Grade 7 Mathematics Overview

In Grade 7, content is organized into five Alabama Content Areas as outlined below: Proportional Reasoning; Number Systems and Operations; Algebra and Functions; Data Analysis, Statistics and Probability; and Geometry and Measurement. Related standards are grouped into clusters, which are listed below each content area. Standards indicate what students should know or be able to do by the end of the course.

Alabama Content Areas	Proportional Reasoning	Number Systems and Operations	Algebra and Functions	Data Analysis, Statistics, and Probability	Geometry and Measurement
Clusters	• Analyze proportional relationships and use them to solve real-world and mathematical problems.	• Apply and extend prior knowledge of addition, subtraction, multiplication, and division to operations with rational numbers.	• Create equivalent expressions using the properties of operations. • Solve real-world and mathematical problems using numerical and algebraic expressions, equations, and inequalities.	• Make inferences about a population using random sampling. • Make inferences from an informal comparison of two populations. • Investigate probability models.	• Construct and describe geometric figures, analyzing relationships among them. • Solve real-world and mathematical problems involving angle measure, circumference, area, surface area, and volume.

The eight Student Mathematical Practices listed in the chart below represent what students are doing as they learn mathematics. Students should regularly engage in these processes and proficiencies at every level throughout their mathematical studies. Proficiency with these practices is critical in using mathematics, both in the classroom and in everyday life. **The Student Mathematical Practices are standards to be incorporated across all grades**.

Student Mathematical Practices	
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.

Content Priorities

In Grade 7, instructional time should focus on four essential areas, all of which have equal importance:

1. **Developing understanding of and applying proportional relationships**.
   Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students solve a wide variety of percent problems (including those involving discounts, interest, taxes, tips, percent increase or decrease), and solve problems about scale drawings by relating corresponding lengths between the objects, or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

2. **Developing understanding of operations with rational numbers and working with expressions and linear equations**.
   Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percentages as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, recognizing the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

3. **Solving problems involving scale drawings and informal geometric construction, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume**.
   Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle as well as surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8, they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructs, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

4. **Drawing inferences about populations based on samples**.
   Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

Grade 7 Content Standards

Each content standard completes the stem *"Students will…"*

Proportional Reasoning	

Analyze proportional relationships and use them to solve real-world and mathematical problems.	1. Calculate unit rates of length, area, and other quantities measured in like or different units that include ratios or fractions.
	
	2. Represent a relationship between two quantities and determine whether the two quantities are related proportionally.
	  a. Use equivalent ratios displayed in a table or in a graph of the relationship in the coordinate plane to determine whether a relationship between two quantities is proportional.
	  b. Identify the constant of proportionality (unit rate) and express the proportional relationship using multiple representations including tables, graphs, equations, diagrams, and verbal descriptions.
	  c. Explain in context the meaning of a point (x, y) on the graph of a proportional relationship, with special attention to the points $(0,0)$ and $(1, r)$ where r is the unit rate.
	
	3. Solve multi-step percent problems in context using proportional reasoning, including simple interest, tax, gratuities, commissions, fees, markups and markdowns, percent increase, and percent decrease.

Number Systems and Operations

Apply and extend prior knowledge of addition, subtraction, multiplication, and division to operations with rational numbers.	4. Apply and extend knowledge of operations of whole numbers, fractions, and decimals to add, subtract, multiply, and divide rational numbers including integers, signed fractions, and decimals.
	  a. Identify and explain situations where the sum of opposite quantities is 0 and opposite quantities are defined as additive inverses.
	  b. Interpret the sum of two or more rational numbers, by using a number line and in real-world contexts.
	  c. Explain subtraction of rational numbers as addition of additive inverses.
	  d. Use a number line to demonstrate that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
	  e. Extend strategies of multiplication to rational numbers to develop rules for multiplying signed numbers, showing that the properties of the operations are preserved.
	  f. Divide integers and explain that division by zero is undefined. Interpret the quotient of integers (with a non-zero divisor) as a rational number.
	  g. Convert a rational number to a decimal using long division, explaining that the decimal form of a rational number terminates or eventually repeats.
	
	5. Solve real-world and mathematical problems involving the four operations of rational numbers, including complex fractions. Apply properties of operations as strategies where applicable.

Algebra and Functions

Create equivalent expressions using the properties of operations.	6. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. 7. Generate expressions in equivalent forms based on context and explain how the quantities are related.

Solve real-world and mathematical problems using numerical and algebraic expressions, equations, and inequalities.	8. Solve multi-step real-world and mathematical problems involving rational numbers (integers, signed fractions and decimals), converting between forms as needed. Assess the reasonableness of answers using mental computation and estimation strategies.
	
	9. Use variables to represent quantities in real-world or mathematical problems and construct algebraic expressions, equations, and inequalities to solve problems by reasoning about the quantities.
	  a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
	  b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality, and interpret it in the context of the problem.

Data Analysis, Statistics, and Probability

Make inferences about a population using random sampling.	10. Examine a sample of a population to generalize information about the population.
	  a. Differentiate between a sample and a population.
	  b. Compare sampling techniques to determine whether a sample is random and thus representative of a population, explaining that random sampling tends to produce representative samples and support valid inferences.
	  c. Determine whether conclusions and generalizations can be made about a population based on a sample.
	  d. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest, generating multiple samples to gauge variation and making predictions or conclusions about the population.
	  e. Informally explain situations in which statistical bias may exist.

Make inferences from an informal comparison of two populations.	11. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. 12. Make informal comparative inferences about two populations using measures of center and variability and/or mean absolute deviation in context.

Investigate probability models.	13. Use a number from 0 to 1 to represent the probability of a chance event occurring, explaining that larger numbers indicate greater likelihood of the event occurring, while a number near zero indicates an unlikely event.

	14. Define and develop a probability model, including models that may or may not be uniform, where uniform models assign equal probability to all outcomes and non-uniform models involve events that are not equally likely.
	   a. Collect and use data to predict probabilities of events.
	   b. Compare probabilities from a model to observed frequencies, explaining possible sources of discrepancy.

	15. Approximate the probability of an event using data generated by a simulation (experimental probability) and compare it to the theoretical probability. a. Observe the relative frequency of an event over the long run, using simulation or technology, and use those results to predict approximate relative frequency.

	16. Find probabilities of simple and compound events through experimentation or simulation and by analyzing the sample space, representing the probabilities as percents, decimals, or fractions.
	   a. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams, and determine the probability of an event by finding the fraction of outcomes in the sample space for which the compound event occurred.
	   b. Design and use a simulation to generate frequencies for compound events.
	   c. Represent events described in everyday language in terms of outcomes in the sample space which composed the event.

Geometry and Measurement

Construct and describe geometric figures, analyzing relationships among them.	17. Solve problems involving scale drawings of geometric figures, including computation of actual lengths and areas from a scale drawing and reproduction of a scale drawing at a different scale.
	18. Construct geometric shapes (freehand, using a ruler and a protractor, and using technology), given a written description or measurement constraints with an emphasis on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
	19. Describe the two-dimensional figures created by slicing three-dimensional figures into plane sections.

Solve real-world and mathematical problems involving angle measure, circumference, area, surface area, and volume.
 	
Note: Students must select and use the appropriate unit for the attribute being measured when determining length, area, angle, time, or volume.
	20. Explain the relationships among circumference, diameter, area, and radius of a circle to demonstrate understanding of formulas for the area and circumference of a circle.
	   a. Informally derive the formula for area of a circle.
	   b. Solve area and circumference problems in real-world and mathematical situations involving circles.
	
	21. Use facts about supplementary, complementary, vertical, and adjacent angles in multi-step problems to write and solve simple equations for an unknown angle in a figure.
	
	22. Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right rectangular prisms.