

► Grade 3 Topic 6: Connect Area to Multiplication and Addition

Big Conceptual Idea: [Measurement and Data \(Measurement Part\)](#) (pp. 16-18)

Prior to instruction, view the *Topic 6 Professional Development Video* located in Pearson Realize online. Read the *Teacher's Edition (TE): Cluster Overview/Math Background* (pp. 297A-297F), the *Topic Planner* (pp.297I-297K), all 7 lessons, and the *Topic Assessments* (pp. 353-354A).

Mathematical Background: Read Topic 6 Cluster Overview/Math Background (TE, pp. 297A-297F)	Topic Essential Question: How can area be measured and found? <i>Reference Answering the Topic Essential Question (TE, pp. 349-350) for key elements of answers to the Essential Question.</i>
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The lesson map for this topic is as follows:

6-1	6-2	6-3	6-4	6-5	6-6	6-7	Assessment
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2 A/D/E days used strategically throughout the topic

Instructional note:

This topic focuses on cluster heading 3.MD.C “Geometric measurement: understand concepts of area and relate area to multiplication and division” (2010, NVACS). This topic focuses on *beginning* to understand the measure of area. A key idea that students need to conceptualize is that area is an attribute of an object that can be measured. The total number of same-sized square units needed to cover a region without having gaps or overlaps determines the quantity. In 3rd grade, area is described by multiplication expressions such as 3×4 an area model with 3 rows of 4 same sized units.

Students build on their understanding of multiplication and repeated addition to *begin* to understand area concepts. To connect this idea to prior learning from this year continue to ask students the following questions when applicable:

- Explain how determining the area of an object is similar to using an array to show a multiplication equation.
- Where is the repeated addition in this shape? (Asking this question before determining the area of irregular shapes can allow students to generalize this idea and transfer more easily to finding the area of irregular shapes.)
- How can the Distributive Property of Multiplication help us to find the total area of large objects?

Lessons 6-5, 6-6, 6-7 work with students to apply the Distributive property to compose or decompose rectilinear figures into two or more rectangles. Making this connection explicit through classroom discussion will help students to generalize these understandings and conceptualize finding the area of irregular rectilinear figures.

Note that our goal in this topic is not to formalize a formula for area, but rather to see the relationships that exist between area and the operations of multiplication and addition. This relationship is revealed through the spatial structure (MP.7) of two-dimensional shapes in the number of square units in a row and the number of rows or columns. Strongly emphasize throughout this unit that when finding area, the result is reported in square units. Students also learn that the area depends upon the size of the units used to cover the entire figure. Laying this foundation in grade 3 will provide students with the necessary prior knowledge needed to generate the formula in grade 4.

Focus Math Practice 7: Look for and make use of structure

Focus on opportunities for students to develop Mathematical Practice 7 behaviors throughout the entire topic, as this is the focus of the Math Practices and Problem Solving lesson 6-7. Reference the *Teacher's Edition (TE, pp. F21 - F21A)* and the *Nevada Academic Content Standards for Mathematical Practice (2010, p. 8)*.

Looking ahead to the Topic Performance Assessment, students will be expected to find the area of rectilinear shapes within a larger rectilinear area, create a figure with a set area, explain why we can multiply to determine the area of a figure and explain decomposing a rectilinear area to find smaller areas or to determine the area of irregular shapes. While developing the thinking habits that allow students to engage in this problem type are highly beneficial, you may need to scaffold working with the Topic Performance Assessment.

Topic 6

Connect Area to Multiplication and Addition

Number of Lessons: **7**

A/D/E: **2** days

NVACS Focus:
MD.C

Total Days: ~9

[3rd Grade Curriculum Pacing Framework:](#)
[Balanced Calendar](#)

Essential Academic Vocabulary Use these words consistently during instruction.		
New Academic Vocabulary: (First time explicitly taught)	Review Academic Vocabulary: (Vocabulary explicitly taught in prior grades or topics)	
area unit square square unit(s)	<i>estimate</i> <i>addend</i> <i>array</i> <i>equal groups</i> <i>multiply</i> <i>row</i>	<i>length</i> <i>inches</i> <i>feet</i> <i>centimeters</i> <i>meters</i> <i>rectangle</i> <i>square</i>

Additional terminology that students may need support with: decompose, non-standard

Collaborative Team Conversations (CTC)

Consider using **one** of the following as part of the formative assessment process at the lesson level to **collect student work** to analyze for **evidence of mathematical understanding**:

Guiding question: "Are students using their understanding of multiplication and addition to find the area of a figure?"

Lesson	Evidence	Look for
6-3	Math Practices and Problem Solving (student work samples)	Focus CTC around the big idea: <ul style="list-style-type: none"> students communicate the area of a shape by using standard units.
6-6	Solve & Share (student work samples)	Focus CTC around the big idea: <ul style="list-style-type: none"> students determine the area of an irregular shape by decomposing the irregular shape into rectangles.

Learning Cycle Assessments (summative)	Topic Assessments SE pp. 349-354	Use <i>Scoring Guide</i> TE pp. 349-354A
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Standards listed in **bold** indicate a focus of the lesson.

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 6-1: Cover Regions		
3.MD.C.5a 3.MD.C.5b 3.MD.C.6 MP.1 MP.2 MP.3 MP.5 MP.6	Access Prior Learning: At the end of second grade students covered rectangles with rows and columns of squares. Developing the Big Idea: Students are <i>beginning</i> to understand that the amount of space inside a shape is its area, and area can be found or estimated using unit squares.	Topic Opener: Introduce the Topic Essential Question, "How can area be measured and found?" (TE, p. 297). Consider making an anchor chart in your classroom. Each day new ideas are added so that students are able to see the development and connections throughout the topic. Consider having students complete the <i>Review What You Know</i> prior to beginning instruction on topic 6 so that you can respond to students' instructional needs using the Item Analysis for Diagnosis and Intervention (TE, pp. 298-300) prior to beginning the topic. Consider introducing vocabulary as students encounter academic language in the lessons rather than introducing all terms at the beginning of the lesson. Solve & Share: Students will need Teaching Tool 12 found in the <i>Teacher's Resource Master Volume 2</i> to solve the problem. Watch for students that find the area by covering the shapes with the square tiles, decompose the shape, then multiply the sub-units, and add the sub-units together to find the total area. Consider having this student share their solution strategy and reasoning last as they have already connected understanding of multiplication to finding area. Look Back: Consider discussing as a whole group the <i>Look Back!</i> as this directly addresses a key idea in area concepts; area is a measure of two-dimensional shapes of square units needed to cover a region without having gaps or overlaps . Consider asking students the same question, but in this case, there are overlapping tiles.
<i>-continues on next page-</i>		

		<p>Another Example: Consider discussing the <i>Another Example!</i> (TE, pp. 303-304) should students still seem to be unclear about finding area using partially filled unit squares before assigning the <i>Quick Check</i> items.</p> <p>Assess and Differentiate: If time permits, you may consider replacing the <i>Problem Solving Reading Mat</i> with games from previous topics. The “Teamwork” game from lesson 3-4 (TE, p. 131A) has students practicing decomposing arrays to find the total number of objects. Revisiting this game at this time could help activate prior learning that will be generalized to finding area of shapes.</p> <p>Child-watch to identify students who need additional support and pull them in a small group to do the <i>Intervention Activity</i> (TE, p. 305A).</p>
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Lesson 6-2: Area- Nonstandard Units

<p>3.MD.C.6 3.MD.C.5a 3.MD.C.5b</p> <p>MP.2 MP.3 MP.6</p>	<p>Access Prior Learning: In lesson 6-1, Grade 3 students began to understand that area can be measured by counting the number of square units in a two-dimensional figure.</p> <p>Developing the Big Idea: Students are <i>beginning</i> to understand that area can be measured using nonstandard units and to understand that the size of the area depends upon the size of the units used to cover in the rows and number of rows.</p>	<p>Solve & Share: After reading and giving students the opportunity to try solving the <i>Solve & Share</i>, consider discussing as a whole group the question, “What do you notice about the size of the postcard on each grid?” (TE, p. 307). It is important that students recognize they are the same size and shape. In developing understanding that the size of an area depends upon the size of the units used to cover the shape, students may form the misconception that the shapes have different areas instead of identifying the larger area measure is a result of measuring with smaller units.</p> <p>Child-watch for students that miscount the area by double counting squares. For these students suggest a method to help them keep track of squares they have already counted.</p> <p>Look Back: After the sharing of student solution strategies and reasoning, consider posing the <i>Look Back!</i> to emphasize that the measures are different because the square units are different sizes.</p> <p>Convince Me: Consider assigning the <i>Convince Me!</i> to have students apply their understanding of the impact the size of the unit square has in identifying area (e.g. students explain that the squares are alike because each has an area of 16 square units, but the squares are not the same size because the unit squares used to measure them are different sizes (TE, p. 308)).</p> <p>Guided Practice: For item 2 in <i>Guided Practice</i>, consider asking students what they notice about the size relationship between the two unit squares. How might they use this to help them decompose the rectangles by the unit squares (e.g. for the second rectangle they could start by drawing in the larger square unit and then splitting each into fourths)?</p> <p>Independent Practice/Math Practices and Problem Solving: As a result of the difficulty many students have with the motor skills needed to draw in the smaller unit, consider only having students do the <i>Quick Check</i> items. In reviewing student work on item 5, students may need to be questioned to see if they truly do not understand the different sized square units or if motor skills are preventing them from being able to show what they know.</p> <p>Assess and Differentiate: If time permits, teach students how to play “Teamwork” (TE, p. 311A). All students should have the opportunity to play this game.</p> <p>Child-watch to identify students who need additional support and pull them in a small group to do the <i>Intervention Activity</i> (TE, p. 311A).</p>
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Lesson 6-3: Area- Standard Units

<p>3.MD.C.6 3.MD.C.5a 3.MD.C.5b</p> <p>MP.2 MP.3 MP.6</p>	<p>Access Prior Learning: In previous lessons in this topic, students used non-standard unit squares to communicate the area of a two-dimensional figure.</p> <p>Students also learned that the size of the unit square and the size of the area depends upon the size of the units used to cover the rows and number of rows.</p>	<p>Solve & Share: Consider asking students what tool could be helpful in completing the <i>Solve & Share</i> (e.g. ruler, square tiles) and having these tools available for students.</p> <p>Convince Me: Consider assigning the <i>Convince Me!</i> Discuss whole group to reinforce the findings from lesson 6-2 that the size of the area depends upon the size of the units used to cover in the rows and number of rows. Point out that now it is determined using a standard unit of length.</p> <p>Guided Practice: Encourage students who struggle with item 1 to draw a picture to help them understand the information.</p>
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	<p>Developing the Big Idea: Students <i>develop</i> understanding of communicating the area of a shape by using standard units of length, such as inches, centimeters, etc.</p>	<p>Independent Practice/Math Practices and Problem Solving: Students who are struggling with solving item 15 may need to draw a picture like the one they may have for item 1.</p> <p>Assess and Differentiate: If time permits, consider replacing the <i>Problem Solving Reading Mat</i> with game “Teamwork” (TE, p. 311A). All students should have the opportunity to play this game.</p> <p>Child-watch to identify students who need additional support and pull them in a small group to do the <i>Intervention Activity</i> (TE, p. 317A).</p> <p>*CTC: <i>Math Practice and Problem Solving</i> (student work samples)</p>
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Lesson 6-4: Area of Squares and Rectangles

<p>3.MD.C.7a 3.MD.C.7b</p> <p>MP.1 MP.2 MP.3 MP.4 MP.8</p>	<p>Access Prior Learning: In previous grades, students have learned that a square has 4 sides that measure the same length. In previous topics in Grade 3, students have used arrays to model multiplication to show the repeated addition of rows and columns to find the total.</p> <p>Developing the Big Idea: In this lesson students further <i>develop</i> their understanding of area by <i>beginning</i> to understand the relationship between area and multiplication.</p>	<p>Solve & Share: Consider asking students what they know about squares to assess students’ readiness for finding the area of a square. Students need to recall that a square has 4 sides that measure the same length. This is necessary so that they are able to apply the understanding to finding the area of a square where only one side’s measure is given.</p> <p>Watch for students that do not recognize that when we are finding the area of a square, the other side’s measures will also be 6 meters. Revisit what we know about squares that can help determine the area of the shape.</p> <p>Watch for students that solve using Kyoko and Shelly’s work (TE, p. 319). Consider having a student whose solution method is similar to Kyoko’s share first as most students in the class should be able to understand the method of drawing in the unit squares and counting each unit square. Consider having the student whose solution method is similar to Shelly’s share last as this student understands how area measurements connect to multiplication.</p> <p>Visual Learning: Consider pausing the <i>Visual Learning Animation</i> after it shares another way to find the area by counting the number of rows and multiply by the number in each row. Ask students, “Why can we multiply?” (E.g., we have equal rows of 6 so we could skip count by 6 or use repeated addition of 6.) Throughout the <i>Visual Learning Animation</i> consider asking students, where is the repeated addition in this shape, to facilitate connecting multiplication to area.</p> <p>Independent Practice/Math Practices and Problem Solving: For <i>Quick Check</i> item 7 encourage students to use what they know of multiplication and division to solve for the unknown side length. Students did this in topic 4 when they compared and contrasted what was known and unknown in a multiplication array versus a division array. Item 11 of the <i>Quick Check</i> offers distributed practice of multiplication concepts learned in lesson 2-4 <i>Multiply by 10</i> to an area context.</p> <p>Assess and Differentiate: If time permits, teach students how to play “Clip and Cover” (TE, p. 323A). Consider providing students with centimeter grid paper so that they can draw, see, and label the rectangles and areas they are creating. All students should have the opportunity to play this game.</p> <p>Child-watch to identify students who need additional support and pull them in a small group to do the <i>Intervention Activity</i> (TE, p.323A).</p>
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Lesson 6-5: Apply Properties- Area and the Distributive Property

<p>3.MD.C.7c</p> <p>MP.1 MP.3 MP.4 MP.7 MP.8</p>	<p>Access Prior Learning: In topic 3, Grade 3 students used the Distributive Property of Multiplication to break a large array into smaller arrays of known facts to solve for unknown multiplication problems.</p> <p>Developing the Big Idea: Students further <i>develop</i> understanding of area as the measure of unit squares inside a shape by modeling the Distributive Property of Multiplication using rectangles.</p>	<p>Solve & Share: After students have shared their solution methods and reasoning, consider asking if they could find the full area of the floor. Ask, “How does this connect to the Distributive Property of Multiplication?” Students will more easily be able to understand how to find the area of irregular shapes if in this lesson they connect using the Distributive Property of Multiplication to solving for unknown multiplication facts by breaking a larger array into smaller arrays of known facts.</p> <p>Visual Learning: To help students understand that decomposing the rectangle into smaller rectangles does not change the total area, connect topic 3 learning of breaking larger arrays into smaller arrays of known facts to find the product of unknown facts.</p> <p>Convince Me: Consider assigning the <i>Convince Me!</i> and having students post their solution methods for a Gallery Walk. Focus the walk on identifying different ways to break up the large area into smaller areas.</p> <p style="text-align: right;">-continues on next page-</p>
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Lesson 6-6: Apply Properties- Area of Irregular Shapes

<p>3.MD.C.7d</p> <p>MP.1 MP.2 MP.7 MP.8</p>	<p>Access Prior Learning: In previous lessons in this topic, students learned how to find the area of rectangles building on their understanding of multiplication and the Distributive Property of Multiplication to decompose large areas into smaller areas of known multiplication facts.</p> <p>Developing the Big Idea: In this lesson, students further <i>develop</i> their understanding of area by exploring that the area of irregular shapes can be found by dividing the original shapes into rectangles, finding the area of each rectangle, and adding all of the areas.</p>	<p>Solve & Share: After introducing the <i>Solve & Share</i> consider asking students how today's <i>Solve & Share</i> is similar to what they have done in previous lessons in this topic. Pose questions to get students to share out the following ideas:</p> <ul style="list-style-type: none"> • they are still finding the area of a shape • they can decompose the shape so that they are still finding the area of rectangles. <p>For struggling students, you may want to offer geoboards, or if geoboards are not available use centimeter grid paper (Teaching Tool 13). Ask students how this tool might help them find the area (e.g., students would need to redraw the figure with each square centimeter being equivalent to a foot on the drawn figure in their book). For students that use the grid paper and count each individual square centimeter consider pairing them with a student that decomposed the shape into rectangles and solved by multiplying the sides of each decomposed rectangle and then added the areas.</p> <p>After students have shared their solution method and reasoning (if they have not already explained how they knew they could multiply the sides to get the area), consider posing a question that will make the connection to multiplication explicit.</p> <p>Convince Me: After viewing the <i>Visual Learning Animation</i>, consider having students solve the <i>Convince Me!</i> with geoboards, or if geoboards are not available use centimeter grid paper (Teaching Tool 13). Have students share the different ways they could divide the shape. As a whole class, discuss how all the shapes still have the same area. A common misconception students will often develop is that changing the way they decompose the original shape will change the area measurement. After students have reviewed each other's solutions consider asking students what was the most efficient way to decompose the shape?</p> <p>Guided Practice: Item 4 on <i>Guided Practice</i> requires students to reason with the measures offered to determine the measures of unknown sides. Consider asking students that figured it out to share with the whole class how they figured out the measures of the unknown sides.</p> <p>Independent Practice/Math Practices and Problem Solving: Consider assigning item 10 to assess formatively students' development of the mathematical vocabulary in this topic.</p> <p>Assess and Differentiate: If time permits, you may consider replacing the <i>Problem Solving Reading Mat</i> with either the game "Teamwork" (TE, p. 311A), "Clip and Cover" (TE, p. 323A) or the <i>Fluency Practice Activity</i> (TE, p. 343).</p> <p>*CTC: <i>Solve & Share</i> (student work samples)</p>
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Lesson 6-7: Math Practices and Problem Solving- Look for and Use Structure

<p>3.MD.C.7a 3.MD.C.7b 3.MD.C.7d</p> <p>MP.7 MP.1 MP.2 MP.3 MP.4 MP.5 MP.6</p>	<p>Access Prior Learning: In this topic students have developed an understanding of area and how to find the area of regular and irregular shapes.</p> <p>Developing the Big Idea: In this lesson, students continue to develop their understanding of area and finding the area of irregular shapes by applying MP. 7 to find the area in real-world contexts.</p>	<p>This lesson provides an opportunity to focus on the Thinking Habits and display the behaviors associated with Math Practice 7. Refer to the <i>Math Practices and Problem Solving Handbook</i> (TE, pp. 27A-27F, F29) for suggestions on how to develop, connect and assess this Math Practice. Also, reference the handbook in the Student Edition (SE, p. 27F).</p> <p>Solve & Share: Consider reintroducing MP. 7 Thinking Habits (SE, p. 27F) before introducing the <i>Solve & Share</i>. Consider using the time when students are working on the <i>Solve & Share</i> as an opportunity to child-watch for behaviors associated with MP.7 that are listed in the <i>Math Practices and Problem Solving Handbook</i> (TE, p. 27A). After discussing student solution methods and reasoning, have students self-score for the behaviors associated with this math practice.</p> <p>Assess and Differentiate: If time permits, teach students how to play "Display the Digits" (TE, p. 323A). All students should have the opportunity to play this game.</p>
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References

Common Core Standards Writing Team. (2012). *Progressions for the Common Core State Standards in Mathematics (draft). Grades K-5, Measurement and Data*. Tucson, AZ: Institute for Mathematics and Education, University of Arizona.

Council of Chief State School Officers. (2010). The Nevada Academic Content Standards. Retrieved from http://www.doe.nv.gov/uploadedFiles/nde.doe.nv.gov/content/Standards_Instructional_Support/Nevada_Academic_Standards/Math_Documents/mathstandards.pdf.