Common Core Georgia Performance Standards CCGPS

Mathematics

CCGPS Comprehensive Course Guide

(2013 - 14)

6th Grade

Dr. John D. Barge, State School Superintendent
"Making Education Work for All Georgians"

The contents of this guide were developed under a grant from the U. S. Department of Education. However, those contents do not necessarily represent the policy of the U. S. Department of Education, and you should not assume endorsement by the Federal Government.

The Course Guides are designed to provide teachers with clarification of CCGPS Mathematics, grounded in GPS language when appropriate. The resource documents provided reflect teacher input from the original implementation, unit writers and resource revision team. We deeply appreciate the efforts of those who provided comments, feedback, and time during the resource revision process.

Mathematics | Grade 6

In Grade 6, instructional time should focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking. Descriptions of the four critical areas follow:

(1) Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.

(2) Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.

(3) Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as $3x = y$) to describe relationships between quantities.

(4) Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different sets of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets,

identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected.

Students in Grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles and parallelograms. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in Grade 7 by drawing polygons in the coordinate plane.

FLIPBOOKS

The Common Core "FlipBooks" are a compilation of research, "unpacked" standards from many states, instructional strategies and examples for each standard at each grade level. The intent is to show the connections to the Standards of Mathematical Practices for the content standards and to get detailed information at each level. The **6th Grade Flipbook** is an interactive document arranged by the content domains listed on the following pages. The BLUE links on each domain and standard will take you to specific information on that standard/domain within the Flip Book.

Ratios and Proportional Relationships 6.RP

Understand ratio concepts and use ratio reasoning to solve problems.

MCC6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. ***For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."***

MCC6.RP.2 Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$ (b not equal to zero), and use rate language in the context of a ratio relationship. ***For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."***

MCC6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

MCC6.RP.3a Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

- Analyze and describe patterns arising from mathematical rules, tables, and graphs

MCC6.RP.3b Solve unit rate problems including those involving unit pricing and constant speed. ***For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?***

MCC6.RP.3c Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percent.

- Explore and model percents using multiple representations

MCC6.RP.3d Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

- Students will convert from one unit to another within one system of measurement (customary or metric) by using proportional relationships

The Number System 6.NS

Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

MCC6.NS.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. ***For example, create a story context for*** $(2/3) \div (3/4)$ ***and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that*** $(2/3) \div (3/4) = 8/9$ ***because*** $3/4$ ***of*** $8/9$ ***is*** $2/3$. ***(In general,*** $(a/b) \div (c/d) = ad/bc$.***) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?***

Compute fluently with multi-digit numbers and find common factors and multiples.

MCC6.NS.2 Fluently divide multi-digit numbers using the standard algorithm.

MCC6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

MCC6.NS.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. ***For example, express 36 + 8 as 4 (9 + 2).***

Apply and extend previous understandings of numbers to the system of rational numbers.

MCC6.NS.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, debits/credits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

- Students will understand the meaning of positive and negative rational numbers:

MCC6.NS.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

MCC6.NS.6a Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.

MCC6.NS.6b Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.

- Given a point in the coordinate plane, determine the coordinates resulting from a reflection.

MCC6.NS.6c Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

MCC6.NS.7 Understand ordering and absolute value of rational numbers.

MCC6.NS.7a Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. ***For example, interpret*** $-3 > -7$ ***as a statement that –3 is located to the right of –7 on a number line oriented from left to right.***

MCC6.NS.7b Write, interpret, and explain statements of order for rational numbers in real-world contexts. ***For example, write –3°C > –7°C to express the fact that –3°C is warmer than –7°C.***

MCC6.NS.7c Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. ***For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.***

MCC6.NS.7d Distinguish comparisons of absolute value from statements about order. ***For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.***

MCC6.NS.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Expressions and Equations 6.EE

Apply and extend previous understandings of arithmetic to algebraic expressions.

MCC6.EE.1 Write and evaluate numerical expressions involving whole-number exponents.

MCC6.EE.2 Write, read, and evaluate expressions in which letters stand for numbers.

MCC6.EE.2a Write expressions that record operations with numbers and with letters standing for numbers. ***For example, express the calculation "Subtract y from 5" as*** $5-y$.

- Translate verbal phrases to algebraic expressions
- Use variables, such as n or x, for unknown quantities in algebraic expressions

MCC6.EE.2b Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. ***For example, describe the expression*** $2(8+7)$ ***as a product of two factors; view*** $(8+7)$ ***as both a single entity and a sum of two terms.***

MCC6.EE.2c Evaluate expressions at specific values for their variables. Include expressions that arise from formulas in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). ***For example, use the formulas*** $V = s^3$ ***and*** $A = 6s^2$ ***to find the volume and surface area of a cube with sides of length*** $s = 1/2$.

MCC6.EE.3 Apply the properties of operations to generate equivalent expressions. ***For example, apply the distributive property to the expression*** $3(2+x)$ ***to produce the equivalent expression*** $6+3x$***; apply the distributive property to the expression*** $24x+18y$ ***to produce the equivalent expression*** $6(4x+3y)$***; apply properties of operations to*** $y+y+y$ ***to produce the equivalent expression*** $3y$.

- Simplify algebraic expressions, using commutative, associative, and distributive properties as appropriate.

MCC6.EE.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). ***For example, the expressions*** $y+y+y$ ***and*** $3y$ ***are equivalent because they name the same number regardless of which number*** y ***stands for.***

Reason about and solve one-variable equations and inequalities.

MCC6.EE.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

MCC6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

- Given a problem, define a variable, write an equation

MCC6.EE.7 Solve real-world and mathematical problems by writing and solving equations of the form $x+p=q$ **and** $px=q$ **for cases in which p, q and x are all nonnegative rational numbers.**

MCC6.EE.8 Write an inequality of the form $x>c$ **or** $x<c$ **to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form** $x>c$ **or** $x<c$ **have infinitely many solutions; represent solutions of such inequalities on number line diagrams.**

- Include inequalities of the form $x \geq c$ and $x \leq c$

Represent and analyze quantitative relationships between dependent and independent variables.

MCC6.EE.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. ***For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation*** $d = 65t$ ***to represent the relationship between distance and time.***

Geometry 6.G

Solve real-world and mathematical problems involving area, surface area, and volume.

MCC6.G.1 Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

- Find the area of a polygon (regular and irregular) by dividing it into squares, rectangles, and/or triangles and find the sum of the areas of those shapes

MCC6.G.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

MCC6.G.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

MCC6.G.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Statistics and Probability 6.SP

Develop understanding of statistical variability.

MCC6.SP.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. ***For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.***

MCC6.SP.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

MCC6.SP.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

Summarize and describe distributions.

MCC6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

MCC6.SP.5 Summarize numerical data sets in relation to their context, such as by:

a. Reporting the number of observations.

- Analyze categorical data using frequencies of categories or proportions of categories

b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

- Students summarize numerical data by providing background information about the attribute being measured, methods and unit of measurement, and the context of data collection activities

c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data was gathered.

- Analyze numerical data using the appropriate measure of central tendency (mean and/or median)
- Analyze data with respect to the appropriate measures of variation (range, interquartile range, and/or mean absolute deviation). The choice of summary measures to report is related to the shape of the distribution (symmetry versus skewed to the higher values or skewed to the lower values)

d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data was gathered.

Mathematics | Standards for Mathematical Practice

Mathematical Practices are listed with each grade's mathematical content standards to reflect the need to connect the mathematical practices to mathematical content in instruction.

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

1 Make sense of problems and persevere in solving them.
In grade 6, students solve problems involving ratios and rates and discuss how they solved them. Students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?"

2 Reason abstractly and quantitatively.
In grade 6, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.

3 Construct viable arguments and critique the reasoning of others.
In grade 6, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?" "Does that always work?" They explain their thinking to others and respond to others' thinking.

4 Model with mathematics.
In grade 6, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students begin to explore covariance and represent two quantities simultaneously. Students use number lines to compare numbers and represent inequalities. They use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences about and make comparisons between data sets. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to a problem context.

5 Use appropriate tools strategically.
Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 6 may decide to represent similar data sets using dot plots with the same scale to visually compare the center and variability of the data. Additionally, students might use physical objects or applets to construct nets and calculate the surface area of three-dimensional figures.

6 Attend to precision.
In grade 6, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to rates, ratios, geometric figures, data displays, and components of expressions, equations or inequalities.

7 Look for and make use of structure.
Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables recognizing both the additive and multiplicative properties. Students apply properties to generate equivalent expressions
(i.e. $6 + 2x = 3\ (2 + x)$ by distributive property) and solve equations (i.e. $2c + 3 = 15$, $2c = 12$ by subtraction property of equality), c=6 by division property of equality). Students compose and decompose two- and three-dimensional figures to solve real world problems involving area and volume.

8 Look for and express regularity in repeated reasoning.
In grade 6, students use repeated reasoning to understand algorithms and make generalizations about patterns. During multiple opportunities to solve and model problems, they may notice that $a/b \div c/d = ad/bc$ and construct other examples and models that confirm their generalization. Students connect place value and their prior work with operations to understand algorithms to fluently divide multi-digit numbers

and perform all operations with multi-digit decimals. Students informally begin to make connections between covariance, rates, and representations showing the relationships between quantities.

Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content
The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction.

The Standards for Mathematical Content are a balanced combination of procedure and understanding. Expectations that begin with the word "understand" are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.

In this respect, those content standards which set an expectation of understanding are potential "points of intersection" between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, instruction, assessment, professional development, and student achievement in mathematics.

CLASSROOM ROUTINES

The importance of continuing the established classroom routines cannot be overstated. Daily routines must include such obvious activities as estimating, analyzing data, describing patterns, and answering daily questions. They should also include less obvious routines, such as how to select materials, how to use materials in a productive manner, how to put materials away, how to access classroom technology such as computers and calculators. An additional routine is to allow plenty of time for children to explore new materials before attempting any directed activity with these new materials. The regular use of routines is important to the development of students' number sense, flexibility, fluency, collaborative skills and communication. These routines contribute to a rich, hands-on standards based classroom and will support students' performances on the tasks in this unit and throughout the school year.

STRATEGIES FOR TEACHING AND LEARNING

- Students should be actively engaged by developing their own understanding.
- Mathematics should be represented in as many ways as possible by using graphs, tables, pictures, symbols and words.
- Interdisciplinary and cross curricular strategies should be used to reinforce and extend the learning activities.
- Appropriate manipulatives and technology should be used to enhance student learning.
- Students should be given opportunities to revise their work based on teacher feedback, peer feedback, and metacognition which includes self-assessment and reflection.
- Students should write about the mathematical ideas and concepts they are learning.
- Consideration of all students should be made during the planning and instruction of this unit. Teachers need to consider the following:
  - What level of support do my struggling students need in order to be successful with this unit?
  - In what way can I deepen the understanding of those students who are competent in this unit?
  - What real life connections can I make that will help my students utilize the skills practiced in this unit?

TYPES OF TASKS

The following tasks represent the level of depth, rigor, and complexity expected of all eighth grade students. These tasks, or tasks of similar depth and rigor, should be used to demonstrate evidence of learning. It is important that all elements of a task be addressed throughout the learning process so that students understand what is expected of them. While some tasks are identified as a performance task, they may also be used for teaching and learning (learning/scaffolding task).

Scaffolding Task	Tasks that build up to the learning task.
Learning Task	Constructing understanding through deep/rich contextualized problem solving tasks.
Practice Task	Tasks that provide students opportunities to practice skills and concepts.
Performance Task	Tasks which may be a formative or summative assessment that checks for student understanding/misunderstanding and or progress toward the standard/learning goals at different points during a unit of instruction.
Culminating Task	Designed to require students to use several concepts learned during the unit to answer a new or unique situation. Allows students to give evidence of their own understanding toward the mastery of the standard and requires them to extend their

	chain of mathematical reasoning.
Short Cycle Task	Designed to exemplify the performance targets that the standards imply. The tasks, with the associated guidance, equip teachers to monitor overall progress in their students' mathematics.
Formative Assessment Lesson (FAL)	Lessons that support teachers in formative assessment which both reveal and develop students' understanding of key mathematical ideas and applications. These lessons enable teachers and students to monitor in more detail their progress towards the targets of the standards.
Achieve CCSS-CTE Classroom Tasks	Designed to demonstrate how the Common Core and Career and Technical Education knowledge and skills can be integrated. The tasks provide teachers with realistic applications that combine mathematics and CTE content.

FORMATIVE ASSESSMENTS LESSONS (FALs) OVERVIEW

What is a Formative Assessment Lesson (FAL)? The Formative Assessment Lesson is designed to be part of an instructional unit typically implemented approximately two-thirds of the way through the instructional unit. The results of the tasks should then be used to **inform** the instruction that will take place for the remainder of the unit.

Formative Assessment Lessons are intended to support teachers in formative assessment. They both reveal and develop students' understanding of key mathematical ideas and applications. These lessons enable teachers and students to monitor in more detail their progress towards the targets of the standards. They assess students' understanding of important concepts and problem solving performance, and help teachers and their students to work effectively together to move each student's mathematical reasoning forward.

What does a Formative Assessment Lesson look like in action? Videos of Georgia Teachers implementing FALs can be accessed HERE and a sample of a FAL lesson may be seen HERE

Where can I find more information on FALs? More information on types of Formative Assessment Lessons, their use, and their implementation may be found on the Math Assessment Project's guide for teachers.

Where can I find samples of FALs?

Formative Assessment Lessons can also be found at the following sites:
Mathematics Assessment Project
Kenton County Math Design Collaborative
MARS Tasks by grade level

A **sample FAL** with extensive dialog and suggestions for teachers may be found HERE. This resource will help teachers understand the flow and purpose of a FAL.

Where can I find more training on the use of FALs? The Math Assessment Project has developed Professional Development Modules that are designed to help teachers with the practical and pedagogical challenges presented by these lessons.

Module 1 introduces the model of *formative assessment* used in the lessons, its theoretical background and practical implementation. Modules 2 & 3 look at the two types of *Classroom Challenges* in detail. Modules 4 & 5 explore two crucial pedagogical features of the lessons: asking probing questions and collaborative learning.

All of our Georgia RESAs have had a math specialist trained to provide instruction on the use of formative assessment lessons in the classroom. The request should be made through the teacher's local RESA and can be referenced by asking for more information on the Mathematics Design Collaborative (MDC). Also, if done properly, these lessons should take about 120-150 minutes, 2-3 classroom periods.

Sources of Information: Vicki Mixon, Former MDC (Math Design Collaborative) trainer, http://www.reneeyates2math.com/ and from The Mathematics Assessment Project and http://melissatabor.wikispaces.com/Formative+Assessment+Lessons+%28FALs%29

WEBINAR INFORMATION

Several webinars are available to support your instruction of Coordinate Algebra. All webinars may be accessed via https://www.georgiastandards.org/Common-Core/Pages/default.aspx. Each of the CCGPS two-hour professional learning grade level/course overviews is available for archived viewing at the original broadcast link http://www.gpb.org/education/common-core and includes closed captioning. You can also choose to access the GPB links, along with resource packets, and presentation slides from the GeorgiaStandards.org Common Core GPS Professional Learning Session landing page. Unit by Unit CCGPS Professional Learning WEBINARS and recordings of archived WEBINARS may be accessed at Mathematics CCGPS landing page. Follow up webinars are slated for the 2013-14 school year to address focus areas for each unit

Assessment Resources and Instructional Support Resources

The resource sites listed below are designed to support the instructional and assessment needs of teachers. All BLUE links will direct teachers to the site mentioned.

- CCGPS Frameworks are "models of instruction" designed to support teachers in the implementation of the Common Core Georgia Performance Standards (CCGPS). The Georgia Department of Education, Office of Standards, Instruction, and Assessment has provided an example of the Curriculum Map for each grade level and examples of Frameworks aligned with the CCGPS to illustrate what can be implemented within the grade level. School systems and teachers are free to use these models as is; modify them to better serve classroom needs; or create their own curriculum maps, units and tasks.

- The Teacher Resource Link (TRL) is an application that delivers vetted and aligned digital resources to Georgia's teachers. TRL is accessible via the GaDOE "tunnel" in conjunction with LDS using the single sign-on process. The content is aligned to Common Core Georgia Performance Standards, Georgia Performance Standards, and National Education Technology Standards and pushed to teachers based on course schedule.

- Georgia Online Assessment (OAS) System Teachers can use the OAS as a tool for Assessment for Learning. Student results on assessments help teachers identify learner needs and strengths and inform instructional practices. Robust reports also allow teachers to communicate with students and parents about learner goals, intentions, and outcomes. The OAS helps with a cycle of assessments, instruction, feedback, and communication that allows teachers, students, and parents to be confident with instructional success. Teachers will be particularly interested in the Formative Item Bank.

- Webinar support and links will direct teachers to archived webinars as well as links to join or view upcoming webinars.

- Course/Grade Level WIKI spaces are available to post questions about a unit, a standard, the course, or any other CCGPS math related concern. Shared resources and information are also available at the site.

- CRCT Resources are available to provide more information for the CRCT as provided by the GaDoe.

- Georgiastandards.org provides a gateway to a wealth of instructional links and information. Open the Common Core GPS tab at the top to access specific math resources for CCGPS.

- Formula Sheet is the formula sheet found on the GaDoe website and the formula sheet used on the CRCT.

INTERNET RESOURCES

GENERAL RESOURCES

Mathematics in Movies
http://www.math.harvard.edu/~knill/mathmovies/
Short movie clips related to a variety of math topics.

Mathematical Fiction
http://kasmana.people.cofc.edu/MATHFICT/browse.php
Plays, short stories, comic books and novels dealing with math.

The Shodor Educational Foundation
http://www.shodor.org/interactivate/lessons/byAudience/
This website has extensive notes, lesson plans and applets aligned with the standards.

NEA Portal Arkansas Video Lessons on-line
http://neaportal.k12.ar.us/index.php/9th-12th-grades-mathematics/
The NEA portal has short videos aligned to each standard. This resource may be very helpful for students who need review at home.

Learnzillion
http://learnzillion.com/common_core/math/hs
This is another good resource for parents and students who need a refresher on topics.

Math Words
http://www.mathwords.com/
This is a good reference for math terms.

National Library of Virtual Manipulatives
http://nlvm.usu.edu/en/nav/vlibrary.html
Java must be enabled for this applet to run. This website has a wealth of virtual manipulatives helpful for use in presentation. Listed by domain.

Geogebra Download
http://www.geogebra.org/cms/download
Free software similar to Geometer's Sketchpad. This program has applications for algebra, geometry & statistics.

Utah Resources
http://www.uen.org/core/core.do?courseNum=5600
Although the state of Utah followed an integrated approach in their adoption of CCGPS, many of their resources are applicable.

RESOURCES FOR PROBLEM-BASED LEARNING

Dan Meyer's Website http://blog.mrmeyer.com/
Dan Meyer has created many problem-based learning tasks. The tasks have great hooks for the students and are aligned to the standards in this spreadsheet:

Andrew Stadel
https://docs.google.com/spreadsheet/ccc?key=0AkLk45wwjYBudG9LeXRad0lHM0E0VFRyOEtRckVvM1E#gid=0
Andrew Stadel has created many problem-based learning tasks using the same format as Dan Meyer.

Robert Palinsky
Robert Palinsky has created many tasks that engage students with real life situations.
http://robertkaplinsky.com/lessons/

Geoff Krall's Emergent Math
http://emergentmath.com/my-problem-based-curriculum-maps/
Geoff Krall has created a curriculum map structured around problem-based learning tasks.

ADDITIONAL RESOURCES

Burns, Marilyn. *About Mathematics.* (1992) Math Solutions Publications. Sausalito, California.

Burns, Marilyn (2007). *About Teaching Mathematics: A K-8 Resource.* Sausalito, CA: Scholastic, Inc.

Chapin, Suzanne and Johnson, Art (2006). *Math matters: Understanding the math you teach* 2nd Edition. Sausalito, CA: Math Solutions Publications

Katie Hendrickson, Illuminations Summer Institute., (2012) National Council of Teachers of Mathematics, Reston, Virginia.

National Research Council (2001). *Adding it up: Helping children learn mathematics*. J. Kilpatrick, J. Swafford, and B. Findell (Eds). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

Swetz, Frank and J.S. Hartzler. *Mathematical Modeling.* (1991) National Council of Teachers of Mathematics. Reston, Virginia.

Van De Walle, John, *Elementary and Middle School Mathematics, Teaching Developmentally,* (2005).

Van de Walle, John A., Karp, Karen, Bay-Williams, Jennifer (2010). *Elementary and middle school mathematics: teaching developmentally* 7th edition. Boston: Allyn & Bacon (Pearson)

Georgia Department of Education

Common Core Georgia Performance Standards
Sixth Grade – At a Glance

Common Core Georgia Performance Standards: Curriculum Map							
1st Semester				2nd Semester			
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
Number System Fluency	**Rate, Ratio and Proportional Reasoning Using Equivalent Fractions**	**Expressions**	**One-Step Equations and Inequalities**	**Area and Volume**	**Statistics**	**Rational Explorations: Numbers and their Opposites**	**Show What We Know**
MCC6.NS.1 **MCC6.NS.2** **MCC6.NS.3** **MCC6.NS.4**	**MCC6.RP.1** **MCC6.RP.2** **MCC6.RP.3a** **MCC6.RP.3b** **MCC6.RP.3c** **MCC6.RP.3d**	**MCC6.EE.1** **MCC6.EE.2a** **MCC6.EE.2b** **MCC6.EE.2c** **MCC6.EE.3** **MCC6.EE.4**	**MCC6.EE.5** **MCC6.EE.6** **MCC6.EE.7** **MCC6.EE.8** **MCC6.EE.9** **MCC6.RP.3a** **MCC6.RP.3b** **MCC6.RP.3c** **MCC6.RP.3d** **(equations)**	**MCC6.G.1** **MCC6.G.2** **MCC6.G.4**	**MCC6.SP.1** **MCC6.SP.2** **MCC6.SP.3** **MCC6.SP.4** **MCC6.SP.5**	**MCC6.NS.5** **MCC6.NS.6a** **MCC6.NS.6b** **MCC6.NS.6c** **MCC6.NS.7a** **MCC6.NS.7b** **MCC6.NS.7c** **MCC6.NS.7d** **MCC6.NS.8** **MCC6.G.3**	**ALL**
Incorporated Standards							
	MCC6.NS.1 ***MCC6.NS.2*** ***MCC6.NS.3*** ***MCC6.NS.4***	***MCC6.NS.1*** ***MCC6.NS.2*** ***MCC6.NS.3*** ***MCC6.NS.4***	***MCC6.NS.1*** ***MCC6.NS.2*** ***MCC6.NS.3*** ***MCC6.NS.4***	***MCC6.EE.2c*** ***MCC6.NS.1*** ***MCC6.NS.2*** ***MCC6.NS.3*** ***MCC6.NS.4***	***MCC6.NS.1*** ***MCC6.NS.2*** ***MCC6.NS.3*** ***MCC6.NS.4***		
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.							

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.

Grades 6-8 Key: NS = The Number System, RP = Ratios and Proportional Relationships, EE = Expressions and Equations, G = Geometry, SP = Statistics and Probability.

Common Core Georgia Performance Standards: Curriculum Map			
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.	
1st Semester			
Unit 1	Unit 2	Unit 3	Unit 4
Number System Fluency	**Rate, Ratio and Proportional Reasoning Using Equivalent Fractions**	**Expressions**	**One-Step Equations and Inequalities**
Apply and extend previous understandings of multiplication and division to divide fractions by fractions. **MCC6.NS.1** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. **Compute fluently with multi-digit numbers and find common factors and multiples.** **MCC6.NS.2** Fluently divide multi-digit numbers using the standard algorithm. **MCC6.NS.3** Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. **MCC6.NS.4** Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.	**Understand ratio concepts and use ratio reasoning to solve problems.** **MCC6.RP.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. **MCC6.RP.2** Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$ (b not equal to zero), and use rate language in the context of a ratio relationship. **MCC6.RP.3** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. **MCC6.RP.3a** Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. **MCC6.RP.3b** Solve unit rate problems including those involving unit pricing and constant speed. **MCC6.RP.3c** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percent.	**Apply and extend previous understandings of arithmetic to algebraic expressions.** **MCC6.EE.1** Write and evaluate numerical expressions involving whole-number exponents. **MCC6.EE.2** Write, read, and evaluate expressions in which letters stand for numbers. **MCC6.EE.2a** Write expressions that record operations with numbers and with letters standing for numbers. **MCC6.EE.2b** Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. **MCC6.EE.2c** Evaluate expressions at specific values for their variables. Include expressions that arise from formulas in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). **MCC6.EE.3** Apply the properties of operations to generate equivalent expressions. **MCC6.EE.4** Identify when two expressions are equivalent (i.e., when the two expressions	**Reason about and solve one-variable equations and inequalities.** **MCC6.EE.5** Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true. **MCC6.EE.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. **MCC6.EE.7** Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers. **MCC6.EE.8** Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

	MCC6.RP.3d Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.	name the same number regardless of which value is substituted into them).	**Represent and analyze quantitative relationships between dependent and independent variables.** **MCC6.EE.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. **Understand ratio concepts and use ratio reasoning to solve problems.** **MCC6.RP.3** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. **MCC6.RP.3a** Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. **MCC6.RP.3b** Solve unit rate problems including those involving unit pricing and constant speed. **MCC6.RP.3c** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole given a part and the percent. **MCC6.RP.3d** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
Incorporated Standards			
	MCC6.NS.1, MCC6.NS.2 MCC6.NS.3, MCC6.NS.4	***MCC6.NS.1, MCC6.NS.2 MCC6.NS.3, MCC6.NS.4***	***MCC6.NS.1, MCC6.NS.2 MCC6.NS.3, MCC6.NS.4***

Common Core Georgia Performance Standards: Curriculum Map			
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.	
2nd Semester			
Unit 5	Unit 6	Unit 7	Unit 8
Area and Volume	**Statistics**	**Rational Explorations: Numbers and their Opposites**	**Show What We Know**
Solve real-world and mathematical problems involving area, surface area, and volume. **MCC6.G.1** Find area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. **MCC6.G.2** Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. **MCC6.G.4** Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	**Develop understanding of statistical variability.** **MCC6.SP.1** Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. **MCC6.SP.2** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. **MCC6.SP.3** Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number. **Summarize and describe distributions.** **MCC6.SP.4** Display numerical data in plots on a number line, including dot plots, histograms, and box plots. **MCC6.SP.5** Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute	**Apply and extend previous understandings of numbers to the system of rational numbers.** **MCC6.NS.5** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, debits/credits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. **MCC6.NS.6** Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. **MCC6.NS.6a** Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite. **MCC6.NS.6b** Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by	**ALL**

	deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data was gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data was gathered.	signs, the locations of the points are related by reflections across one or both axes. **MCC6.NS.6c** Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane. **MCC6.NS.7** Understand ordering and absolute value of rational numbers. **MCC6.NS.7a** Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. **MCC6.NS.7b** Write, interpret, and explain statements of order for rational numbers in real-world contexts. **MCC6.NS.7c** Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. **MCC6.NS.7d** Distinguish comparisons of absolute value from statements about order. **MCC6.NS.8** Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. **Solve real-world and mathematical problems involving area, surface area, and volume.** **MCC6.G.3** Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.	
Incorporated Standards			
MCC6.EE.2c, MCC6.NS.1 MCC6.NS.2, MCC6.NS.3, MCC6.NS.4	***MCC6.NS.1, MCC6.NS.2 MCC6.NS.3, MCC6.NS.4***		