functions** **Exponential Functions** Analytic Geometry-Unit 5 **Quadratic Functions** Linear Functions (review) Exponential Functions (review)	**Strategic Thinking (3)** **Synthesis (4)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Functions can be represented in four ways—VNAG—verbally, numerically, algebraically, and graphically. **Students should be able to determine which method might be the best for which property.** **Strategies for interpreting key features of representations.**	**What function family is being described?** **How do I find the maximum/minimum, average rate of change, x/y intercepts, domain, range, and number of roots of my function?** **How do I compare the key features of two functions represented in different ways?**

Explanations and Examples
Example: • **Examine the functions below. Which function has the larger maximum? How do you know?** **A.** **B.** $f(x) = -2x^2 - 8x + 20$    **Example:** **Which has a greater slope, A or B?** **A. F(x) = 3x + 5 or** **B. A function representing the number of bottle caps in a shoebox where 5 are added each time.** **Create a graphic organizer to highlight your understanding of functions and their properties by comparing two functions using at least two different representations.**
Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	High School Math Functions
Grade/Course	9/Coordinate Algebra
Unit of Study	Unit 3: Linear and Exponential Functions
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.F.LE.5 Interpret the parameters in a linear or exponential function in terms of context. ☆

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Interpret a problem's context. **Determine** the function that models the problem's situation.	**Applications of linear functions** **Applications of exponential functions**	**Application (2)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Students should be able to identify the situations where linear/exponential functions are necessary.	**How do I explain the meaning of the coefficients, factors, exponents, and/or intercepts in a linear or exponential function based on the context of a situation?** **Can I determine whether a situation can be represented with a linear function or an exponential function?** **Can I write the equation that is needed to solve the problem?**

Explanations and Examples
Use technology to explore the effects of the parameters *m* and *b* in the linear functions *y* = *mx* + *b* by holding first one parameter and then the other constant while allowing the other one to vary. **Example:** **A student club is raising funds to fight cancer. They raffle off a gift basket and sell raffle tickets. The function that gives their profit is *f*(*x*) = 2*x* – 80, where *x* is the number of tickets sold.** **a. How much did they spend on the gift basket?** **b. How much do they charge for each ticket?** **c. If they raise the price of a ticket, which parameter will change, the slope or the y-intercept? Explain.** **Students may use graphing calculators or programs, spreadsheets, or computer algebra systems to model and interpret parameters in linear, quadratic or exponential functions.** **Example:** • **A function of the form $f(n) = P(1 + r)^n$ is used to model the amount of money in a savings account that earns 5% interest, compounded annually, where *n* is the number of years since the initial deposit. What is the value of *r*? What is the meaning of the constant *P* in terms of the savings account? Explain either orally or in written format.** **You put $500 under your mattress and also deposit $500 in a bank with a 3% annual interest. Write an equation that represents the total amount of money you have at time *t*. Show how the base and vertical shift are displayed in the explicit form of the function.** **Annie is picking apples with her sister. The number of apples in her basket is described by *n* = 22*t* + 12, where t is the number of minutes Annie spends picking apples. What do the numbers 22 and 12 tell you about Annie's apple picking?**
Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra
Unit of Study	Unit 5: Transformations in the Coordinate Plane
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Given **Draw**	**Geometric Figures** **Rotation** **Reflection** **Translation**	**Comprehension (2)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Transform a geometric figure given a rotation, reflection, or translation using graph paper, tracing paper, or geometric software. **Create sequences of transformations that map a geometric figure on to itself and another geometric figure.**	**What methods can be used to perform rotations, reflections, and translations?** **How do you identify the sequence of transformations that will carry a given figure to another?**

Explanations and Examples

Students may use geometry software and/or manipulatives to model transformations and demonstrate a sequence of transformations that will carry a given figure onto another.

Have students use a variety of tools to explore and perform simple, multi-step, and composite rotations, reflections, and translations.
Given a transformation, work backwards to discover the sequence that led to that transformation.

Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	High School Math
Grade/Course	9/ Coordinate Algebra and 10/Analytic Geometry
Unit of Study	Unit 6: Connecting Algebra and Geometry through Coordinates, Unit 6: Modeling Geometry
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.G.GPE.4 Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Use (coordinate formulas)	Coordinate Algebra: **distance formula , slope formula**	**Application (2)**
Prove (geometric theorems)	Analytic Geometry: **properties of circles and parabolas**	**Analysis (3)** **Synthesis (4)**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Coordinates can be used to prove simple geometric theorems algebraically by applying the distance formula, slope formula, and midpoint formula.	**How do you prove geometric theorems using coordinates?**

Explanations and Examples
Students may use geometric simulation software to model figures and prove simple geometric theorems. **Example: Use slope and distance formula to verify the polygon formed by connecting the points (-3, -2), (5, 3), (9, 9), (1, 4) is a parallelogram.** **Prove or disprove that triangle ABC with coordinates A(-1,2), B(1,5), C(-2,7) is an isosceles right triangle.** **Take a picture or find a picture which includes a polygon. Overlay the picture on a coordinate plane (manually or electronically). Determine the coordinates of the vertices. Classify the polygon. Use the coordinates to justify the classification.**
Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra
Unit of Study	Unit 4: Describing Data
Duration of Unit	

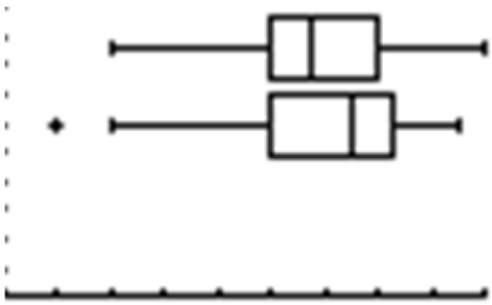
Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

MCC9-12.S.ID.3 Interpret differences in shape, center, spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

- **Students will examine graphical representations to determine if the data are symmetric, skewed left, or skewed right and how the shape of the data affects descriptive statistics.**

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Interpret **Account for Effects** **Examine** **Determine**	**Shape** **Center** **Spread** **Data Sets** **Outliers** **Graphical Representation** **Descriptive Statistics**	**(3) Strategic Thinking**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)
Outliers impact numerical and graphical data summaries **Shape of distribution indicates the relationship between measures of center** **Comparing graphs of multiple distributions can provide information about shape, center, and spread.**	**Which descriptive statistics should be used to characterize a data set based on its shape?** **How can we compare different distributions by analyzing their graphs?**

Explanation and Examples
Students may use spreadsheets, graphing calculators and statistical software to statistically identify outliers and analyze data sets with and without outliers as appropriate. **The boxplots show the distribution of scores on a district writing test in two fifth grade classes at a school. Which class performed better and why?**      **Find two similar data sets A and B (use textbook or internet resources). What changes would need to be made to data set A to make it look like the graph of set B?**
Next step, create assessments and engaging learning experiences

CCGPS Unwrapped Standard

Forsyth County Schools

Content Area	Mathematics
Grade/Course	9/Coordinate Algebra
Unit of Study	Unit 4: Describing Data
Duration of Unit	

Insert a CCGPS standard below (include code). **CIRCLE** the **SKILLS** that students need to be able to do and **UNDERLINE** the **CONCEPTS** that students need to know.

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

a. **Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, ~~quadratic~~, and exponential models.**
b. **Informally assess the fit of a function by plotting and analyzing residuals.**
c. **Fit a linear function for a scatter plot that suggests a linear association.**

Skills (what students must be able to do)	**Concepts** (what students need to know)	**DOK Level / Bloom's**
Represent Data **Describe Relations** **Fit a function** **Solve (in context)** **Assess fit** **Plot residuals** **Analyze residuals**	**Quantitative Variables** **Scatter Plot** **Exponential Models** **Residuals** **Linear Association** **Linear Models**	**(1) Knowledge and Comprehension** **(2) Application** **(3) Analysis**

Step 5: Determine BIG Ideas (enduring understandings students will remember long after the unit of study)	**Step 6: Write Essential Questions** (these guide instruction and assessment for all tasks. The big ideas are answers to the essential questions)

CCGPS Unwrapped Standard Forsyth County Schools

Describe how variables are related **Represent data on a scatter plot** **Fit functions and Assess the fit (association)** **Solve problems in context using the fitted function**	**How do I know if two variables are related?** **What are residuals and how do they help me assess fit?** **How can fitted functions help me solve real-world problems?**

Explanations and Examples

The residual in a regression model is the difference between the observed and the predicted y for some x(y the dependent variable and $x$the independent variable).
So if we have a model $y = ax + b$, and a data point (x_i, y_i) the residual is for this point is: $r_i = y_i - (ax_i + b)$.
Students may use spreadsheets, graphing calculators, and statistical software to represent data, describe how the variables are related, fit functions to data, perform regressions, and calculate residuals.

Example:

- **Measure the wrist and neck size of each person in your class and make a scatterplot. Find the least squares regression line. Calculate and interpret the correlation coefficient for this linear regression model. Graph the residuals and evaluate the fit of the linear equations.**

- **The following data shows the age and average daily energy requirements for male children and teens (1, 1110), (2, 1300), (5, 1800), (11, 2500), (14, 2800), (17, 3000). Create a graph and find a linear function to fit the data. Using your function, what is the daily energy requirement for a male 15 years old? Would your model apply to an adult male? Explain.**

- **Collect data on forearm length and height in a class. Plot the data and estimate a linear function for the data. Compare and discuss different student representations of the data and equations they discover. Could the equation(s) be used to estimate the height for any person with a known forearm length? Why or why not?**

Next step, create assessments and engaging learning experiences