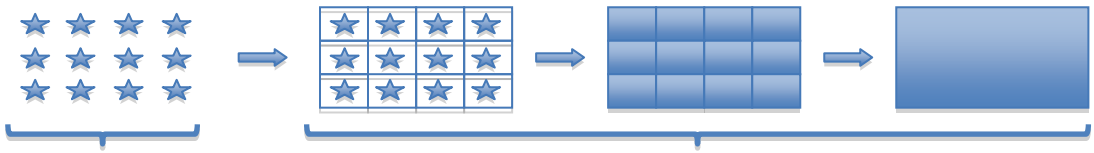
# *Grade 3 Module 4 – Multiplication and Area*

## New or Recently Introduced Terms

- Area (the amount of two-dimensional space in a bounded region)
- Area model (a model for multiplication that relates rectangular arrays to area)

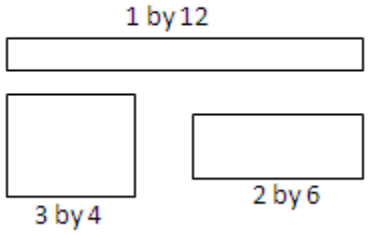


Module 1 and Module 3 Module 4

- Square unit (a unit of area—specifically square centimeters, inches, feet, and meters)
- Tile (to cover a region without gaps or overlaps)
- Unit square (e.g., given a length unit, it is a 1 unit by 1 unit square)
- Whole number (an integer, a number without fractions)

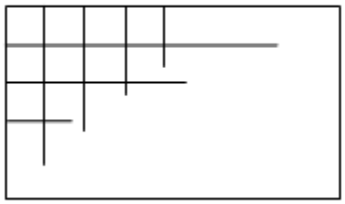
## Topic A: Foundations for Understanding Area

- In Lesson 1, students come to understand area as an attribute of plane figures that is defined by the amount of two-dimensional space within a bounded region. Students use pattern blocks to tile given polygons without gaps or overlaps, and without exceeding the boundaries of the shape.
- Lesson 2 takes students into an exploration in which they cut apart paper rectangles into same-sized squares to concretely define a square unit, specifically square inches and centimeters. They use these units to make rectangular arrays that have the same area, but different side lengths.
- Lessons 3 and 4 introduce students to the strategy of finding area using centimeter and inch tiles. Students use tiles to determine the area of a rectangle by tiling the region without gaps or overlaps. They then bring the ruler (with corresponding units) alongside the array to discover that the side length is equal to the number of tiles required to cover one side of the rectangle. From this experience, students begin to relate total area with multiplication of side lengths.
    - Students may, for example, cut and fold rectangles to confirm predictions about whether a 1 by 12 rectangle covers more area than a 3 by 4 or a 2 by 6 rectangle. They reinforce their ideas by using inch and centimeter square manipulatives to tile the same rectangles and prove the areas are equal.

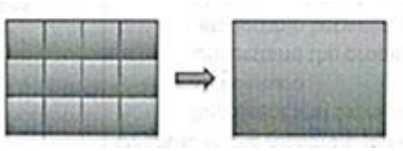


## Topic B: Concepts of Area Measurement

- In Lesson 5, students build rectangles using unit square tiles to make arrays when given specific criteria. For example, students may be told that there are 24 tiles inside the rectangle and that one side of the rectangle is covered with 4 tiles. Students may start by building one column of the array to represent a length of 4 units, then duplicate that process until they reach 24 total tiles, skip-counting by fours. Finally they physically push together the rows of tiles to make the array. When they count the number of fours, the process connects to unknown factor problems (in this case, the unknown factor of 6) from previous modules and builds toward students' discovery of the area formula.
- Now experienced with drawing rectangular arrays within an area model, students find the area of an incomplete array in Lesson 6. They visualize and predict what the finished array looks like, then complete it by joining opposite end points with a straight edge and determine the total area using skip-counting. The incomplete array model bridges to the area model, where no array is given.



- In Lesson 7, students are given information about the side lengths of an area model (shown at right). Based on this information they use a straight edge to draw a grid of equal sized squares within the area model, then skip-count to find the total number of squares. Units move beyond square centimeters and inches to include square feet and square meters.



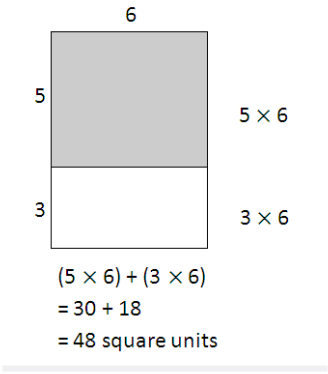
Array Area Model

- In Lesson 8, students recognize that side lengths play an important part in determining the area of a rectangle. They understand that multiplying the number of square units in a row by the number of rows produces the same result as skip-counting the squares within the array. Given the area and one side length, students realize that they can use multiplication with an unknown factor or division to find the unknown side length.

## Topic C: Arithmetic Properties Using Area Models

- Topic C begins with a concrete study of arithmetic properties. Students cut apart rectangular grids and rearrange the parts to create new rectangles with the same area. They apply tiling and multiplication skills to determine all whole number possibilities for the side lengths of rectangles given their areas

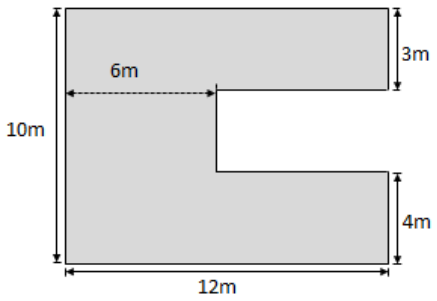
- In Lesson 10, students apply knowledge of the distributive property from Modules 1 and 3 to find area. In previous modules, they learned to decompose an array of discrete items into two parts, determine the number of units in each part, and then find the sum of the parts. Now students connect this experience to using the distributive property to determine the missing side length of an array that may, for example, have an area of 72 square units. They might decompose the area into an 8 by 5 rectangle and an 8 by 4 rectangle. The sum of the side lengths, 5 + 4, gives them the length of the missing side.




- In Lesson 11, students use a given number of square units to determine all possible whole number side lengths of rectangles with that area. They justify that they have found all possible solutions for each given area using the associative property. Areas of 24, 36, 48, and 72 are chosen to reinforce multiplication facts that are often more difficult. Students realize that different factors give the same product. For example, they find that 4 by 12, 6 by 8, 1 by 48, and 2 by 24 arrays all have an area of 48 square units. They use understanding of the commutative property to recognize that area models can be rotated similar to the arrays in Modules 1 and 3.

## Topic D: Applications of Area Using Side Lengths of Figures

- Topic D requires students to synthesize and apply their knowledge of area. Lesson 12 begins the topic with an emphasis on real world applications by providing students with opportunities to apply their understanding of area to solving word problems. Students may practice *unknown product*, *group size unknown*, and *number of groups unknown* types of problems. (See examples of problem types in the chart on page 19 of the Geometric Measurement progression.) The word problems provide a stepping stone for the real world project based application with composite shapes and the area floor plan in Topic D.




- Lessons 13 and 14 introduce students to finding the area of composite shapes. They learn to find the missing measurements using the given side lengths and then make decisions about whether to decompose the tiled region into smaller rectangles and add the areas, or complete the composite figures and then subtract.

- In Lessons 15 and 16, students apply their work with composite shapes from the previous two lessons to a real word application to determine areas of rooms in a given floor plan.