Georgia
Standards of Excellence
Curriculum Map

Mathematics

GSE Foundations of Algebra

Georgia Department of Education

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

Georgia Standards of Excellence Foundations of Algebra Curriculum Map				
1st Semester			2nd Semester	
Module 1	**Module 2**	**Module 3**	**Module 4**	**Module 5**
Number Sense and Quantity	**Arithmetic to Algebra**	**Proportional Reasoning**	**Equations and Inequalities**	**Quantitative Reasoning with Functions**
MFANSQ1 **MFANSQ2** **MFANSQ3** **MFANSQ4**	**MFAAA1** **MFAAA2**	**MFAPR1** **MFAPR2** **MFAPR3**	**MFAEI1** **MFAEI2** **MFAEI3** **MFAEI4**	**MFAQR1** **MFAQR2** **MFAQR3**
All units will include the Mathematical Practices and indicate skills to maintain.				

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

Foundations of Algebra Key:
NSQ = Number Sense and Quantity
AA = Arithmetic to Algebra
PR = Proportional Reasoning
EI = Equations and Inequalities
QR = Quantitative Reasoning with Functions

Georgia Standards of Excellence Foundations of Algebra
Curriculum Map Rationale

Module 1: This module focuses on building a conceptual understanding of basic mathematical ideas which will enhance the student's number sense, rather than a focus on algorithms. The unit begins with the use of whole numbers followed by fractions, decimals, and integers through the lens of problem solving. Students will use a variety of strategies and manipulative tools.

Module 2: This module focuses on the creation of a connection between arithmetic skills and operations in algebra. Students will draw conclusions from computation with specific numbers in order to build generalizations about properties that can be used for numbers and variables. Students will interpret and apply the properties of exponents and use concrete models to investigate square roots and cube roots. The module lays the groundwork for modules 3, 4, and 5.

Module 3: This module focuses on the use of modeling to explain equivalent ratios and to understand real-world rate, ratio, and percentage problems. Students will derive slope using similar triangles and interpret slope using unit rates.

Module 4: This module focuses on building understanding of concepts of variables, equations, and inequalities. Systems of equations, solutions of equations, and inequalities will be interpreted in relationship to real-world applications. Multi-variable formulas will be solved for specific variables using algebraic operations.

Module 5: This module focuses on functions and the characteristics of functions such as domain, range, and rates of change. The y-intercept form of linear functions will be used to graph lines and to compare the rates of change of functions.

Georgia Standards of Excellence Foundations of Algebra 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

Module 1 – Number Sense and Quantity

Students will compare different representations of numbers (i.e. fractions, decimals, radicals, etc.) and perform basic operations using these different representations.

MFANSQ1. Students will analyze number relationships.

a. Solve multi-step real world problems, analyzing the relationships between all four operations. *For example, understand division as an unknown-factor problem in order to solve problems. Knowing that 50 x 40 = 2000 helps students determine how many boxes of cupcakes they will need in order to ship 2000 cupcakes in boxes that hold 40 cupcakes each.* (MGSE3.OA.6, MGSE4.OA.3)

b. Understand a fraction a/b as a multiple of 1/b. (MGSE4.NF.4)

c. Explain patterns in the placement of decimal points when multiplying or dividing by powers of ten. (MGSE5.NBT.2)

d. Compare fractions and decimals to the thousandths place. *For fractions, use strategies other than cross multiplication. For example, locating the fractions on a number line or using benchmark fractions to reason about relative size. For decimals, use place value.* (MGSE4.NF.2;MGSE5.NBT.3,4)

MFANSQ2. Students will conceptualize positive and negative numbers (including decimals and fractions).

a. Explain the meaning of zero. (MGSE6.NS.5)

b. Represent numbers on a number line. (MGSE6.NS.5,6)

c. Explain meanings of real numbers in a real world context. (MGSE6.NS.5)

MFANSQ3. Students will recognize that there are numbers that are not rational, and approximate them with rational numbers.

a. Find an estimated decimal expansion of an irrational number locating the approximations on a number line. *For example, for the $\sqrt{2}$, show that the $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue this pattern in order to obtain better*

Module 2 – Arithmetic to Algebra

Students will extend arithmetic operations to algebraic modeling.

MFAAA1. Students will generate and interpret equivalent numeric and algebraic expressions.

a. Apply properties of operations emphasizing when the commutative property applies. (MGSE7.EE.1)

b. Use area models to represent the distributive property and develop understandings of addition and multiplication (all positive rational numbers should be included in the models). (MGSE3.MD.7)

c. Model numerical expressions (arrays) leading to the modeling of algebraic expressions. (MGSE7.EE.1,2; MGSE9-12.A.SSE.1,3)

d. Add, subtract, and multiply algebraic expressions. (MGSE6.EE.3, MGSE6.EE.4, MC7.EE.1, MGSE9-12.A.SSE.3)

e. Generate equivalent expressions using properties of operations and understand various representations within context. *For example, distinguish multiplicative comparison from additive comparison. Students should be able to explain the difference between "3 more" and "3 times".* (MGSE4.0A.2; MGSE6.EE.3, MGSE7.EE.1, 2, MGSE9-12.A.SSE.3)

f. Evaluate formulas at specific values for variables. *For example, use formulas such as A = l x w and find the area given the values for the length and width.* (MGSE6.EE.2)

MFAAA2. Students will interpret and use the properties of exponents.

a. Substitute numeric values into formulas containing exponents, interpreting units consistently. (MGSE6.EE.2, MGSE9-12.N.Q.1, MGSE9-12.A.SSE.1, MGSE9-12.N.RN.2)

b. Use properties of integer exponents to find equivalent numerical expressions. *For example, $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$.* (MGSE8.EE.1)

Module 3 – Proportional Reasoning

Students will use ratios to solve real-world and mathematical problems.

MFAPR1. Students will explain equivalent ratios by using a variety of models. *For example, tables of values, tape diagrams, bar models, double number line diagrams, and equations.* (MGSE6.RP.3)

MFAPR2. Students will recognize and represent proportional relationships between quantities.

a. Relate proportionality to fraction equivalence and division. *For example, $\frac{3}{6}$ is equal to $\frac{4}{8}$ because both yield a quotient of ½ and, in both cases, the denominator is double the value of the numerator.* (MGSE4.NF.1)

b. Understand real-world rate/ratio/percent problems by finding the whole given a part and find a part given the whole. (MGSE6.RP.1,2,3;MGSE7.RP.1,2)

c. Use proportional relationships to solve multistep ratio and percent problems. (MGSE7.RP.2,3)

MFAPR3. Students will graph proportional relationships.

a. Interpret unit rates as slopes of graphs. (MGSE8.EE.5)

b. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. (MGSE8.EE.6)

c. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* (MGSE8.EE.5)

approximations. (MGSE8.NS.1,2) b. Explain the results of adding and multiplying with rational and irrational numbers. (MGSE9-12.N.RN.3) **MFANSQ4. Students will apply and extend previous understanding of addition, subtraction, multiplication, and division.** a. Find sums, differences, products, and quotients of multi-digit decimals using strategies based on place value, the properties of operations, and/or relationships between operations. (MGSE5.NBT.7; MGSE6.NS.3) b. Find sums, differences, products, and quotients of all forms of rational numbers, stressing the conceptual understanding of these operations. (MGSE7.NS.1,2) c. Interpret and solve contextual problems involving division of fractions by fractions. *For example, how many 3/4-cup servings are in 2/3 of a cup of yogurt?* (MGSE6.NS.1) d. Illustrate and explain calculations using models and line diagrams. (MGSE7.NS.1,2) e. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using estimation strategies and graphing technology. (MGSE7.NS.3, MGSE7.EE.3, MGSE9-12.N.Q.3)	c. Evaluate square roots of perfect squares and cube roots of perfect cubes (MGSE8.EE.2) d. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. (MGSE8.EE.2) e. Use the Pythagorean Theorem to solve triangles based on real-world contexts (Limit to finding the hypotenuse given two legs). (MGSE8.G.7)	

Georgia Standards of Excellence Foundations of Algebra 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

Module 4

Equations and Inequalities

Students will solve, interpret, and create linear models using equations and inequalities.

MFAEI1. Students will create and solve equations and inequalities in one variable.

a. Use variables to represent an unknown number in a specified set. (MGSE.6.EE2,5,6)
b. Explain each step in solving simple equations and inequalities using the equality properties of numbers. (MGSE9-12.A.REI.1)
c. Construct viable arguments to justify the solutions and methods of solving equations and inequalities. (MGSE9-12.A.REI.1)
d. Represent and find solutions graphically.
e. Use variables to solve real-world and mathematical problems. (MGSE6.EE.7, MGSE7.EE.4)

MFAEI2. Students will use units as a way to understand problems and guide the solutions of multi-step problems.

a. Choose and interpret units in formulas. (MGSE9-12.N.Q.1)
b. Choose and interpret graphs and data displays, including the scale and comparisons of data. (MGSE3.MD.3, MGSE9-12.N.Q.1)
c. Graph points in all four quadrants of the coordinate plane. (MGSE6.NS.8)

MFAEI3. Students will create algebraic models in two variables.

a. Create an algebraic model from a context using two-variable equations (MGSE6.EE.6; MGSE8.EE.8; MGSE9-12.A.CED.2)
b. Find approximate solutions using technology to graph, construct tables of values, and find successive approximations. (MGSE9-12.A.REI.10,11)
c. Represent solutions to systems of equations graphically or by using a table of values. (MGSE6.EE.5; MGSE7.EE3; MGSE8.EE.8; MGSE9-12.A.CED.2)
d. Analyze the reasonableness of the solutions of systems of equations within a given context. (MGSE6.EE.5,6,MGSE7.EE4)

MFAEI4. Students will solve literal equations.

a. Solve for any variable in a multi-variable equation. (MGSE6.EE.9,MGSE9-12.A.REI.3)
b. Rearrange formulas to highlight a particular variable using the same reasoning as in solving equations. *For example, solve for the base in A = ½ bh.* (MGSE9-12.A.CED.4)

Module 5

Quantitative Reasoning with Functions

Students will create function statements and analyze relationships among pairs of variables using graphs, table, and equations.

MFAQR1. Students will understand characteristics of functions.

a. 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.(MGSE9-12.F.IF.1)
b. 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*. (MGSE9-12.F.IF.5)
c. Graph functions using sets of ordered pairs consisting of an input and the corresponding output. (MGSE8.F.1,2)

MFAQR2. Students will compare and graph functions.

a. Calculate rates of change of functions, comparing when rates increase, decrease, or stay constant. *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.* (MGSE6.RP.2;MGSE7.RP.1,2,3;MGSE8.F.2,5; MGSE9-12.F.IF.6)
b. Graph by hand simple functions expressed symbolically. (use all four quadrants). (MGSE9-12.F.IF.7)
c. Interpret the equation y = mx + b as defining a linear function whose graph is a straight line. (MGSE8.F.3)
d. Use technology to graph non-linear functions. (MGSE8.F.3, MGSE9-12.F.IF.7)
e. Analyze graphs of functions for key features (intercepts, intervals of increase/decrease, maximums/minimums, symmetries, and end behavior) based on context. (MGSE9-12.F.IF.4,7)
f. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.* (MGSE8.F.2)

MFAQR3. Students will construct and interpret functions.

a. Write a function that describes a relationship between two quantities. (MGSE8.F.4, MGSE9-12.F.BF.1)
b. Use variables to represent two quantities in a real-world problem that change in relationship to one another (conceptual understanding of a variable). (MGSE6.EE.9)
c. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of context. (MGSE9-12.F.IF.2)