Kenmore-Town of Tonawanda UFSD

We educate, prepare, and inspire all students to achieve their highest potential

Grade 3 Module 4
Parent Handbook

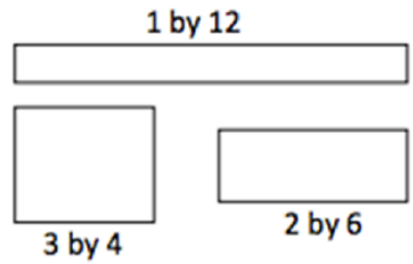
The materials contained within this packet have been taken from the Great Minds curriculum Eureka Math.

Eureka Math Tips for Parents

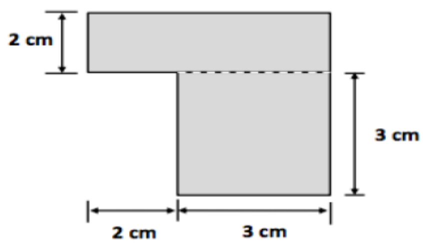
Grade 3
Module 4

Multiplication and Area

In this 20-day module, students explore area as an attribute of two-dimensional figures and relate it to their prior work with multiplication. Students will build understanding that a 2x6, 1x12, and 3x4 rectangle each have the same area, and will learn how to calculate the area of a floor plan of their own design.



Students will learn, through concrete experience, that each of these rectangles has the same area, and relate their learning to multiplication.



Toward the end of this module, students will learn how to calculate the area of an irregular shape like this one by looking at the area of the rectangles within the shape.

What Came Before this Module: We worked extensively on relating multiplication and division, learned several different strategies for those operations, and practiced our math facts.

What Comes After this Module: We will begin to formalize our understanding of fractions as equal parts of a whole, using the number line as well as area models to support our learning.

Key Terms and Ideas

New Terms:

Area - the amount of two-dimensional space inside a bounded region

Area model - a model for multiplication that relates rectangular arrays to area

Square unit - a unit of area (could be square centimeters, inches, feet, or meters)

Tile (as a verb) - to cover a region without gaps or overlaps

Unit Square - whatever the length unit (e.g. centimeters, inches), a unit square is a 1 unit by 1 unit square of that length

Whole Number - an integer number without fractions

Terms to Review:

Array

Commutative Property

Distribute

Length

Multiplication

+ How you can help at home:

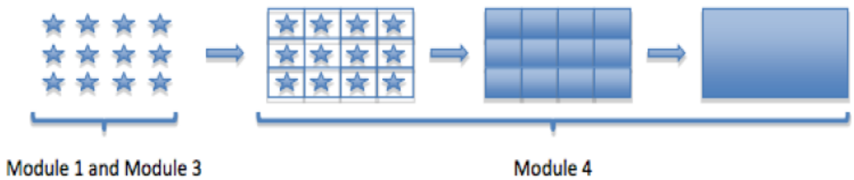
⇒ Continue to review multiplication and division math facts with your student

⇒ Practice drawing simple two-dimensional rectangular shapes and calculating the area using multiplication

Key Common Core Standards:

- **Geometric Measurement: understand concepts of area and relate area to multiplication and to addition**
    - 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
    - Measure areas by counting unit squares
    - Relate area to the operations of multiplication and addition

This flow chart shows how 3rd grade students start working with arrays in earlier Modules of *A Story of Units*. In Module 4, they become comfortable with the connection between rectangular arrays to the area of a two-dimensional region.



Spotlight on Math Models:

Area Models

You will often see this mathematical representation in *A Story of Units.*

A Story of Units has several key mathematical "models" that will be used throughout a student's elementary years.

Students began in earlier grades to build arrays, showing multiplication and division as a series of rows and columns. In 3rd grade, they begin the transition to understanding these types of problems in the context of an area model.

As students move through the grades, the area model will be a powerful tool that can take them all the way into algebra and beyond. One of the goals in *A Story of Units* is to first give students concrete experiences with mathematical concepts, and then build slowly toward more abstract representations of those concepts. The area model is a tool that helps students to make that important leap.

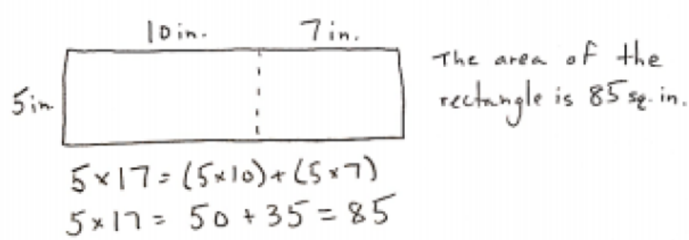
Module 4 Sample Problem

(Example taken from Lesson 13)

Anil finds the area of a 5-inch by 17-inch rectangle by breaking it into 2 smaller rectangles. Show one way that he could have solved the problem.

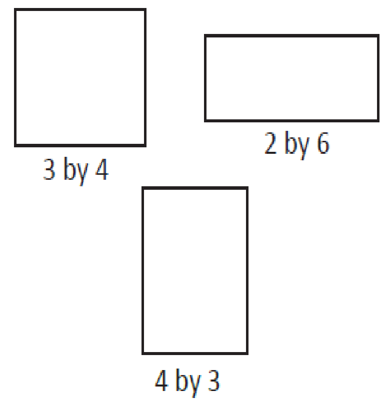
What is the area of the rectangle?

Possible Solution:

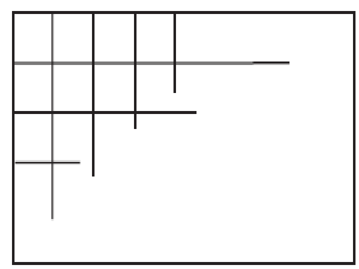


OVERVIEW

In this 20-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 addends represented by the rows or columns (**2.G.2**, **2.OA.4**).

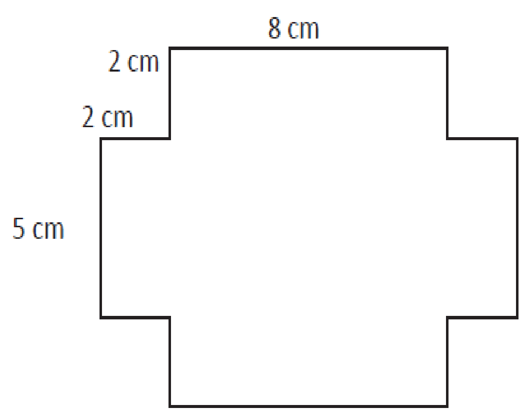


In Topic A, students begin to conceptualize area as the amount of two-dimensional surface that is contained within a plane figure. They come to understand that the space can be tiled with unit squares without gaps or overlaps (**3.MD.5**). Students decompose paper strips into square inches and square centimeters, which they use to tile 3 by 4, 4 by 3, and 2 by 6 rectangles. They compare rectangles tiled with like units and notice different side lengths but equal areas. 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 (**3.MD.6**).



In Topic B, 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 formula for a rectangle, which is formally introduced in Grade 4 (**3.MD.7a**).

In Topic C, 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. They apply tiling and multiplication skills to determine all whole number possibilities for the side lengths of rectangles given their areas (**3.MD.7b**).

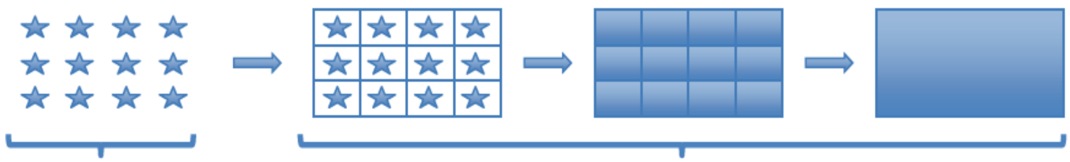


Topic D creates an opportunity for students to solve problems involving area (**3.MD.7b**). Students decompose or compose composite regions, such as the one shown to the right—into non-overlapping rectangles, find the area of each region, and then add or subtract to determine the total area of the original shape. This leads students to find the areas of rooms in a given floor plan (**3.MD.7d**).

Terminology

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)



- 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, i.e., a number without fractions)

Familiar Terms and Symbols[1]

- Array (a set of numbers or objects that follow a specific pattern: a matrix)
- Commutative property (e.g., rotate a rectangular array 90 degrees to demonstrate that factors in a multiplication sentence can switch places)
- Distribute (e.g., $2 \times (3 + 4) = 2 \times 3 + 2 \times 4$)
- Geometric shape (a two-dimensional object with a specific outline or form)
- Length (the straight-line distance between two points)
- Multiplication (e.g., $5 \times 3 = 15$)
- Rows and columns (e.g., in reference to rectangular arrays)

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)

[1] These are terms and symbols students have seen previously.

Grade 3 Module 4 Topic A

Foundations for Understanding Area

Focus Standards:

3.MD.5 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 *n* unit squares is said to have an area of *n* square units.

Instructional Days Recommended: 4

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-size 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 using centimeter and inch tiles to find area. 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 relating total area with multiplication of side lengths.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 1

Objective: Understand area as an attribute of plane figures.

Homework Key

1. a. 12

   b. 6

   c. 4; because $12 \div 3 = 4$

2. a. 12

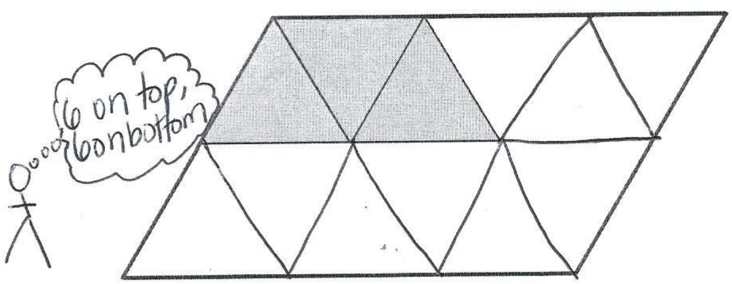
   b. 12; because 12 squares fit inside of it

3. A, because it has an area of 18 square units

Homework Sample

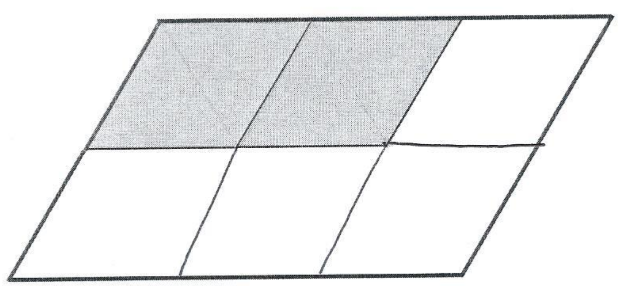
1. Magnus covers the same shape with triangles, rhombuses, and trapezoids.

   a. How many triangles will it take to cover the shape?



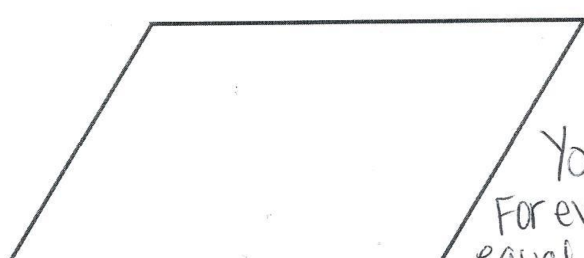
12 triangles

   b. How many rhombuses will it take to cover the shape?



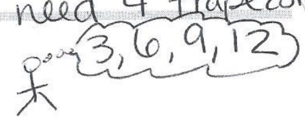
6 rhombuses

   c. Magnus notices that 3 triangles from Part (a) cover 1 trapezoid. How many trapezoids will you need to cover the shape below? Explain your answer.



4 trapezoids

You will need 4 trapezoids. For every 1 trapezoid that would equal 3 triangles and there were 12 triangles to cover the whole shape so you need 4 trapezoids.



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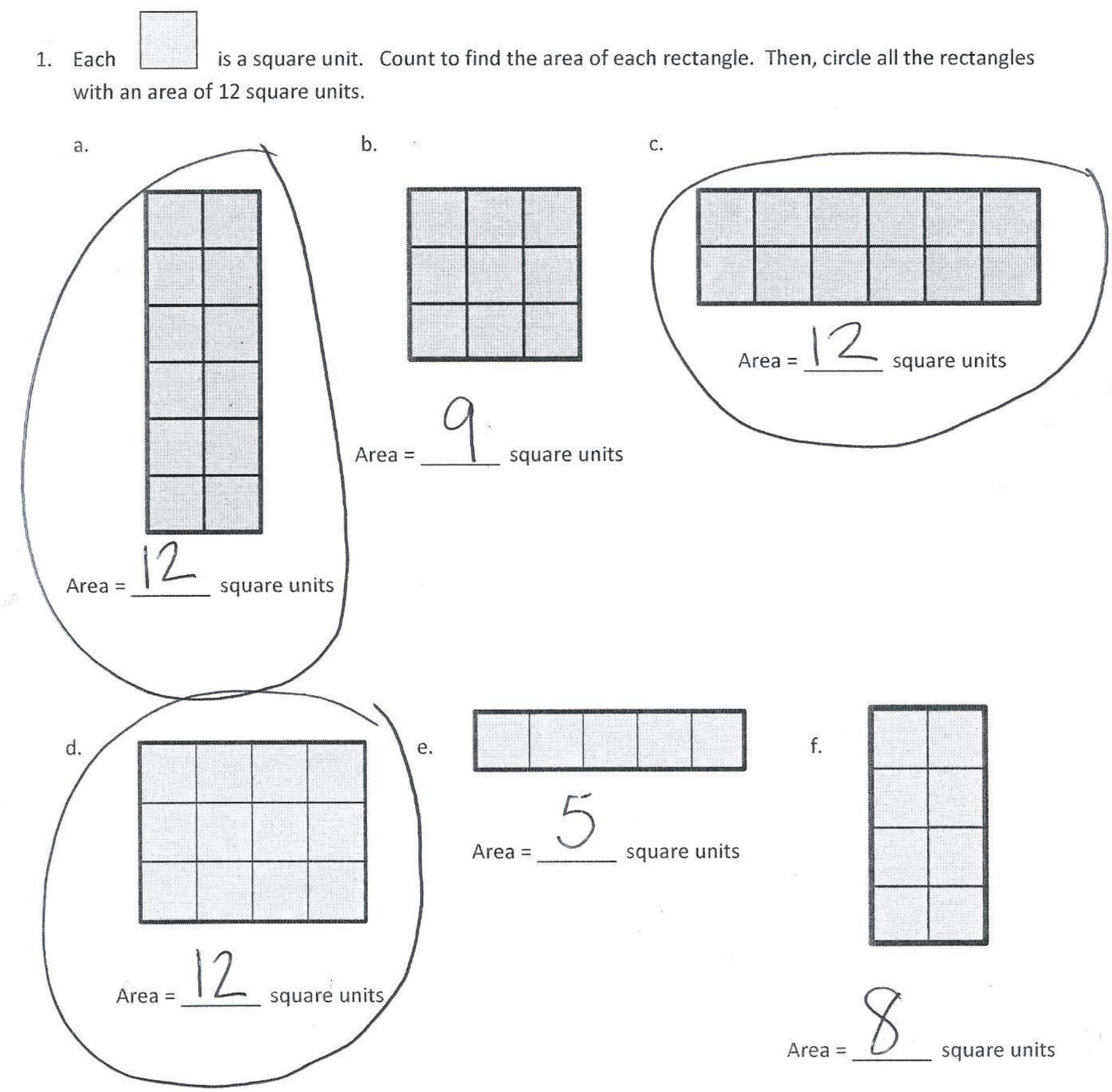
Lesson 2

Objective: Decompose and recompose shapes to compare areas

Homework Key

1. a. 12; rectangle circled
   b. 9
   c. 12; rectangle circled
   d. 12; rectangle circled
   e. 5
   f. 8
2. No, rectangle with 8 square units; rectangle with 6 square units
3. 16 square units; a different rectangle with an area of 16 square units drawn

Homework Samples


1. Each ☐ is a square unit. Count to find the area of each rectangle. Then, circle all the rectangles with an area of 12 square units.

a. Area = 12 square units

b. Area = 9 square units

c. Area = 12 square units

d. Area = 12 square units

e. Area = 5 square units

f. Area = 8 square units

Lesson 3

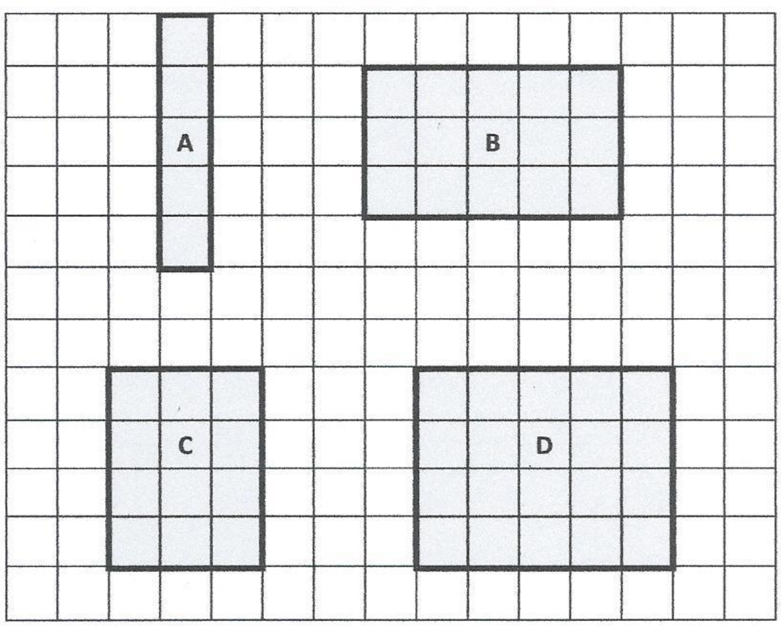
Objective: Model tiling with centimeter and inch unit squares as a strategy to measure area.

Homework Key

1. a. 5
   b. 15 square units
   c. 12 square units
   c. 20 square units
2. a. 9 square units
   b. 24 square units
   c. 8 square units
   d. 18 square units
3. a. 10; rectangle with an area of 10 square units drawn
   b. 9 square units; rectangle with an area of 9 square units drawn
   c. 12 square units; rectangle with an area of 12 square units drawn

Homework Sample

1. Each ☐ is 1 square unit. What is the area of each of the following rectangles?



A: 5 square units

B: 15 square units

C: 12 Square units

D: 20 Square units

Lesson 4

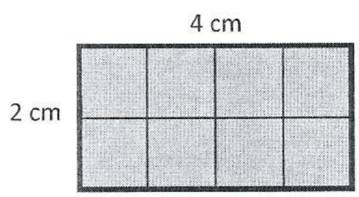
Objective: Relate side lengths with the number of tiles on a side.

Homework Key

1. 8 sq cm
2. 4 cm by 5 cm labeled; 20 sq cm
3. 2 in by 7 in labeled; 14 sq in
4. Both are correct; explanations will vary.
5. 2 in; 4 in; 8 in; explanations will vary.

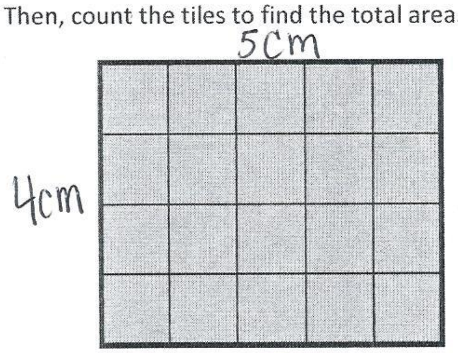
Homework Samples

1. Ella placed square centimeter tiles on the rectangle below, and then labeled the side lengths. What is the area of her rectangle?



Total area: 8 square centimeters

2. Kyle uses square centimeter tiles to find the side lengths of the rectangle below. Label each side length. Then, count the tiles to find the total area.



Total area: 20 square centimeters

Grade 3 Module 4 Topic B

Concepts of Area Measurement

Focus Standards:

3.MD.5 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 *n* unit squares is said to have an area of *n* square units.

3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

3.MD.7 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.

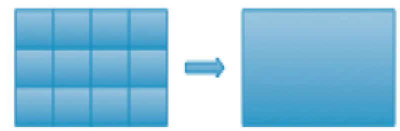
d. Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.

Instructional Days Recommended: 4

In previous lessons, students tiled given rectangles. In Lesson 5, students build rectangles using unit square tiles to make arrays when provided with specific criteria. For example, students may be told that there are 24 tiles inside the rectangle and 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. They 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 receive 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.



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.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 5

Objective: Form rectangles by tiling with unit squares to make arrays.

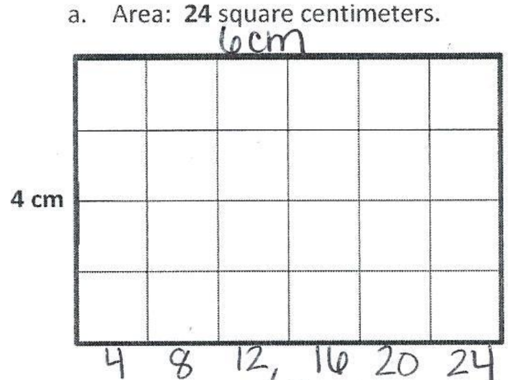
Homework Key

1. a. 6
   b. 4 cm; tiles drawn; 6, 4, 24
   c. 3 cm; tiles drawn; 5, 3, 15
   d. 5 cm; tiles drawn; 3, 5, 15
2. 9; answers will vary.
3. a. 9; answers will vary.
   b. Yes; answers will vary.
   c. Yes; explanations will vary.

Homework Sample

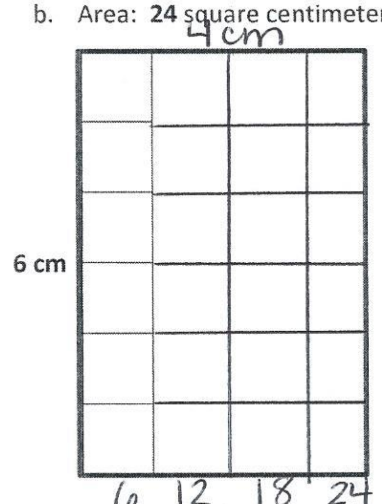
1. Use the centimeter side of a ruler to draw in the tiles, and then skip-count to find the unknown side length or area. Write a multiplication sentence for each tiled rectangle.

a. Area: **24** square centimeters.



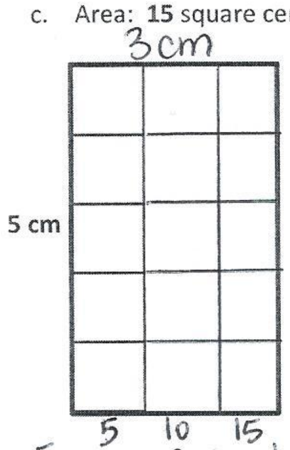
4 × 6 = 24

b. Area: **24** square centimeters.



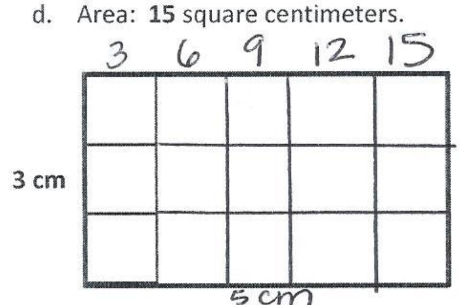
6 × 4 = 24

c. Area: **15** square centimeters.



5 × 3 = 15

d. Area: **15** square centimeters.



3 × 5 = 15

Lesson 6

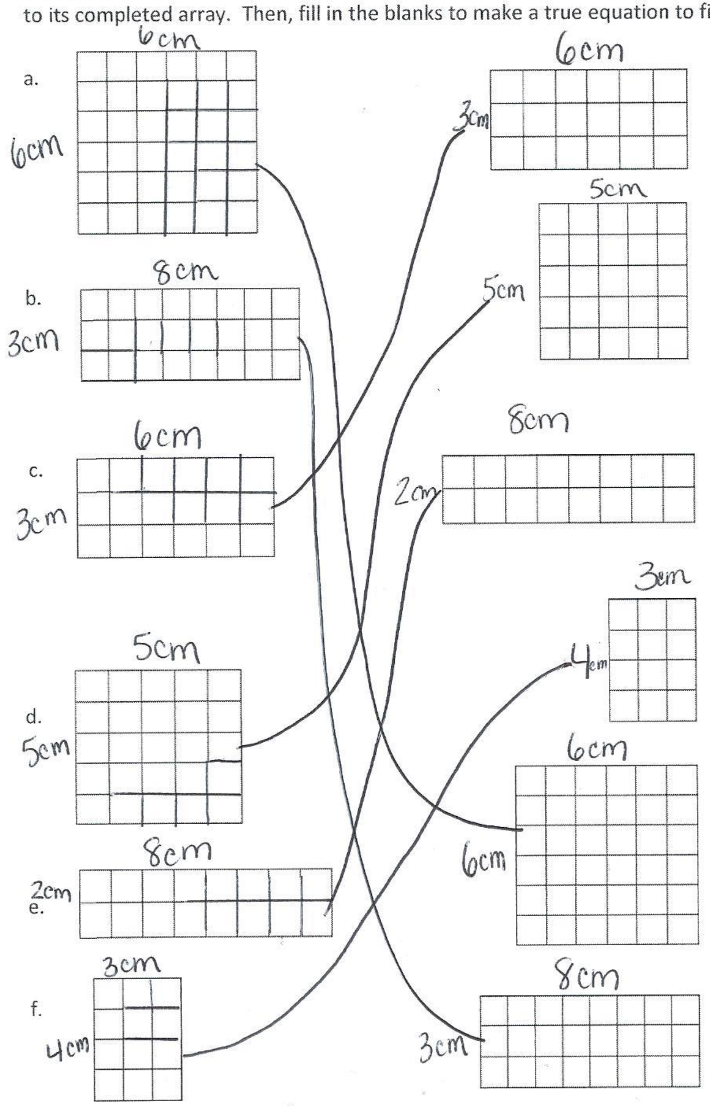
Objective: Draw rows and columns to determine the area of a rectangle given an incomplete array.

Homework Key

1. a. Lines drawn to find 6 cm by 6 cm; matched to fifth completed array; 6 × 6 = 36
   b. Lines drawn to find 3 cm by 8 cm; matched to sixth completed array; 3 × 8 = 24
   c. Lines drawn to find 3 cm by 6 cm; matched to first completed array; 3 × 6 =18
   d. Lines drawn to find 5 cm by 5 cm; matched to second completed array; 5 × 5 = 25
   e. Lines drawn to find 2 cm by 8 cm; matched to third completed array; 2 × 8 = 16
   f. Lines drawn to find 4 cm by 3 cm; matched to fourth completed array; 4 × 3 = 12
2. Yes; explanations may vary.
3. 90
4. 36; explanations may vary.

Homework Sample

1. Each ☐ represents a 1 cm square. Draw to find the number of rows and columns in each array. Match it to its completed array. Then, fill in the blanks to make a true equation to find each array's area.



3 × 6 = 18 sq cm

5 × 5 = 25 sq cm

2 × 8 = 16 sq cm

4 × 3 = 12 sq cm

6 × 6 = 36 sq cm

3 × 8 = 24 sq cm

Lesson 7

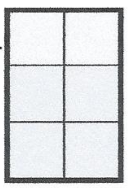
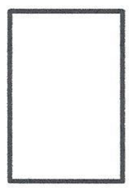
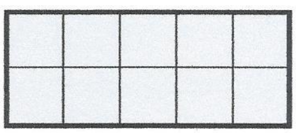
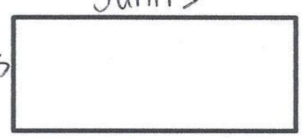
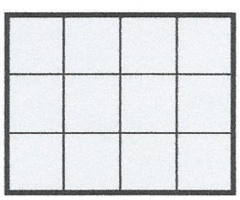
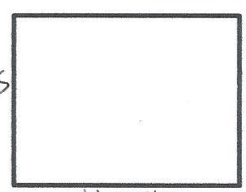
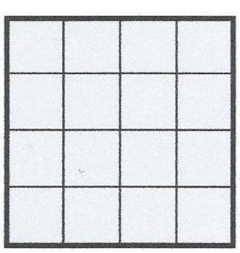
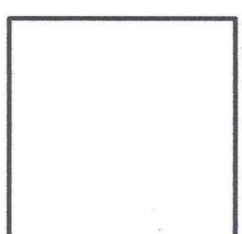
Objective: Interpret area models to form rectangular arrays.

Homework Key

1. a. 6; answer provided; 3 × 2 = 6
   b. 10; side lengths labeled; 2 × 5 = 10
   c. 12; side lengths labeled; 3 × 4 = 12
   d. 16; side lengths labeled; 4 × 4 = 16
2. a. 7 by 4 rectangle drawn on grid; 28 square units
   b. Side lengths labeled; 7 × 4 = 28
3. Gregory, square inches are larger than square centimeters

Homework Sample

1. Find the area of each rectangular array. Label the side lengths of the matching area model, and write a multiplication equation for each area model.

Rectangular Arrays	Area Models
a.  6 square units	3 units  2 units 3 units × 2 units = 6 square units
b.  10 square units	5 units 2 units  2 units × 5 units = 10 square units
c.  12 square units	3 units  4 units 3 units × 4 units = 12 square units
d.  16 square units	 4 units 4 units × 4 units = 16 square units 4 units

Lesson 8

Objective: Find the area of a rectangle through multiplication of the side lengths.

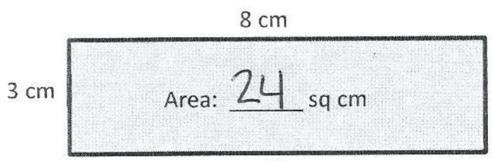
Homework Key

1. a. 24; 3 × 8 = 24
   b. 48; 6 × 8 = 48
   c. 16; 4 × 4 = 16
   d. 28; 4 × 7 = 28
2. a. 8; 3 × 8 = 24; 24 ÷ 3 = 8
   b. 4; 4 × 9 = 36; 36 ÷ 9 = 4
3. Answers will vary.
4. 36 sq cm; explanations will vary.
5. 3 in; explanations will vary.

Homework Samples

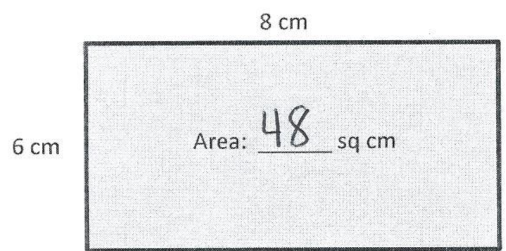
1. Write a multiplication equation to find the area of each rectangle.

a.



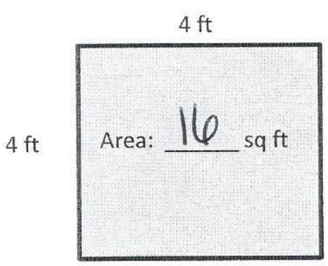
3 × 8 = 24

b.



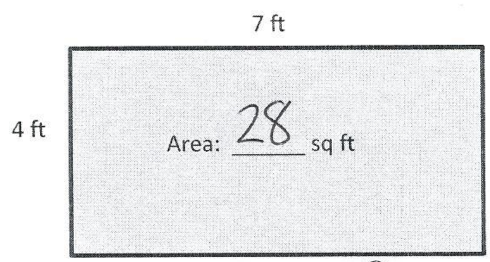
6 × 8 = 48

c.



4 × 4 = 16

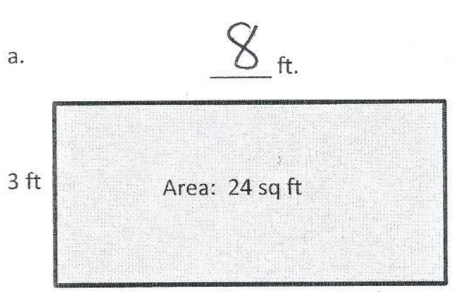
d.



4 × 7 = 28

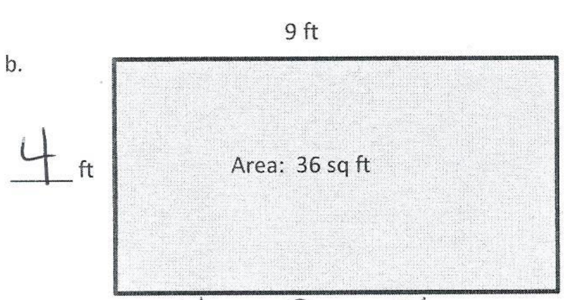
2. Write a multiplication equation and a division equation to find the unknown side length for each rectangle.

a.



3 × 8 = 24
24 ÷ 3 = 8

b.



4 × 9 = 36
36 ÷ 9 = 4

Grade 3 Module 4 Topic C

Arithmetic Properties Using Area Models

Focus Standards:

3.MD.5 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 *n* unit squares is said to have an area of *n* square units.

3.MD.7 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 $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.

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.

Instructional Days Recommended: 3

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. Lesson 9 lays the foundation for the work to come in Lessons 10 and 11.

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 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. Students engage in MP.3 as 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.

Lesson 9

Objective: Analyze different rectangles and reason about their area.

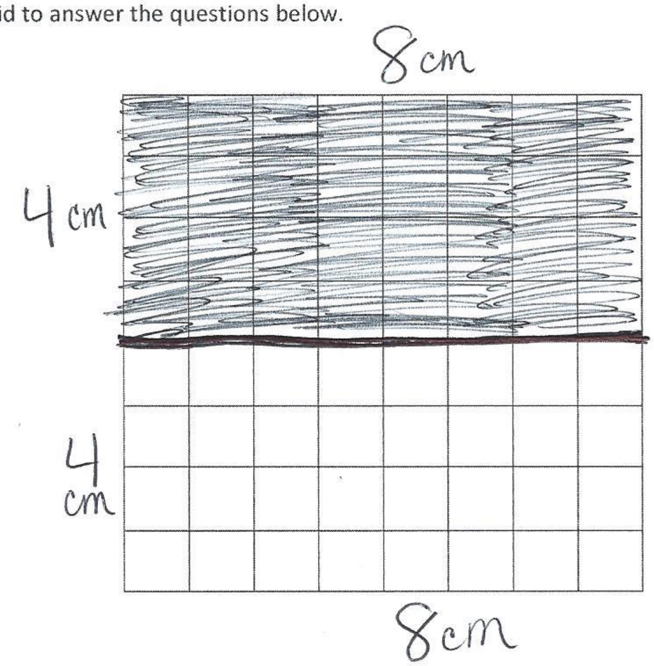
Homework Key

1. a. Line drawn to show two 4 by 8 rectangles or two 8 by 4 rectangles; 1 rectangle shaded
   b. 4, 8; 4, 8 or 8, 4; 8, 4
   c. 4 × 8 + 4 × 8 = 64 sq units
      or 8 × 4 + 8 × 4 = 64 sq units

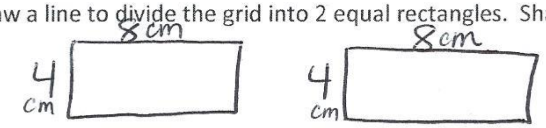
2. a. Rectangle drawn; 4, 16
   b. 64 sq units
   c. Yes; answers will vary.

Homework Sample

1. Use the grid to answer the questions below.



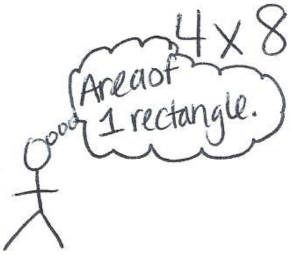
a. Draw a line to divide the grid into 2 equal rectangles. Shade in 1 of the rectangles that you created.



b. Label the side lengths of each rectangle.

c. Write an equation to show the total area of the 2 rectangles.

4 x 8 = 32 square cm



(4 x 8) + (4 x 8) = 64 square cm
32 + 32 = 64 square cm

Lesson 10

Objective: Apply the distributive property as a strategy to find the total area of a larger rectangle by adding two products.

Homework Key

1. a. 40, 32; 72

   b. 10; 10; 10; 50; 60

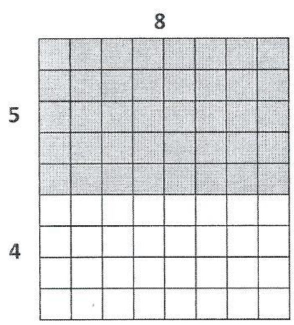
   c. 10, 3; 10; 10; 70, 21; 91

   d. 9, 10, 2; 10, 2; 10, 2; 90, 18; 108
2. Answers will vary.
3. Rectangle shaded; 64 sq units; answers will vary.

Homework Sample

1. Label the side lengths of the shaded and unshaded rectangles. Then, find the total area of the large rectangle by adding the areas of the 2 smaller rectangles.

a.



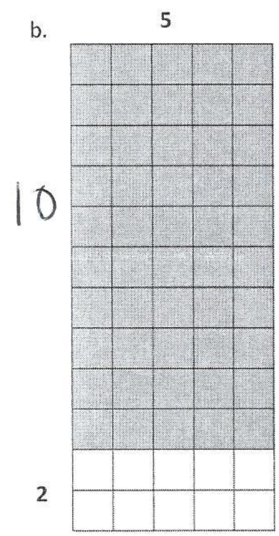
$9 \times 8 = (5 + 4) \times 8$

$= (5 \times 8) + (4 \times 8)$

= 40 + 32

= 72 square units

b.



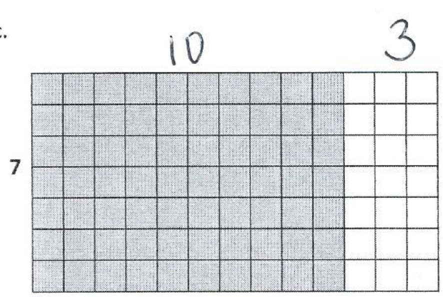
$12 \times 5 =$ (10 + 2) × 5

= (10 × 5) + (2 × 5)

= 50 + 10

= 60 square units

c.



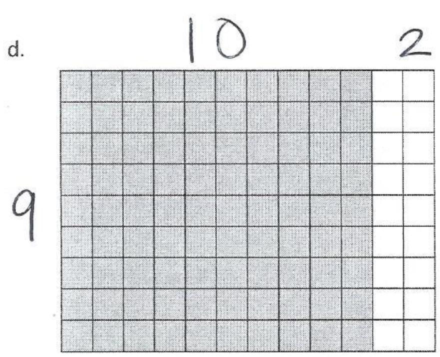
$7 \times 13 = 7 \times$ (10 + 3)

= (7 × 10) + (7 × 3)

= 70 + 21

= 91 square units

d.



$9 \times 12 = 9 \times$ (10 + 2)

= (9 × 10) + (9 × 2)

= 90 + 18

= 108 square units

Lesson 11

Objective: Demonstrate the possible whole number side lengths of rectangles with areas of 24, 36, 48, or 72 square units using the associative property.

Homework Key

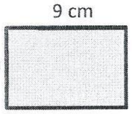
1. a. 9, 36
   b. 36
   c. 18; 2, 18; 36
   d. 12, 3; 12, 3; 36
   e. 6, 6; 6, 6; 36
2. Yes, answers will vary.
3. a. 48 sq cm
   b. 8, 6; 48; yes; answers will vary.
   c. Answers will vary.

Homework Samples

1. The rectangles below have the same area. Move the parentheses to find the missing side lengths. Then, solve.

9 cm

4 cm



a. Area: 4 × 9 = 36 sq cm

36 cm

1 cm

b. Area: 1 × 36 = 36 sq cm

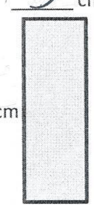
18 cm

2 cm

c. Area: **4 × 9** = (2 × 2) × 9
= 2 × 2 × 9
= 2 × 18
= 36 sq cm

3 cm

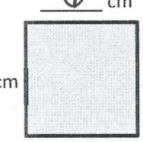
12 cm



d. Area: **4 × 9** = 4 × (3 × 3)
= 4 × 3 × 3
= 12 × 3
= 36 sq cm

6 cm

6 cm



e. Area: **12 × 3** = (6 × 2) × 3
= 6 × 2 × 3
= 6 × 6
= 36 sq cm

2. Does Problem 1 show all the possible whole number side lengths for a rectangle with an area of 36 square centimeters? How do you know?

I know that I found all the possible side length combinations with an area of 36 sq cm. I know that 5, 7, 8, and 10 can't be side lengths of 36 because there aren't any whole numbers I can multiply them by to equal 36.

Grade 3 Module 4 Topic D

Applications of Area Using Side Lengths of Figures

Focus Standards:

3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

3.MD.7 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.

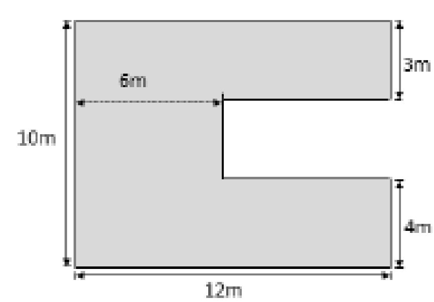
b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.

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 $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.

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.

Instructional Days Recommended: 5

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 of area to 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 (3.MD.7c) 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, determining areas of rooms in a given floor plan.

**The sample homework responses contained in this manual are intended to provide insight into the skills expected of students and instructional strategies used in Eureka Math.*

Lesson 12

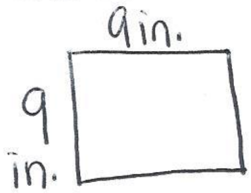
Objective: Solve word problems involving area.

Homework Key

1. 81 sq in
2. Yes; answers will vary.
3. 3 ft
4. 2 rectangles drawn; answers will vary.
5. 5 by 2 rectangle drawn; explanations will vary.

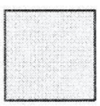
Homework Samples

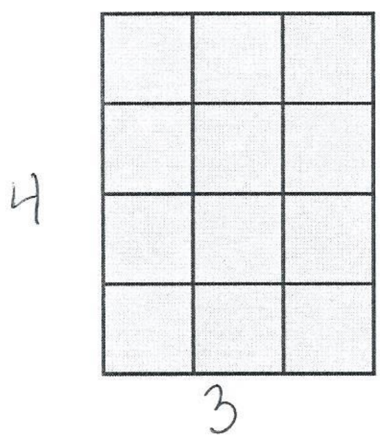
1. A square calendar has sides that are 9 inches long. What is the calendar's area?



9 in x 9 in = 81 Square inches

The calendar is 81 square inches.

2. Each  is 1 square unit. Sienna uses the same square units to draw a 6 × 2 rectangle and says that it has the same area as the rectangle below. Is she correct? Explain why or why not.



4x3=12 sq. units
6x2=12

Yes, they both have an area of 12 Square units.

Lesson 13-14

Objective: Find areas by decomposing into rectangles or completing composite figures to form rectangles.

Homework Key (13)

1. 15, 9, 24; 24, 20, 44; 12, 32, 44; 15, 25, 40
2. 56, 9, 47
3. a. 4, 3
   b. 9, 8, 72
   c. 4, 3, 12
   d. 60 sq cm

Homework Sample

1. Each of the following figures is made up of 2 rectangles. Find the total area of each figure.

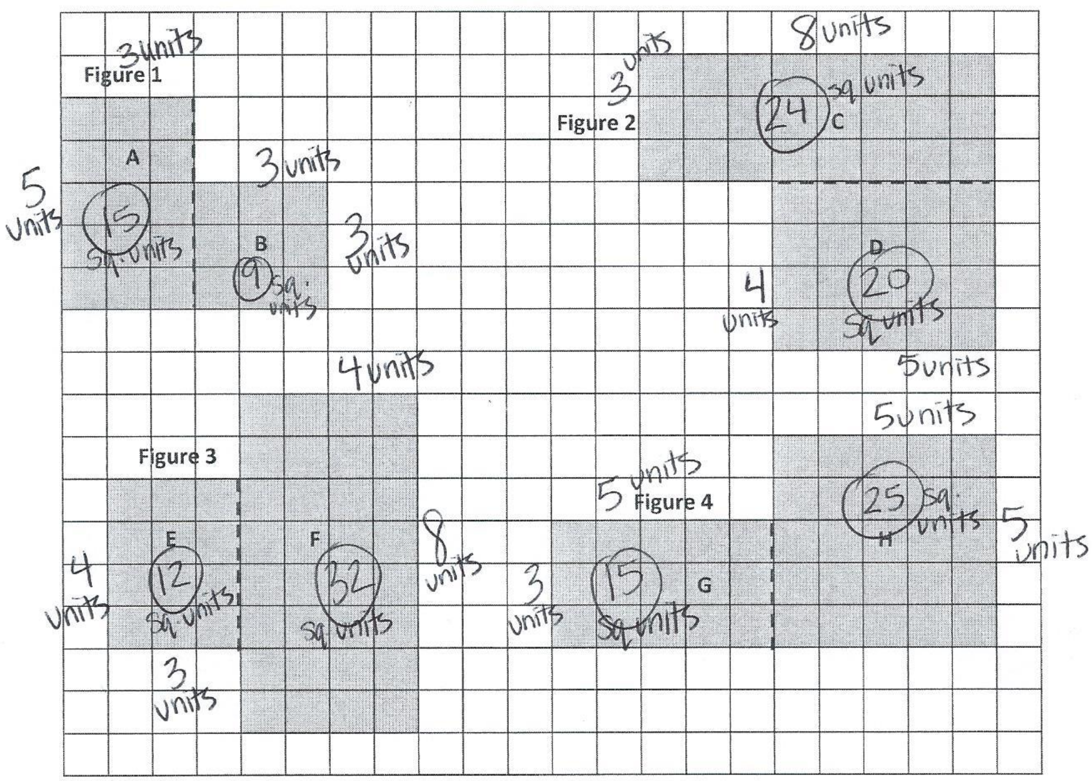


Figure 1: Area of A + Area of B: 15 + 9 = 24 sq units

Figure 2: Area of C + Area of D: 24 + 20 = 44 sq units

Figure 3: Area of E + Area of F: 12 + 32 = 44 sq units

Figure 4: Area of G + Area of H: 15 + 25 = 40 sq units

Lesson 14

Homework Key

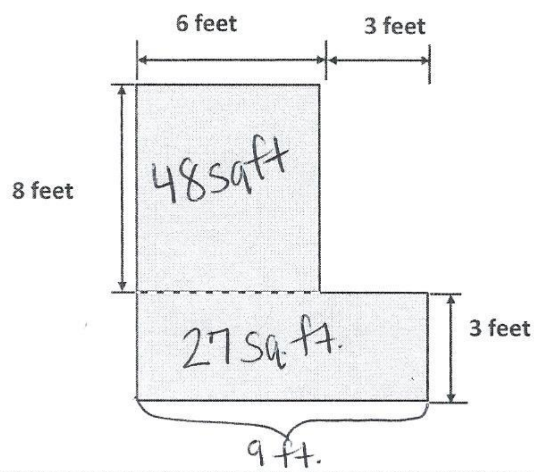
1. a. 75 sq ft
   b. 58 sq in

2. a. 3 ft, 5 ft
   b. 55 sq ft

Homework Sample

1. Find the area of each of the following figures. All figures are made up of rectangles.

a.

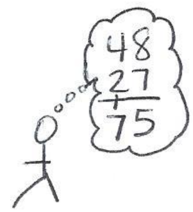


$(6 \times 8) + (9 \times 3)$

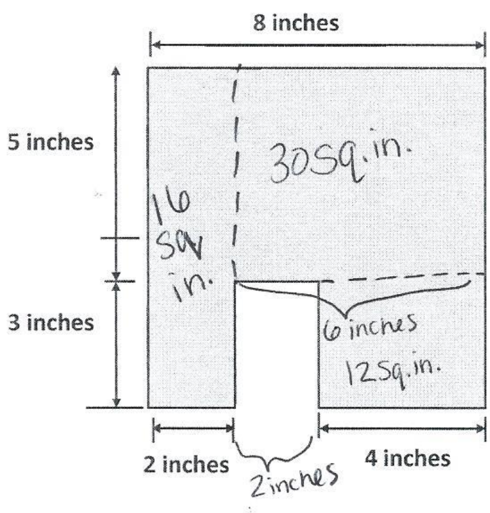
48 sq ft. + 27 sq. ft

75 sq. ft.

The area is 75 square feet.



b.



$(2 \times 8) + (6 \times 5) + (4 \times 3)$

16 + 30 + 12

46 + 12

58 square inches

The area is 58 square inches.

Lesson 15-16

Objective: Apply knowledge of area to determine areas of rooms in a given floor plan.

Homework Key (15)

1. 4, 6; bathroom; 24 sq cm
2. 5, 9; kitchen; 45 sq cm
3. 8, 7; bedroom; 56 sq cm
4. 12, 1; hallway; 12 sq cm
5. 7, 9; living room; 63 sq cm
6. 2, 17; porch; 34 sq cm

Homework Sample

Use a ruler to measure the side lengths of each numbered room in centimeters. Then, find the area. Use the measurements below to match, and label the rooms with the correct areas.

Kitchen: 45 square centimeters

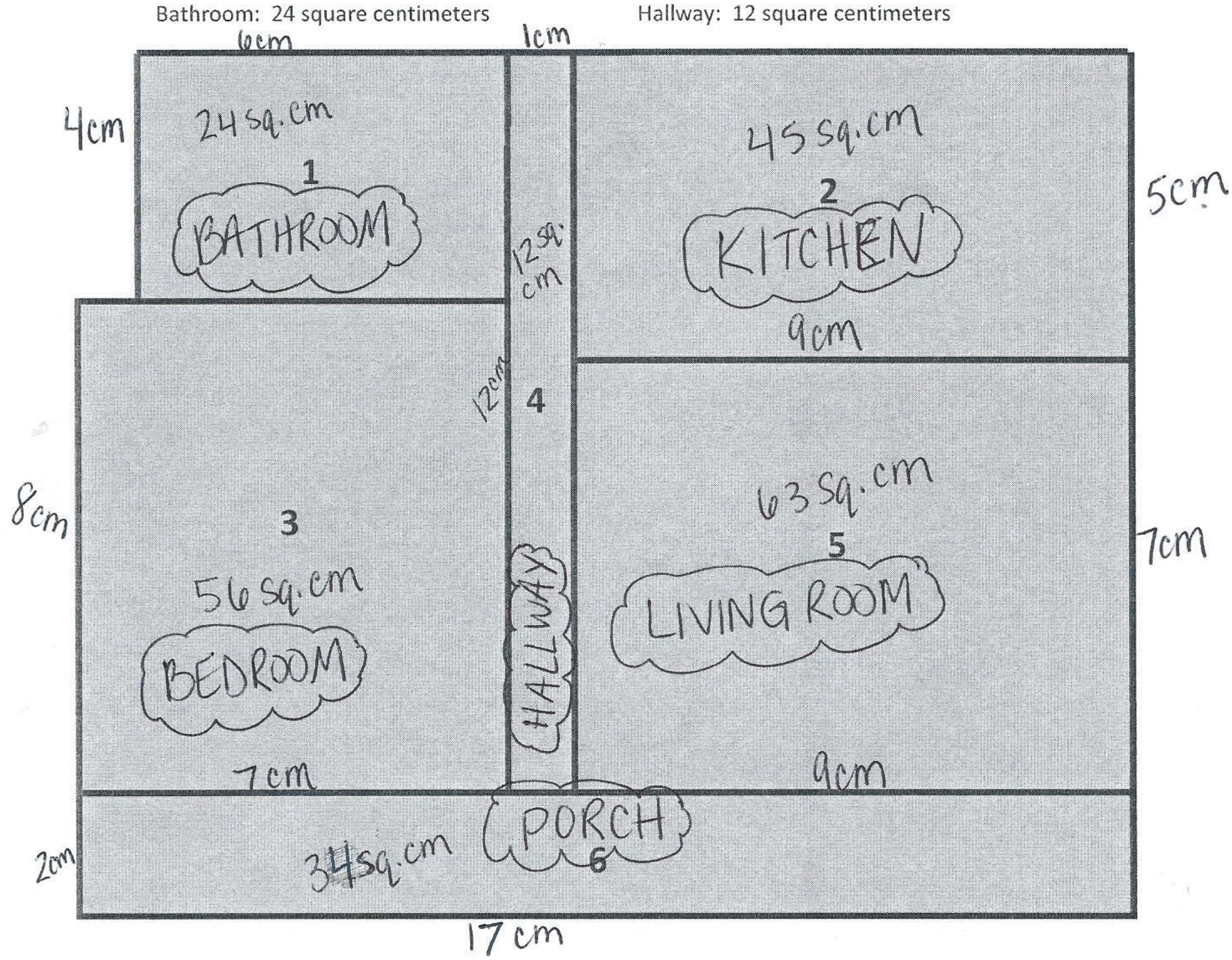
Porch: 34 square centimeters

Bathroom: 24 square centimeters

Living Room: 63 square centimeters

Bedroom: 56 square centimeters

Hallway: 12 square centimeters



Lesson16

Homework Key

Drawings will vary.

Homework Sample

Jeremy plans and designs his own dream playground on grid paper. His new playground will cover a total area of 72 square units. The chart shows how much space he gives for each piece of equipment, or area. Use the information in the chart to draw and label a possible way Jeremy can plan his playground.

Basketball court	10 square units
Jungle gym	9 square units
Slide	6 square units
Soccer area	24 square units