Mathematics – Grade 3

All West Virginia teachers are responsible for classroom instruction that integrates content standards and mathematical habits of mind. Students in the third grade will focus on four critical areas: (1) developing understanding of multiplication and division and strategies for multiplication and division within 100; (2) developing understanding of fractions, especially unit fractions (fractions with numerator 1); (3) developing understanding of the structure of rectangular arrays and of area; and (4) describing and analyzing two-dimensional shapes. Mathematical habits of mind, which should be integrated in these content areas, include: making sense of problems and persevering in solving them, reasoning abstractly and quantitatively; constructing viable arguments and critiquing the reasoning of others; modeling with mathematics; using appropriate tools strategically; attending to precision, looking for and making use of structure; and looking for and expressing regularity in repeated reasoning. Continuing the skill progressions from second grade, the following chart represents the mathematical understandings that will be developed in third grade:

<table>
<tr><th>Operations and Algebraic Thinking</th><th>Number and Operations in Base Ten</th></tr>
<tr><td>• Understand and know from memory how to multiply and divide numbers up to 10 x 10 fluently.
• Solve word problems using addition, subtraction, multiplication, and division.
• Begin to multiply numbers with more than one digit (e.g., multiplying 9 × 80).</td><td>• Understand place value and properties of operations to perform multi-digit arithmetic, such as 10 x 2, 50 x 3, and 40 x 7.</td></tr>
<tr><th>Number and Operations- Fractions</th><th>Measurement and Data</th></tr>
<tr><td>• Understand fractions and relate them to the familiar system of whole numbers (e.g., recognizing that 3/1 and 3 are the same number).</td><td rowspan="2">• Measure and estimate weights and liquid volumes, and solve word problems involving these quantities.
• Tell time and write time to the nearest minute.
• Recognize area as a quality of two-dimensional regions.
• Understand that rectangular arrays can be broken into identical rows or into identical columns. By breaking rectangles into rectangular arrays of squares, students connect area to multiplication, and explain how multiplication is used to determine the area of a rectangle.</td></tr>
<tr><th>Geometry</th></tr>
<tr><td>• Reason about shapes (e.g., all squares are rectangles but not all rectangles are squares).
• Find areas of shapes, and relate area to multiplication (e.g., why is the number of square feet for a 9-foot by 7-foot room given by the product 9 × 7?).
• Understand the connection between equal parts of a shape being a unit of the whole.</td></tr>
</table>

<u>Numbering of Standards</u>

The following Mathematics Standards will be numbered continuously. The following ranges relate to the clusters found within Mathematics:

Operations and Algebraic Thinking	
Represent and solve problems involving multiplication and division.	Standards 1-4
Understand properties of multiplication and the relationship between multiplication and division.	Standards 5-6
Multiply and divide within 100.	Standard 7
Solve problems involving the four operations, and identify and explain patterns in arithmetic.	Standards 8-9
Number and Operations in Base Ten	
Use place value and properties of operations to perform multi-digit arithmetic.	Standards 10-12
Number and Operations- Fractions	
Develop an understanding as fractions as numbers.	Standards 13-15
Measurement and Data	
Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.	Standards 16-17
Represent and interpret data.	Standards 18-19
Geometric measurement: understand concepts of area and relate area to multiplication and to addition.	Standards 20-22
Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.	Standard 23
Geometry	
Reason with shapes and their attributes.	Standards 24-25

Operations and Algebraic Thinking

Cluster	**Represent and solve problems involving multiplication and division.**
M.3.1	Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each (e.g., describe context in which a total number of objects can be expressed as 5 × 7).
M.3.2	Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each (e.g., describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8).
M.3.3	Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays and measurement quantities (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem).
M.3.4	Determine the unknown whole number in a multiplication or division equation

	relating three whole numbers (e.g., determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = ? ÷ 3, 6 × 6 =?).

Cluster	**Understand properties of multiplication and the relationship between multiplication and division.**
M.3.5	Apply properties of operations as strategies to multiply and divide (e.g., If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known: Commutative Property of Multiplication. 3 × 5 × 2 can be found by 3 × 5 = 15, then 15 × 2 = 30, or by 5 × 2 = 10, then 3 × 10 = 30: Associative Property of Multiplication. Knowing that 8 × 5 = 40 and 8 × 2 = 16, one can find 8 × 7 as 8 × (5 + 2) = (8 × 5) + (8 × 2) = 40 + 16 = 56: Distributive Property. Instructional Note: Students need not use formal terms for these properties.
M.3.6	Understand division as an unknown-factor problem (e.g., find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8).

Cluster	**Multiply and divide within 100.**
M.3.7	Learn multiplication tables (facts) with speed and memory in order to fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows that 40 ÷ 5 = 8) or properties of operations by the end of Grade 3.

Cluster	**Solve problems involving the four operations, and identify and explain patterns in arithmetic.**
M.3.8	Solve two-step word problems using the four operations, represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. Instructional Note: This standard is limited to problems posed with whole numbers and having whole number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).
M.3.9	Identify arithmetic patterns (including patterns in the addition table or multiplication table) and explain those using properties of operations (e.g., observe that 4 times a number is always even and explain why 4 times a number can be decomposed into two equal addends).

Number and Operations in Base Ten

Cluster	**Use place value understanding and properties of operations to perform multi-digit arithmetic.**
M.3.10	Use place value understanding to round whole numbers to the nearest 10 or 100.
M.3.11	Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.
M.3.12	Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.

Number and Operations- Fractions

Cluster	Develop understanding of fractions as numbers.
M.3.13	Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b. Instructional Note: Fractions in this standard are limited to denominators of 2, 3, 4, 6, and 8.
M.3.14	Understand a fraction as a number on the number line and represent fractions on a number line diagram. a. Represent a fraction 1/b on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line. (e.g., Given that b parts is 4 parts, then 1/b represents 1/4. Students partition the number line into fourths and locate 1/4 on the number line.) b. Represent a fraction a/b on a number line diagram by marking off a lengths 1/b from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line. (e.g., Given that a/b represents 3/4 or 6/4, students partition the number line into fourths and represent these fractions accurately on the same number line; students extend the number line to include the number of wholes required for the given fractions.) Instructional Note: Fractions in this standard are limited to denominators of 2, 3, 4, 6, and 8.
M.3.15	Explain equivalence of fractions in special cases and compare fractions by reasoning about their size. a. Understand two fractions as equivalent (equal) if they are the same size or the same point on a number line. b. Recognize and generate simple equivalent fractions (e.g., 1/2 = 2/4, 4/6 = 2/3). Explain why the fractions are equivalent (e.g., by using a visual fraction model). c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. (e.g., Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.) d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, = or < and justify the conclusions (e.g., by using a visual fraction model). Instructional Note: Fractions in this standard are limited to denominators of 2, 3, 4, 6, and 8.

Measurement and Data

Cluster	**Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.**
M.3.16	Tell and write time to the nearest minute, measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes (e.g., by representing the problem on a number line diagram).
M.3.17	Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg) and liters (l). Add, subtract, multiply or divide to solve one-step word problems involving masses or volumes that are given in the same units (e.g., by using drawings, such as a beaker with a measurement scale) to represent the problem. Instructional Note: Exclude compound units such as cm^3 and finding the geometric volume of a container.

Cluster	**Represent and interpret data.**
M.3.18	Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs (e.g., draw a bar graph in which each square in the bar graph might represent 5 pets).
M.3.19	Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves or quarters.

Cluster	**Geometric measurement: understand concepts of area and relate area to multiplication and to addition.**
M.3.20	Recognize area as an attribute of plane figures and understand concepts of area measurement. a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area and can be used to measure area. b. A plane figure which can be covered without gaps or overlaps by b unit squares is said to have an area of b square units.
M.3.21	Measure areas by counting unit squares (square cm, square m, square in, square ft. and improvised units).
M.3.22	Relate area to the operations of multiplication and addition. a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. b. Multiply side lengths to find areas of rectangles with whole number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning. c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and b + c is the sum of a × b and a × c. Use area models to represent the distributive property in mathematical reasoning. d. Recognize area as additive and find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the

	areas of the non-overlapping parts, applying this technique to solve real world problems.

Cluster	**Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.**
M.3.23	Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Geometry

Cluster	**Reason with shapes and their attributes.**
M.3.24	Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), that the shared attributes can define a larger category (e.g. quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.
M.3.25	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. For example, partition a shape into 4 parts with equal area, and describe the area of each part as ¼ or the area of the shape.