Grade 3 Math Unit 5-Geometric Measurement

UNIT OVERVIEW

In Grade 3, math instruction should focus on four critical areas. This unit addresses Critical Focus Area #3, **Developing understanding of the structure of rectangular arrays and of area.**
(See Connections for explanation)

This unit addresses work in these clusters:

- Geometric measurement: understand concepts of area and relate area to multiplication and to addition *(see Connections for explanation)
- Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures**

STANDARDS

CC_Common Core State Standards - Mathematics (2010) - Grade 3
Domain 3.MD Measurement and Data
Cluster Statement: Geometric measurement: understand concepts of area and relate area to multiplication and to addition.
Standard 3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.
3.MD.5.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.
3.MD.5.b A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.
Standard 3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).
Standard 3.MD.7 Relate area to the operations of multiplication and addition.
3.MD.7.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.
3.MD.7.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.
3.MD.7.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.
3.MD.7.d Recognize area as additive. 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 Statement: Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.
Standard 3.MD.8 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.

CONTENT ELABORATIONS

3.MD.5	**3.MD.5** calls for students to explore the concept of covering a region with "unit squares," which could include square tiles or shading on grid or graph paper. Students can cover rectangular shapes with tiles and count the number of units to begin developing the idea that area is a measure of covering. Area describes the size of an object that is two-dimensional. The formulas should not be introduced before students discover the meaning of area. **MP.2, MP.4, MP.5, MP.6** should be emphasized.

3.MD.6	Counting the square units to find the area can be done in metric, customary or non-standard square units. Using different sized graph paper, students can explore the areas measured in square centimeters and square inches. **MP.2, MP.3, MP.5, MP.6** should be emphasized.
3.MD.7a-b	Students should solve real world and mathematical problems. Students tile areas of rectangles, determine the area, record the length and width of the rectangle, investigate the patterns in the numbers, and discover that the area is the length times the width.
3.MD.7c	This standard extends students' work with the distributive property.
3.MD.7d	Students can decompose a rectilinear figure into different rectangles. They find the area of the figure by adding the areas of each of the rectangles together. **MP.1, MP.2, MP.4, MP.5, MP.6** should be emphasized.
3.MD.8	Students develop an understanding of the concept of perimeter by walking around the perimeter of a room, using rubber bands to represent the perimeter of a plane figure on a geoboard, or tracing around a shape on the Smartboard. They find the perimeter of objects; use addition to find perimeters; and recognize the patterns that exist when finding the sum of the lengths and widths of rectangles. Students use geoboards, tiles and graph paper to find all the possible rectangles that have a given perimeter (e.g., find the rectangles with a perimeter of 14cm) They record all the possibilities using dot or graph paper, compile the possibilities into an organized list or a table, and determine whether they have all the possible rectangles. Given a perimeter and a length or width, students use objects or pictures to find the missing length or width. They justify and communicate their solutions using words, diagrams, pictures, and numbers. Students use geoboards, tiles, graph paper or technology to find all the possible rectangles with a given area (e.g., find the rectangles that have an area of 12 square units) they record all the possibilities using dot or graph paper, compile the possibilities into an organized list or a table and determine whether they have all the possible rectangles. Having students record their findings in a chart, allow them to identify the factors, connect the results to the commutative property, and discuss the differences in perimeter within the same area. **MP.1, MP.2, MP.3, MP.4, MP.7** should be emphasized.

UNIT VOCABULARY

perimeter	unit square	formula
area	square unit	composite figures

BIG IDEAS

ENDURING UNDERSTANDINGS

ESSENTIALS QUESTIONS

Choose a few questions based on the needs of your students

●Area models are related to addition and multiplication.
●Area covers a certain amount of space using square units.
●When finding the area of a rectangle, the dimensions represent the factors in a multiplication problem.
●Multiplication is repeated addition.
●Multiplication can be used to find the area of rectangles with whole numbers.
●Area models of rectangles and squares are directly related to the commutative property of multiplication.
●Rearranging an area such as 24 sq. units based on its dimensions or factors does NOTchange the amount of area being covered (Van de Walle, pg 234). Ex. A 3 x 8 is the same area as a 4 x 6, 2 x12, and a 1 x 24.
●Area in measurement is equivalent to the product in multiplication.
●Area models can be used as a strategy for solving multiplication problems.
●Some word problems may require two or more operations to find the solution.
•The length around a polygon can be calculated by adding the lengths of its sides.

● How are perimeter and area related and how are they different?

CONNECTIONS

In Critical Focus Area #3, students recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-size units of area required to cover the shape without gaps or overlaps, a square with sides of unit length being the standard unit for measuring area. Students understand that rectangular arrays can be decomposed into identical rows or into identical columns. By decomposing rectangles into rectangular arrays of squares, students connect area to multiplication, and justify using multiplication to determine the area of a rectangle.
* This cluster connects with **3.OA.7**, Fluently multiply and divide within 100 and also to the distributive property.
** This cluster connects with *Measure and estimate lengths in standard units* , and to *Relate addition and subtraction to length in grade 2* (**2.MD.1-4, 2.MD.5-6**)

Standards for Mathematical Practice (SMP)
MP.1 Make sense of problems and persevere in solving them
MP.2 Reason abstractly and quantitatively
MP.3 Construct viable arguments and critique the reasoning of others
MP.4 Model with mathematics
MP.5 Use appropriate tools strategically
MP.6 Attend to precision
MP.7 Look for and make use of structure (Deductive reasoning)
MP.8 Look for and express regularity in repeated reasoning (Inductive Reasoning)

GEOMETRIC MEASUREMENT: UNDERSTAND CONCEPTS OF AREA AND RELATE AREA TO MULTIPLICATION AND ADDITION

	CONTENT	SKILLS
3.MD.5	Recognize area as an attribute of plane figures and understand concepts of area measurement.	Recognize area as an attribute of plane figures and understand concepts of area measurement. 1. Define “unit square”. 2. Define area. 3. Relate the number (n) of unit squares to the area of a plane figure. 4. Cover the area of a plane figure with unit squares without gaps or overlaps.

3.MD.6	Measure areas by counting unit squares.	Measure areas by counting unit squares. 1. Measure areas by counting unit squares. 2. Use unit squares of cm, m, in, ft, and other sizes of unit squares to measure area.
3.MD.7a	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.	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. 1. Find the area of a rectangle by tiling it in unit squares. 2. Find the side lengths of a rectangle in units. 3. Compare the area found by tiling a rectangle to the area found by multiplying the side lengths.
3.MD.7b	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.	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. 1. Multiply side lengths to find areas of rectangles. 2. Solve real world and mathematical area problems by multiplying side lengths of rectangles. 3. Use rectangular arrays to represent whole-number products in multiplication problems.
3.MD.7c	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.	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. 1. Multiply using an area model (array). 2. Relate area of a rectangle to multiplication and addition by modeling the distributive property. Ex. 3 x (5+2) = 3x5 + 3x2.
3.MD.7d	Recognize area as additive.	Recognize area as additive. 1. Find areas of rectangles. 2. Add areas of rectangles. 3. Recognize that areas of each rectangle in a rectilinear (straight line) figure can be added together to find the area of the figure. 4. Use the technique of decomposing rectilinear figures to find the area of each rectangle to solve real world problems. 5. Decompose rectilinear figures into non-overlapping rectangles.
	RECOGNIZE PERIMETER AS AN ATTRIBUTE OF PLANE FIGURES AND DISTINGUISH BETWEEN LINEAR AND AREA MEASURES	
3.MD.8	Solve real world and mathematical problems involving perimeters of polygons.	Solve real world and mathematical problems involving perimeters of polygons. 1. Define a polygon. 2. Define perimeter. 3. Find the perimeter when given the length of sides. 4. Find the perimeter when there is an unknown side length. 5. Exhibit (design, create, draw, model, etc.) rectangles with the same perimeter and different areas. 6. Exhibit rectangles with the same area and different perimeters.

1. Common Core Model Curriculum
2. McGraw-Hill, **My Math** Chapter 13
3. **Hands-on Standards** Measurement Lessons # 1-9 & Data Analysis Lessons # 2 &3
4. Manipulatives: fraction circles, wipe-off clocks, analog clocks, color tiles, centimeter cubes, geoboards, pattern blocks, 3 Bear Family Counters, beakers with whole number measures, graduated cylinders, measuring cups with liter markings, standard rulers
5. Deb Diller Math Work Stations materials & process
6. Georgia Math Frameworks, Grade 3 Unit 3
7. *United Streaming* : Measuring Length, Areas, and Perimeters, Volume & Capacity
8. Creating pictographs *http://illuminations.nctm.org/LessonDetail.aspx?ID=L536*
9. SCS Math Resources: Bang on Time, Time Clock
10. Possible Literature: The Information Please Kid's Almanac by Alice Siegel and Margo McLoone Basta: The Top 10 of Everything by Russell Ash; Measuring Up: Experiments, Puzzles and Games Exploring Measurement by Sandra Markle; I Wonder Why the Sun Rises and Other Questions About Time and Seasons by Barbara Taylor; What a Load of Trash! by SteveSkidmore; Measuring by Sally Hewitt; Measuring Penny by Loreen Leedy; Counting on Frank by Rod Clement; Polygons by David L. Stienecker; Build It with Boxes by Joan Irvine