Correlation: 2016 Alabama Course of Study, Mathematics standards and NAEP Objectives

When teaching Alabama Course of Study content, NAEP objectives and items are useful for identifying a level of rigor which matches proficient student performance nationwide. The NAEP objectives identify content that could be included in lessons building toward master of the correlating standards from the *2016 Alabama Course of Study: Mathematics*.

Grade	Grade 5 Alabama Course of Study Standard	NAEP Objective(s) Grade 4	NAEP Objective(s) Grade 8
5	**1. [5.OA.1]** Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.		
5	**2. [5.OA.2**] Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. - Example: Express the calculation "add 8 and 7, then multiply by 2" as 2 x (8 + 7). Recognize that 3 x (18,932 + 921) is three times as large as 18,932 + 921, without having to calculate the indicated sum or product.		
5	**3. [5.OA.3]** Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. - Example: Given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.	**4A1b** Given a pattern or sequence, construct or explain a rule that can generate the terms of the pattern or sequence. **4A1c** Given a description, extend or find a missing term in a pattern or sequence.	

5	**4. [5.NBT.1**] Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.		**8NPO1a** Use place value to model and describe integers and decimals.
5	**5. [5.NBT.2]** Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.	**4NPO3d** Describe the effect of operations on size (whole numbers). **4NPO6a** Explain or justify a mathematical concept or relationship (e.g., explain why 15 is an odd number or why 7–3 is not the same as 3–7). **4A1b** Given a pattern or sequence, construct or explain a rule that can generate the terms of the pattern or sequence.	**8NPO1a** Use place value to model and describe integers and decimals.
5	**6. [5.NBT.3]** Read, write, and compare decimals to thousandths. a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 x 100 + 4 x 10 + 7 x 1 + 3 x (1/10) + 9 x (1/100) + 2 x (1/1000). b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.		**8NPO1a** Use place value to model and describe integers and decimals. **8NPO1d** Write or rename rational numbers. **8NPO1h** Order or compare rational numbers (fractions, decimals, percents, or integers) using various models and representations (e.g., number line).
5	**7. [5.NBT.4]** Use place value understanding to round decimals to any place.		**8NPO1a** Use place value to model and describe integers and decimals.
5	**8. [5.NBT.5]** Fluently multiply multi-digit whole numbers using the standard algorithm.	**4NPO3b** Multiply whole numbers: • No larger than two-digit by two-digit with paper-and-pencil computation, or • Larger numbers with use of Calculator	**8NPO3a** Perform computations with rational numbers.

5	**9. [5.NBT.6**] Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	**4NPO3c** Divide whole numbers: • Up to three digits by one digit with paper-and-pencil computation, or • Up to five digits by two digits with use of calculator.	**8NPO3a** Perform computations with rational numbers.
5	**10. [5.NBT.7]** Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method, and explain the reasoning used.	**4NPO3a** Add and subtract: • Whole numbers, or • Fractions with like denominators, or • Decimals through hundredths.	**8NPO3a** Perform computations with rational numbers.
5	**11. [5.NF.1]** Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. - Example: 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, $a/b + c/d = (ad + bc)/bd$.)		**8NPO3a** Perform computations with rational numbers. **8NPO6b** Provide a mathematical argument to explain operations with two or more fractions.
5	**12. [5.NF.2]** Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally, and assess the reasonableness of answers. Example: Recognize an incorrect result 2/5 + 1/2 = 3/7 by observing that 3/7 < 1/2.	**4NPO3f** Solve application problems involving numbers and operations.	**8NPO3a** Perform computations with rational numbers. **8NPO6b** Provide a mathematical argument to explain operations with two or more fractions.

5	**13. [5.NF.3]** Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. Example: Interpret 3/4 as the result of dividing 3 by 4, noting that 3/4 multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size 3/4. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between which two whole numbers does your answer lie?	**4NPO3f** Solve application problems involving numbers and operations. **4NPO4a** Use simple ratios to describe problem situations.	**8NPO3a** Perform computations with rational numbers. **8NPO3d** Describe the effect of multiplying and dividing by numbers, including the effect of multiplying or dividing a rational number by: • Zero, or • A number less than zero, or • A number between zero and one, • One, or • A number greater than one. **8NPO6b** Provide a mathematical argument to explain operations with two or more fractions.

5	**14. [5.NF.4]** Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product (a/b) x q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a x $q \div b$. Example: Use a visual fraction model to show (2/3) x 4 = 8/3, and create a story context for this equation. Do the same with (2/3) x (4/5) = 8/15. (In general, (a/b) x (c/d) = ac/bd.) b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.	**4M1g** Solve problems involving area of squares and rectangles.	**8NPO3a** Perform computations with rational numbers. **8NPO3d** Describe the effect of multiplying and dividing by numbers, including the effect of multiplying or dividing a rational number by: • Zero, or • A number less than zero, or • A number between zero and one, • One, or • A number greater than one. **8NPO5e** Apply basic properties of operations. **8NPO6**b Provide a mathematical argument to explain operations with two or more fractions.

5	**15. [5.NF.5]** Interpret multiplication as scaling (resizing), by: a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication. b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case), explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number, and relating the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.	**4NPO6a** Explain or justify a mathematical concept or relationship (e.g., explain why 15 is an odd number or why 7–3 is not the same as 3–7).	**8NPO1h** Order or compare rational numbers (fractions, decimals, percents, or integers) using various models and representations (e.g., number line). **8NPO3a** Perform computations with rational numbers. **8NPO3d** Describe the effect of multiplying and dividing by numbers, including the effect of multiplying or dividing a rational number by: • Zero, or • A number less than zero, or • A number between zero and one, • One, or • A number greater than one.
5	**16. [5.NF.6]** Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.	**4NPO3f** Solve application problems involving numbers and operations.	**8NPO1b** Model or describe rational numbers or numerical relationships using number lines and diagrams. **8NPO1d** Write or rename rational numbers.

5	**17. [5.NF.7]** Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students able to multiply fractions in general can develop strategies to divide fractions in general by reasoning about the relationship between multiplication and division. However, division of a fraction by a fraction is not a requirement at this grade.) a. Interpret division of a unit fraction by a nonzero whole number, and compute such quotients. Example: Create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) x 4 = 1/3. b. Interpret division of a whole number by a unit fraction, and compute such quotients. - Example: Create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 x (1/5) = 4. c. Solve real-world problems involving division of unit fractions by nonzero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. Examples: How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?	**4NPO3f** Solve application problems involving numbers and operations.	**8NPO3a** Perform computations with rational numbers. **8NPO3d** Describe the effect of multiplying and dividing by numbers, including the effect of multiplying or dividing a rational number by: • Zero, or • A number less than zero, or • A number between zero and one, • One, or • A number greater than one. **8NPO5e** Apply basic properties of operations.

5	**18. [5.MD.1]** Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multistep, real-world problems.	**4M2b** Solve problems involving conversions within the same measurement system, such as conversions involving inches and feet or hours and minutes.	
5	**19. [5.MD.2]** Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. Example: Given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.	**4DASP1b** For a given set of data, complete a graph (limits of time make it difficult to construct graphs completely).	
5	**20. [5.MD.3]** Recognize volume as an attribute of solid figures, and understand concepts of volume measurement. a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.		**8M1h** Solve problems involving volume or surface area of rectangular solids, cylinders, prisms, or composite shapes.
5	**21. [5.MD.4]** Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.		**8M1h** Solve problems involving volume or surface area of rectangular solids, cylinders, prisms, or composite shapes.

5	**22. [5.MD.5]** Relate volume to the operations of multiplication and addition, and solve real world and mathematical problems involving volume. a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. b. Apply the formulas $V = l \times w \times h$ and $V = B \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems. c. Recognize volume as additive. Find volumes of solid figures composed of two nonoverlapping right rectangular prisms by adding the volumes of the nonoverlapping parts, applying this technique to solve real-world problems.		**8A4e** Use and evaluate common formulas (e.g., relationship between a circle's circumference and diameter [C=], distance, and time under constant speed). **8M1h** Solve problems involving volume or surface area of rectangular solids, cylinders, prisms, or composite shapes.

5	**23. [5.G.1]** Use a pair of perpendicular number lines, called axes, to define a coordinate system with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x*-axis and *x*-coordinate, *y*-axis and *y*-coordinate).	**4A2c** Graph or interpret points with whole- number or letter coordinates on grids or in the first quadrant of the coordinate plane. **4G4a** Describe relative positions of points and lines using the geometric ideas of parallelism or perpendicularity.	
5	**24. [5.G.2]** Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.	**4A2c** Graph or interpret points with whole- number or letter coordinates on grids or in the first quadrant of the coordinate plane.	
5	**25. [5.G.3]** Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. - Example: All rectangles have four right angles and squares are rectangles, so all squares have four right angles.	**4G3a** Analyze or describe patterns of geometric figures by increasing number of sides, changing size or orientation (e.g., polygons with more and more sides). **4G5a** Distinguish which objects in a collection satisfy a given geometric definition and explain choices.	**8G1b** Identify a geometric object given a written description of its properties. **8G3f** Describe or analyze simple properties of, or relationships between, triangles, quadrilaterals, and other polygonal plane figures.
5	**26. [5.G.4]** Classify two-dimensional figures in a hierarchy based on properties.	**4G5a** Distinguish which objects in a collection satisfy a given geometric definition and explain choices.	**8G3f** Describe or analyze simple properties of, or relationships between, triangles, quadrilaterals, and other polygonal plane figures.