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**GRADE 3 • MODULE 4**

**Multiplication and Area**

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*Conceptual*

*Application*

Module - 10 days

Instruction - 8 days

EOM - 2 days ← suggested



Grade 3 • Module 4

# Multiplication and Area

## OVERVIEW

In this 10-day module, students explore area as an attribute of two-dimensional figures and relate it to their prior understandings of multiplication. In Grade 2, students partitioned a rectangle into rows and columns of same-sized squares and found the total number by both counting and adding equal groups represented by the rows or columns (2.6A, 2.9F).

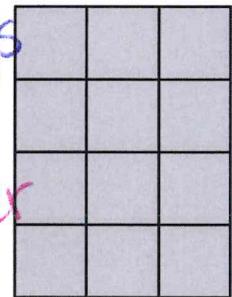
Topic A provides students' first experience with tiling from which they learn to distinguish between length and area by placing a ruler with the same size units (inches or centimeters) next to a tiled array. They discover that the number of tiles along a side corresponds to the length of the side.

Students progress from using square tile manipulatives to drawing their own area models. Anticipating the final structure of an array, they complete rows and columns in figures such as the example shown to the right. Students connect their extensive work with rectangular arrays and multiplication to eventually discover the area of rectangles in problems using multiplication related to the number of rows times the number of square units in each row (3.6C).

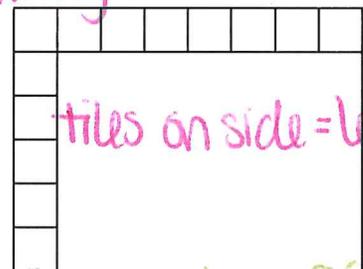
In Topic B, students manipulate rectangular arrays to concretely demonstrate the arithmetic properties in anticipation of the lessons that follow. They do this by cutting rectangular grids and rearranging the parts into new wholes using the properties to validate that area stays the same, despite the new dimensions. Students decompose or compose composite figures, such as the one shown to the right—into non-overlapping rectangles, find the area of each region, and then add or subtract to determine the total area of the original shape (3.6D).

Throughout Module 4 students engage with the TEKS mathematical process standards by using representations to record their understanding of the relationship in a tiled rectangle between the number of tiles on a side and the length of that side (3.1E). They use precise language to explain and justify the process for determining the area of a rectangle (3.1G). This process includes using the appropriate units to label the area of a rectangle (e.g., square units, square inches). Students connect their understanding of multiplication to the method of determining the area of a rectangle by multiplying the side lengths (3.1F). When solving problems involving finding the area of a composite figure, students use a familiar problem-solving model to analyze given information, formulate a strategy, determine a solution, and justify the solution (3.1B). Students make decisions regarding the tools and techniques they use to solve problems (3.1C). Throughout the module, students use multiple representations to communicate their understanding of how to determine the areas of rectangles and composite figures (3.1D).

*connect area to 2D figs*

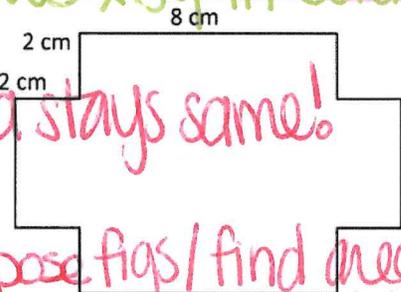


*- use ruler tile an array*



*tiles on side = length*

*take away 8 rows x sq in each row*



*\* Area stays same!*

*\* compose/decompose figs / find area / add - total*

*coherence mod 1+3 multipl*

*C-R-A*

*concrete cut grids or arrays*

*Process standards*



## Collaboratively Troubleshooting Student Misconceptions

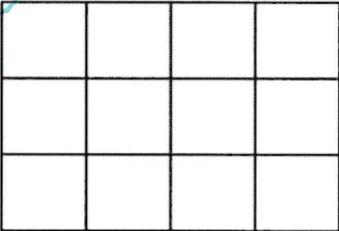
It is common for students to make mistakes as they build their understanding of new or difficult concepts. As noted in the Program and Implementation Guide, *collaborative troubleshooting* is a routine to help teachers address students' misconceptions. The three steps to collaborative troubleshooting are

- (1) surface student thinking;
- (2) validate what the student did right; and
- (3) bridge to a better understanding.

The following table presents teachers with guidance on how to collaboratively troubleshoot misconceptions with students. The first three columns of the table outline misconceptions that commonly arise in this module, reasons why students may have the misconceptions, and associated TEKS. Teachers can use this information to help them decide which questions to ask students to surface thinking and to validate what the students understood or did correctly.

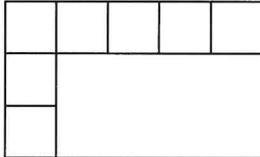
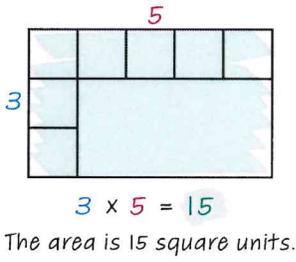
The last column of the table provides instructional strategies and sample guided questions that can support students as they build on what they already know and bridge to a better understanding.

*Note: Teachers can also refer to the sample teacher–student dialogue in the “Collaboratively Troubleshooting Student Misconceptions” section of the Grade 3 Course Guide for additional guidance on implementing the three-step routine.*

Topic	TEKS	Student Misconception	How to Bridge to a Better Understanding
Topics A and B	3.6C 3.6D	<p>Students add the number of length units and the number of width units to find area (e.g., The left side of the rectangle is 3 centimeters. The top side of the rectangle is 4 centimeters. <math>3 + 4 = 7</math>, so the area is 7 square centimeters.).</p> 	<p>Include gestures when discussing side lengths and area. For example, use the following prompts when students determine the side lengths and area of a rectangle:</p> <p>T: Use your finger to trace the length of the left side. What is the side length? S: (Trace the length of the left side.) 3 centimeters.</p> <p>T: Use your finger to trace the length of the top side. What is the side length? S: (Trace the length of the top side.) 4 centimeters.</p> <p>T: Cover the area inside of the rectangle with your fingers. What is the area? S: (Cover the area with fingers.) 12 square centimeters.</p>

- only add the dimensions  
 - not considering the coverage



Topic	TEKS	Student Misconception	How to Bridge to a Better Understanding
Topics A and B	3.6C 3.6D	<p>Students count the number of square units only on the side lengths to determine the area and do not connect multiplication to area (e.g., I can count the squares. The area is 7 square units.).</p> 	<p>Create an anchor chart. Use color coding to highlight how the side lengths of a rectangle relate to the factors in the equation.</p>  <p>Also, continue to make connections to what students know about how multiplication is related to rows and columns.</p>

## Focus Grade Level Standards

### Geometry and Measurement

The student applies mathematical process standards to analyze attributes of two-dimensional geometric figures to develop generalizations about their properties. The student is expected to:

- RS 3.6C determine the area of rectangles with whole number side lengths in problems using multiplication related to the number of rows times the number of unit squares in each row;
- SS 3.6D decompose composite figures formed by rectangles into non-overlapping rectangles to determine the area of the original figure using the additive property of area.

## Foundational Standards

The student is expected to:

- 2.6A model, create, describe contextual multiplication situations in which equivalent sets of concrete objects are joined;
- 2.9A find the length of objects using concrete models for standard units of length;
- 2.9B describe the inverse relationship between the size of the unit and the number of units needed to equal the length of an object;
- 2.9D determine the length of an object to the nearest marked unit using rulers, yardsticks, meter sticks, or measuring tapes;



- 2.9F use concrete models of square units to find the area of the rectangle by covering it with no gaps or overlaps, counting to find the total number of square units, and describing the measurement using a number and the unit.

## TEKS Mathematical Process Standards

The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

- 3.1B use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
- 3.1C select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;
- 3.1D communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
- 3.1E create and use representations to organize, record, and communicate mathematical ideas;
- 3.1F analyze mathematical relationships to connect and communicate mathematical ideas;
- 3.1G display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

## Overview of Module Topics and Lesson Objectives

TEKS	ELPS	Topics and Objectives	Days
3.6C 3.6D 3.4F	2.C 2.E 2.I 3.D 3.E 5.G	<p>A <b>Concepts of Area Measurement</b></p> <p>Lesson 1: C Relate side lengths to the number of tiles on a side.</p> <p>Lesson 2: Form rectangles by tiling with unit squares to make arrays.</p> <p>Lesson 3: R Draw rows and columns to determine the area of a rectangle given an incomplete array.</p> <p>Lesson 4: Interpret area models to form rectangular arrays.</p> <p>Lesson 5: A Determine the area of rectangles in problems using multiplication related to the number of rows times the number of square units in each row.</p>	5

*Build up tiles*  
*connect arrays*



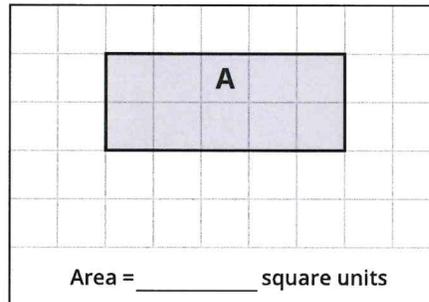
TEKS	ELPS	Topics and Objectives	Days
3.6C 3.6D 3.4F	1.A 1.F 2.E 3.F 4.F 4.G 5.G	<b>B Arithmetic Properties and Applications of Area</b> Lesson 6: Analyze different rectangles and reason about their area. Lessons 7 – 8: Find areas by decomposing into rectangles or completing composite figures to form rectangles. <i>Supporting /but hard!</i>	3
		End-of-Module Assessment Task: Topics A and B	2
<b>Total Number of Instructional Days</b>			<b>10</b>

## Terminology

A Spanish cognate is included when the term has a similar meaning and spelling in English. Not every term in this module has a Spanish cognate.

### Familiar Terms and Symbols<sup>1</sup>

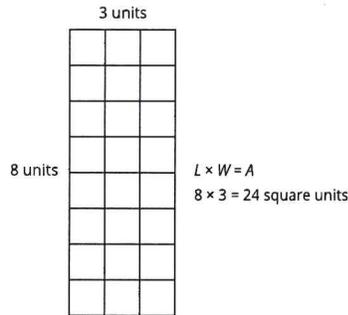
- **Area (Área):** the measurement attribute that describes the number of unit squares (or square units) a figure or region covers



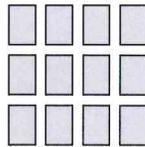
<sup>1</sup>These are terms and symbols students have seen previously.



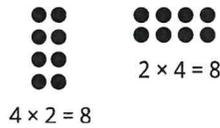
- **Area model** (*Modelo de área*): a model for multiplication problems that relates a rectangular array to the area of a rectangle. The length and width of the rectangle represent the factors of the multiplication problem.



- **Array**: a rectangular arrangement of equal groups organized in rows and columns



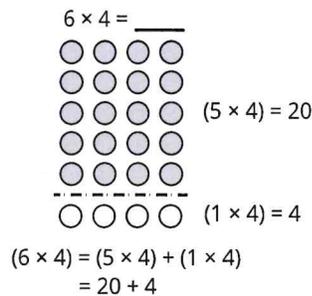
- **Commutative property of multiplication** (*Propiedad conmutativa*): changing the order of the factors in a multiplication expression or equation does not change its product



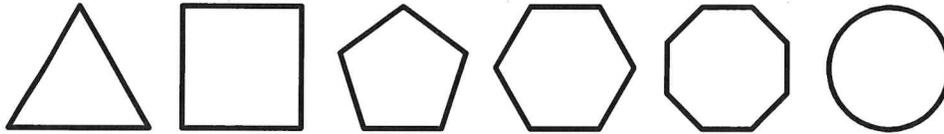
- **Commutative property of addition** (*Propiedad conmutativa*): changing the order of the numbers in an addition expression or equation does not change its sum

$$3 + 2 + 7 = 7 + 3 + 2$$

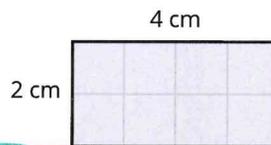
- **Distribute** (*Distribuir*): to multiply each part of a decomposed factor by the other factor, or to divide each part of a decomposed total by the divisor



- **Geometric shape/figure** (*Figura geométrica*): a two-dimensional object with a specific outline or form



- **Length**: the distance measurement between two points

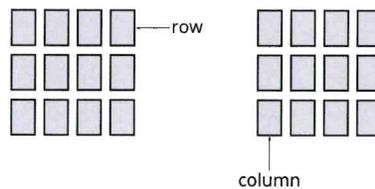


The side lengths of the rectangle are 2 cm and 4 cm.

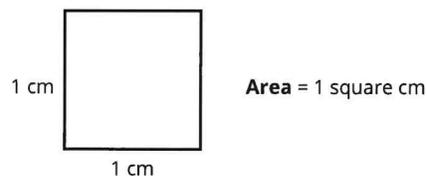
- **Multiplication** (*Multiplicación*): an operation showing how many times a number is added to itself. For example,  $6 \times 2$  represents repeated addition—adding 2 six times.

$$\begin{array}{l} 6 \times 2 \\ 6 \text{ twos} \\ 2 + 2 + 2 + 2 + 2 + 2 = 12 \end{array}$$

- **Rows and columns** (*Columnas*): horizontal and vertical groups in a rectangular array

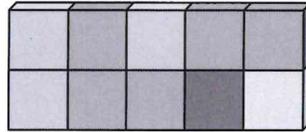


- **Square unit**: a unit of area in the shape of a square that has side lengths of 1 unit

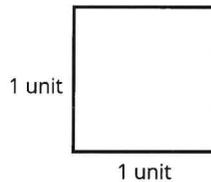


verb

- **Tile:** to cover a region without gaps or overlaps



- **Unit square:** a square with given side lengths of 1 unit



- **Whole number:** the number 0 or any of the counting numbers, e.g., 1, 2, 3, ...

### Suggested Tools and Representations

- Area model
- Array
- Grid paper (inch and centimeter)
- Rulers (both centimeter and inch measurements)
- Unit squares in both inch and centimeter lengths (e.g., square tiles used for measuring area—can be made out of paper if plastic or wood tiles are not available)

### Module 4 Lesson Overview Materials List

Lesson	Teacher Materials	Student Materials <i>All counts are per student unless otherwise indicated.</i>
1	12 square tiles	Personal white board 15 square inch tiles 15 square centimeter tiles → can use cubes Ruler
2		Personal white board 1 sheet of blank paper 15 square inch tiles Straight edge
3		Personal white board Straight edge Array 1 (T)* Array 2 (T)



Lesson	Teacher Materials	Student Materials <i>All counts are per student unless otherwise indicated.</i>
4	Meter stick 12-inch ruler Pad of square sticky notes	Personal white board Grid paper 1 set of square centimeter and square inch tiles per pair 12-inch ruler Area model (T)
5		Personal white board 12-inch ruler Grid (T)
6		Personal white board Small centimeter grid (T)
7		Personal white board 1 sheet of blank paper Large grid (T)
8		Personal white board

**\*\***(T) Template provided in TE, Practice, and/or Learn

