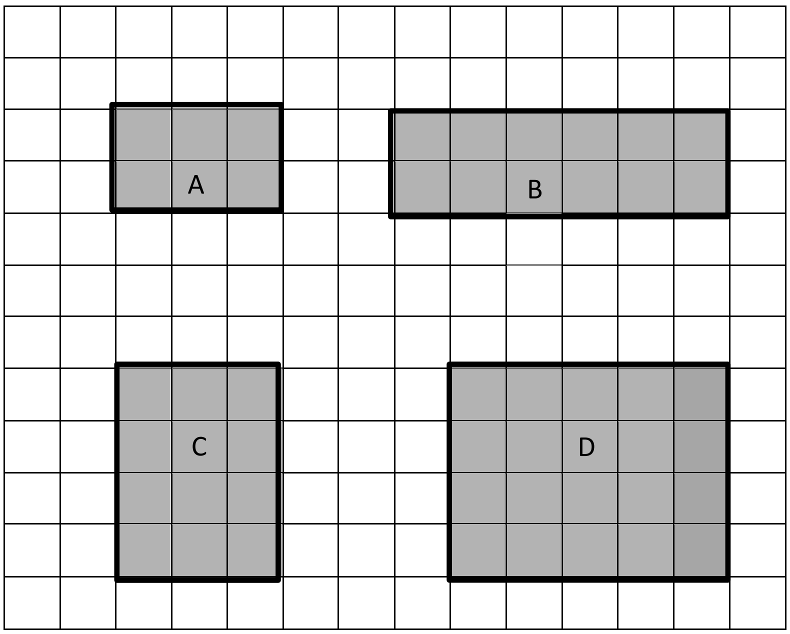
Name ____ Date ______________________

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



A: __________________ square units

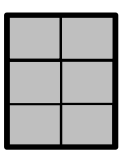
B: ____________________________

C: ____________________________

D: ____________________________

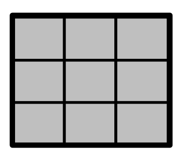
2. Each ☐ is 1 square unit. What is the area of each of the following rectangles?

a.



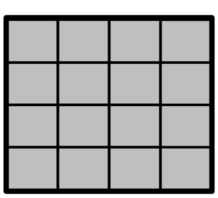
____

b.



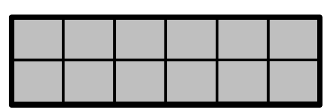
____

c.



____

d.



____

3.

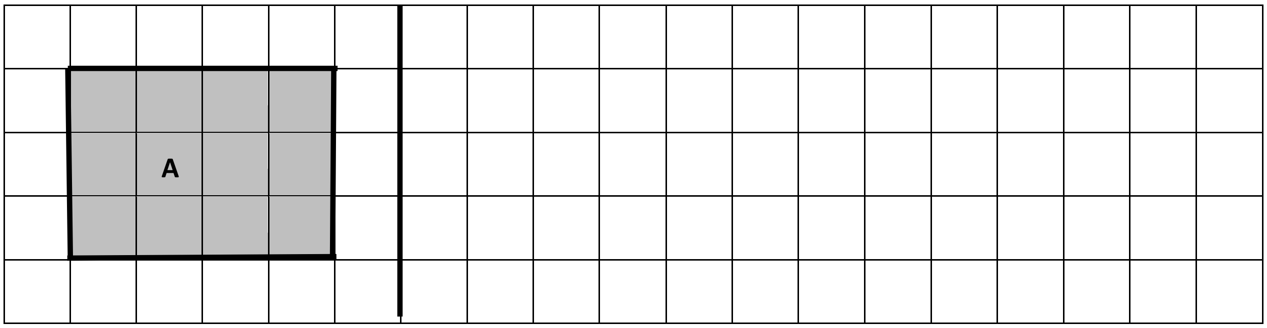
a. How would the rectangles in Problem 1 be different if they were composed of square inches?

b. Select one rectangle from Problem 1 and recreate it on square-inch and square-centimeter grid paper.

4. Use a separate piece of square-centimeter grid paper. Draw four different rectangles that each has an area of 8 square centimeters.

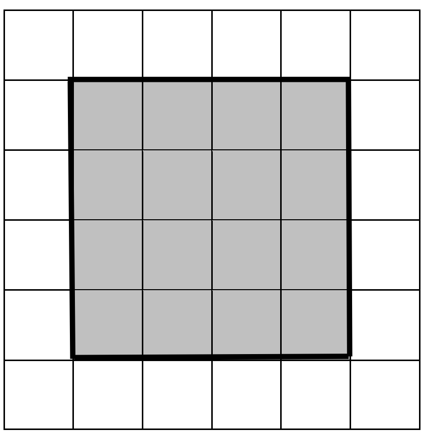
Name ______________________________ Date ________________

1. Each ☐ is 1 square unit. Write the area of Rectangle A. Then draw another rectangle with the same area in the space provided.



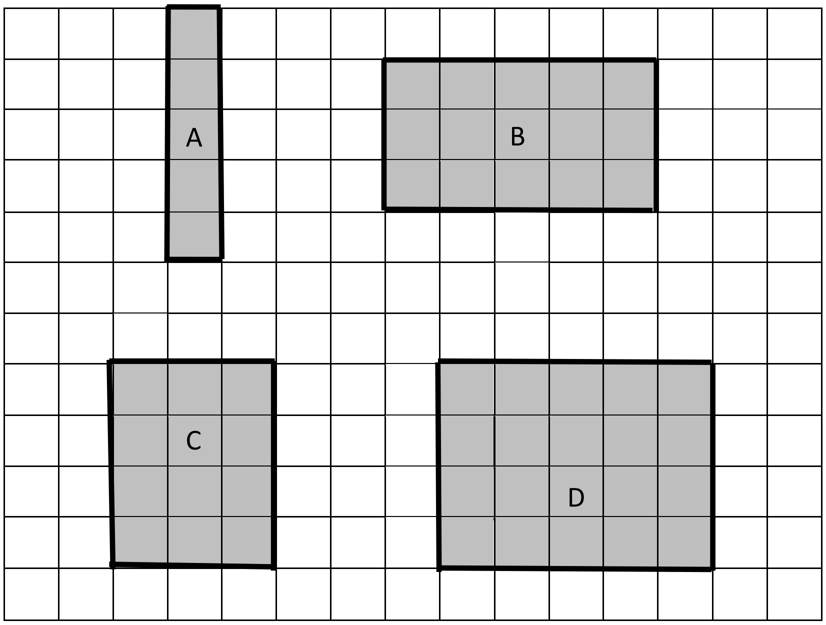
Area = ______________________________

2. Each ☐ is 1 square unit. Does this rectangle have the same area as Rectangle A? Explain.



Name ________________________________ Date ____________________

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



A: ________ square units

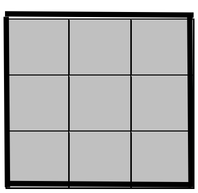
B: ____________________

C: ____________________

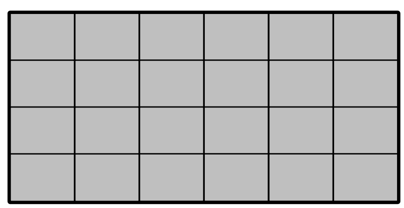
D: ____________________

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

a.

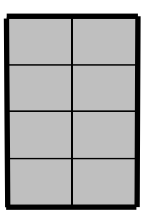


b.

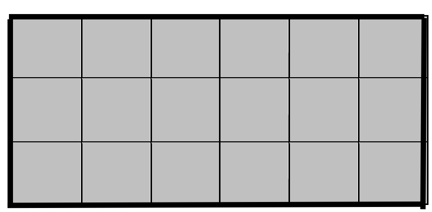


____________________________________ ____________________________________

c.

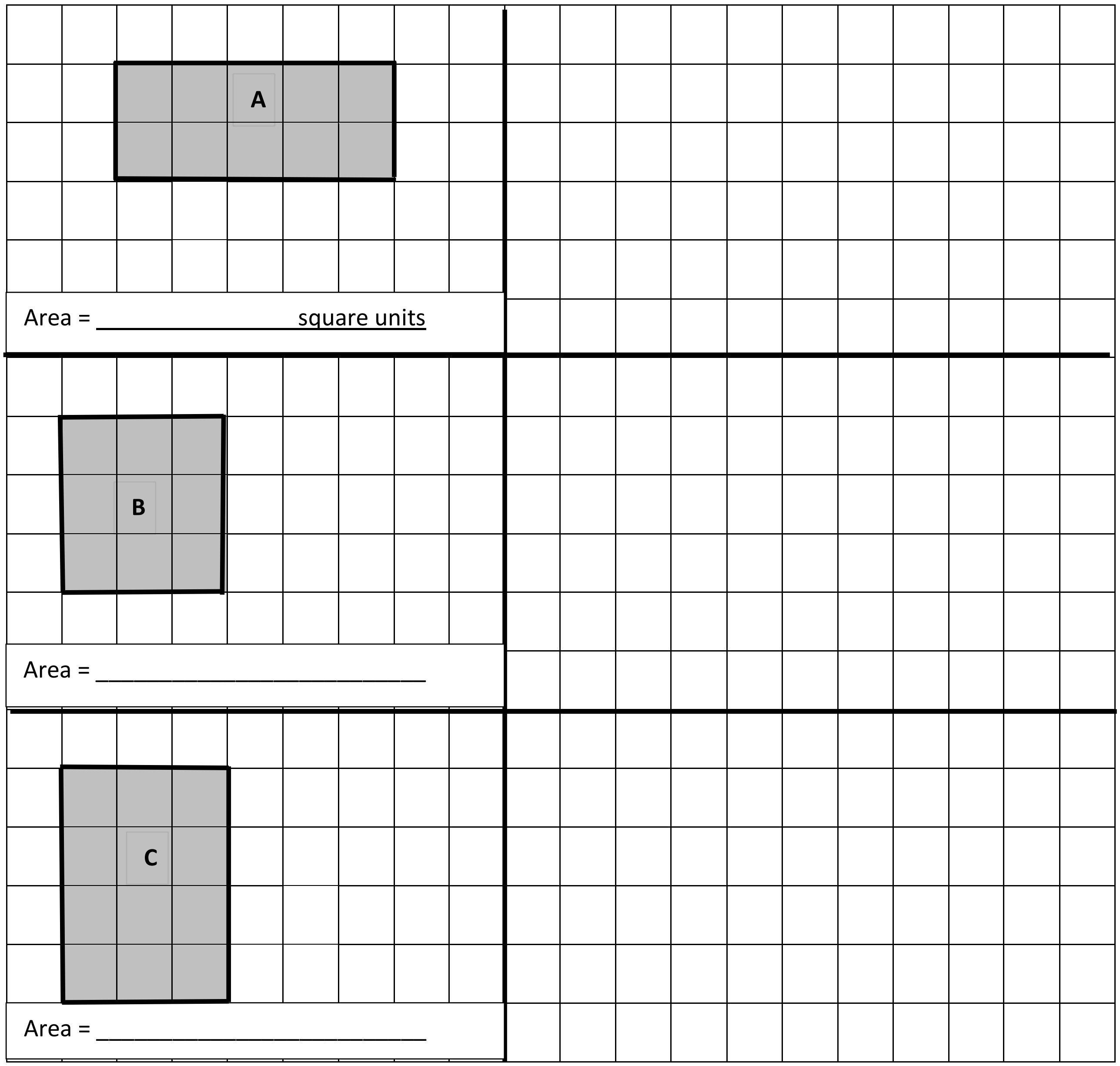


d.



____________________________________ ____________________________________

3. Each $\square$ is 1 square unit. Write the area of each rectangle. Then draw another rectangle with the same area in the space provided.

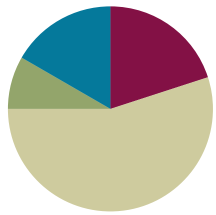


Lesson 4

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

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(5 minutes)
Concept Development	(33 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Products in an Array **3.OA.3** (3 minutes)
- Count the Square Units **3.MD.6** (6 minutes)

Group Counting (3 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Sixes to 60
- Sevens to 70
- Eights to 80
- Nines to 90

Products in an Array (3 minutes)

Materials: (S) Personal white boards

Note: This fluency anticipates relating multiplication with area in G3–M4–Topic B.

T: (Project an array with 5 rows of 3 stars.) How many rows of stars do you see?

S: 5 rows.

T: How many stars are in each row?

S: 3 stars.

T: On your boards, write two multiplication sentences that can be used to find the total number of stars.

S: (Write 5 × 3 = 15 and 3 × 5 = 15.)

Continue with the following possible sequence: 4 by 6, 7 by 3, 8 by 5, and 9 by 7.

Count the Square Units (6 minutes)

Note: This fluency reviews comparing the area of different shapes.

T: (Project an 8 × 1 tiled array.) How many square units are in the rectangle?

S: 8 units.

T: (Write *8 units* next to the rectangle. Project a 4 × 2 tiled array.) How many square units are in the rectangle?

S: 8 units.

T: (Write *8 units* next to the rectangle. Project a 2 × 4 tiled array.) How many square units are in the rectangle?

S: 8 units.

T: (Write *8 units* next to the rectangle. Project a 1 × 8 tiled array.) How many square units are in the rectangle?

S: 8 units.

T: (Write *8 units* next to the rectangle.) Do the four rectangles look the same?

S: No.

T: What do the rectangles have in common?

S: They are each made up of 8 square units.

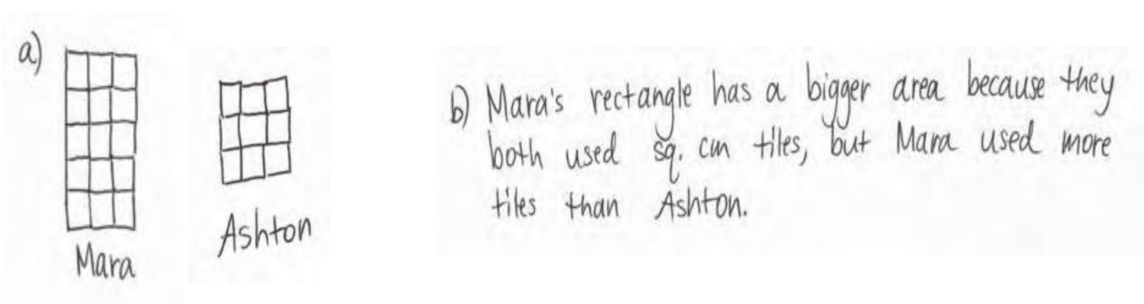
Continue with the following possible sequence: 12 × 1, 1 × 12, 6 × 2, 3 × 4, 2 × 6, and 4 × 3.

Application Problem (5 minutes)

Mara uses 15 square-centimeter tiles to make a rectangle. Ashton uses 9 square-centimeter tiles to make a rectangle.

a. Draw what Mara's and Ashton's rectangles might look like.

b. Whose rectangle has a bigger area? How do you know?



Note: This problem reviews G3–M4–Lesson 2, specifically tiling with square units. Invite students to share and compare their drawings for Mara's and Ashton's rectangles.

Concept Development (33 minutes)

Materials: (S) 15 square-inch and square-centimeter tiles, ruler, personal white board

Pass out 15 square-inch tiles to each student.

T: These tiles are square…?

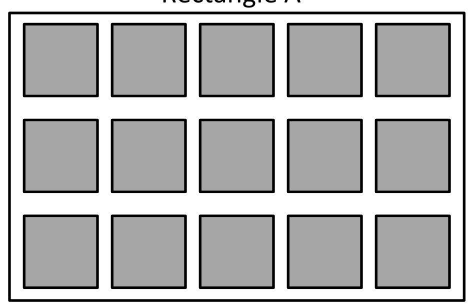
S: Inches!

T: Use the tiles to make a 3 by 5 array. (Allow students time to make array.) Push the tiles together to form a rectangle with no gaps or overlaps. What is the area of your rectangle?

S: 15 square inches.

T: I see your squares are nicely arranged to form a rectangle. What about these? (Project Rectangles A and B shown at right.) I used 15 square-inch tiles to make both of these rectangles. Talk to a partner. Is the area of both rectangles 15 square inches?

Rectangle A

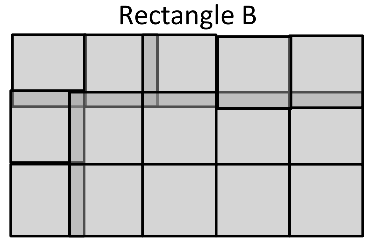


S: Yes, the number of tiles is the same. → No, A's area is bigger than 15 square inches because there are gaps between the tiles. B's area is smaller because some of the tiles are on top of each other.

T: Why is it important to avoid gaps or overlaps when we measure area?

S: If there are gaps or overlaps the amount of space the rectangle takes up changes. → The square unit would be wrong since some area is taken away if there are overlaps or some is added if there are gaps.

Rectangle B



T: Use your ruler to measure across the top of your rectangle in inches. What is the length of this side?

S: 5 inches.

T: How many tiles are on this side?

S: 5 tiles.

MP.8

T: Use your ruler to measure the shorter side of the rectangle in inches. What is the length of this side?

S: 3 inches.

T: How many tiles are on this side?

S: 3 tiles!

T: What is the relationship between the number of tiles on a side and the side length of the rectangle?

S: They're the same!

T: What do you notice about the lengths of the opposite sides of the rectangles?

S: They are equal!

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Scaffold student contrast of *length* and *area*. Consider placing a long string along the side of the rectangle, or have students trace the side with a finger to better illustrate *length*. In contrast, have students shade in the *area* before writing 15 square inches.

T: Trace the rectangle on your board, then remove the tiles and label the side lengths. Now write the area inside the rectangle. What are the units for the side lengths?

S: Inches.

T: What are the units for the area?

S: Square inches.

T: Talk to a partner, why are the units different for side lengths and area?

S: The unit for side lengths is inches because we used a ruler to measure the length of the side in inches. For area, the unit is square inches because we counted the number of square-inch tiles that we used to make the rectangle.

T: Inches are used to measure lengths, like the side lengths, and square inches are used to measure the amount of flat space a figure takes up, which is the area.

Direct students to exchange square-inch tiles for square-centimeter tiles.

T: These tiles are square…

S: Centimeters!

T: Use them to make a rectangle with side lengths of 5 centimeters and 4 centimeters. (Write 5 cm and 4 cm.) Tell your partner how many tiles you'll count to make each side.

S: I'll make one side with 5 tiles and the other with 4 tiles. → Actually we'll count 5 tiles each for two sides of the rectangle, and 4 tiles each for the other two sides. Opposite sides are the same, remember?

T: Make your rectangle on top of your personal board. Label the side lengths.

S: (Make rectangle and label side lengths 5 cm and 4 cm.)

T: How many fives did you make? Why?

S: 4 fives, because the other side length is 4.

T: What is the total of 4 fives?

S: 20.

T: Skip-count your fives to find the total area of the rectangle. (Pause.) What is the total area?

S: 20 square centimeters!

T: What is the relationship between the side lengths and area?

S: If you multiply 5 times 4 then you get 20!

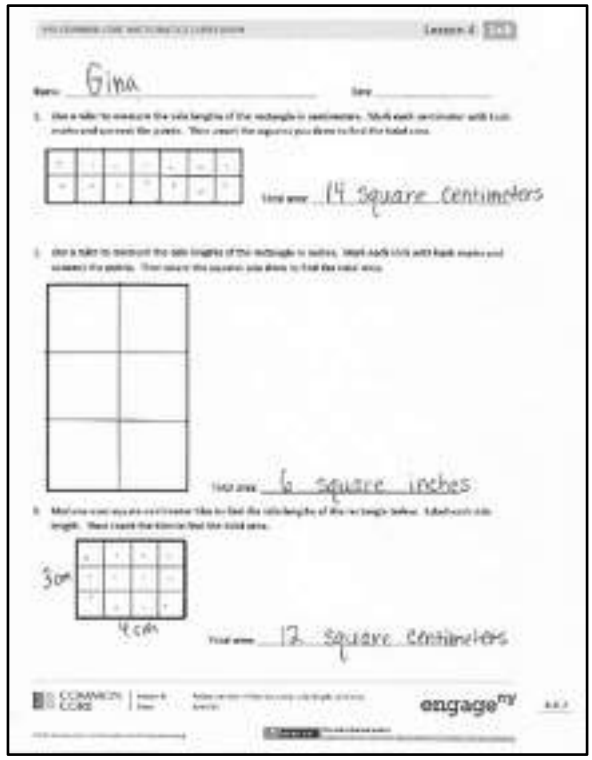
NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Alternatively, build the rectangle in 4 rows of 5 centimeter tiles. As students place each row, encourage careful and meaningful counting. Students may benefit from counting each tile in the row so as not to add extra tiles. Then, recapture by counting by fives, "5, 10, 15, 20."

If time allows, repeat the process with a rectangle with side lengths of 3 centimeters and 6 centimeters. As students are ready, tell them the area and let them build a rectangle and name the side lengths.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.


Gina

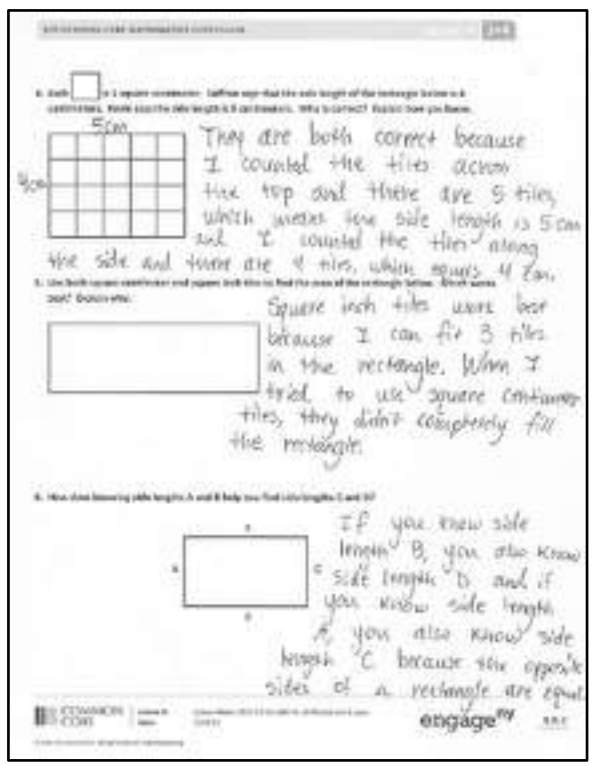
14 square centimeters

6 square inches

3cm

4cm

12 square centimeters


5cm

4cm

They are both correct because I counted the tiles across the top and there are 5 tiles, which makes the side length is 5 cm and I counted the tiles along the side and there are 4 tiles, which equals 4 cm.

Square inch tiles work best because I can fit 3 tiles in the rectangle. When I tried to use square centimeter tiles, they didn't completely fill the rectangle.

If you knew side length B, you also know side length D and if you know side length A, you also know side length C because the opposite sides of a rectangle are equal.

Student Debrief (10 minutes)

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

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- Tell a partner how you could use square-centimeter tiles to check your work in Problem 1.
- Compare the areas of the rectangles in Problems 1 and 2. Which rectangle has a bigger area? How do you know?
- What are the side lengths of the shape in Problem 3? Are all the sides the same? How do you know? What shape is this?
- What is the area of the rectangle in Problem 4? Explain how you found the area to a partner.
- How many centimeter tiles fit in the rectangle in Problem 5? Is that the area of the rectangle in square centimeters? Why or why not?
- In Problem 6, if the side length of A is 4 units, would 3 units make sense for the side length of B? Why or why not? What *would* make sense?

Exit Ticket (3 minutes)

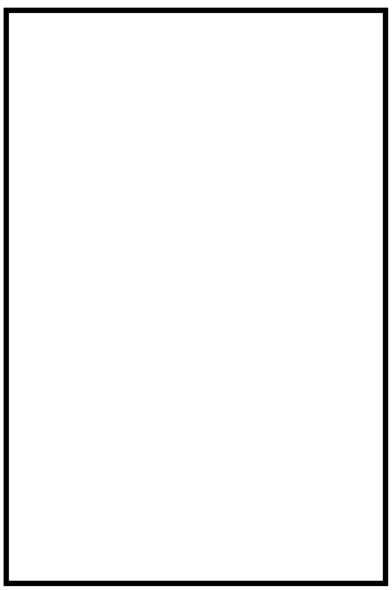
After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the student.

Name ______________________________ Date ________________

1. Use a ruler to measure the side lengths of the rectangle in centimeters. Mark each centimeter with a point and connect the points to show the square units. Then count the squares you drew to find the total area.

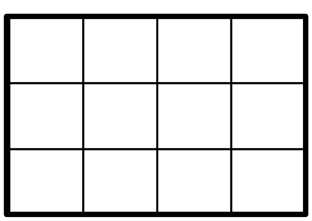
Total area: ______________________________

2. Use a ruler to measure the side lengths of the rectangle in inches. Mark each inch with a point and connect the points to show the square units. Then count the squares you drew to find the total area.

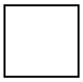


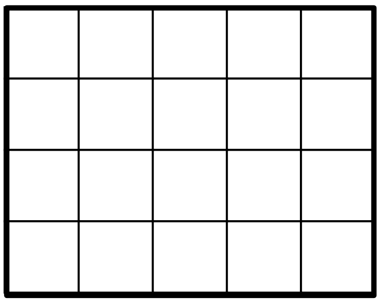
Total area: ______________________________

3. Mariana 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.



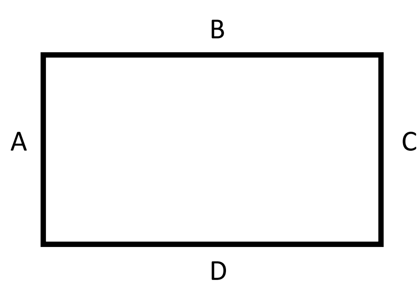
Total area: ______________________________

4. Each  is 1 square centimeter. Saffron says that the side length of the rectangle below is 4 centimeters. Kevin says the side length is 5 centimeters. Who is correct? Explain how you know.



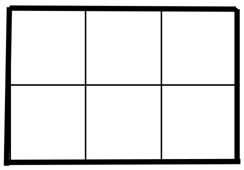
5. Use both square-centimeter and square-inch tiles to find the area of the rectangle below. Which works best? Explain why.

6. How does knowing side lengths A and B help you find side lengths C and D on the rectangle below?

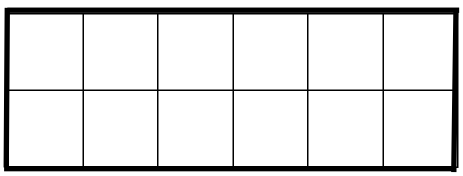


Name ______________________________ Date ________________

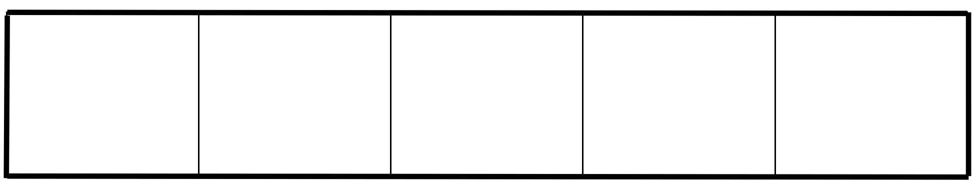
Label the side lengths of each rectangle. Then match the rectangle to its total area.



12 sq cm



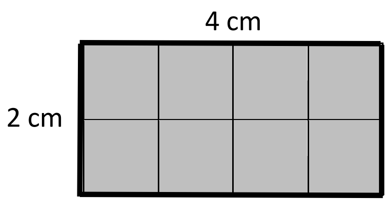
5 sq in



6 sq cm

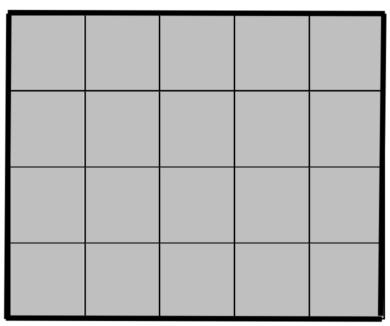
Name ____ Date ____________________

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



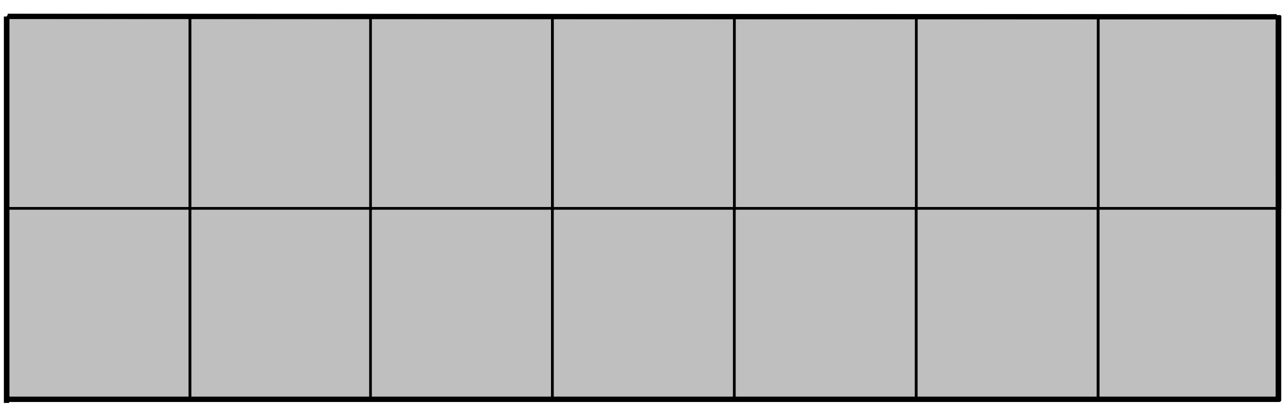
Total area: _______________________

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.



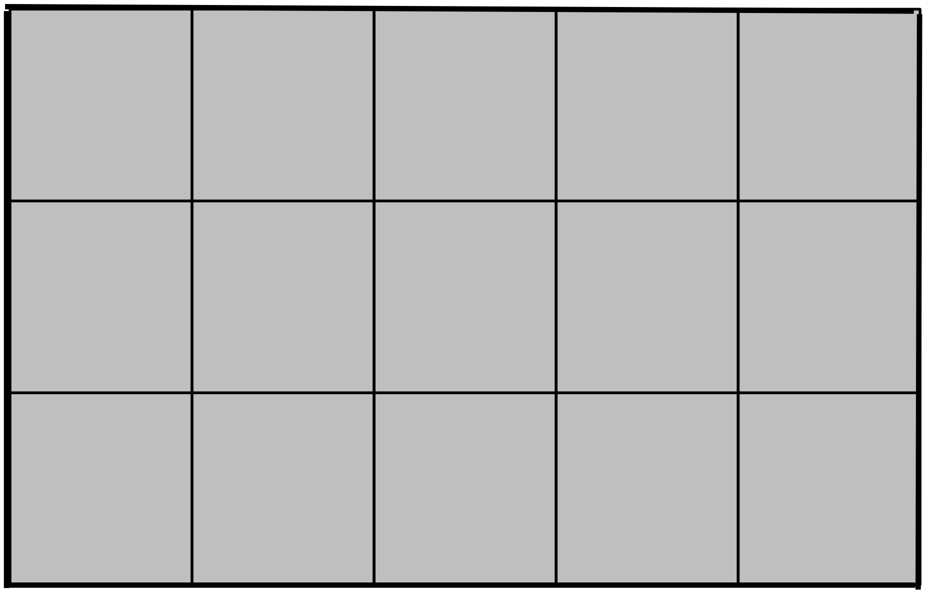
Total area: _______________________

3. Maura uses square-inch tiles to find the side lengths of the rectangle below. Label each side length. Then find the total area.



Total area: _______________________

4. Each square unit below is 1 square inch. Claire says that the side length of the rectangle below is 3 inches. Tyler says the side length is 5 inches. Who is correct? Explain how you know.



5. Label the unknown side lengths for the rectangle below, then find the area. Explain how you used the lengths provided to find the unknown lengths and area.

Topic B

Concepts of Area Measurement

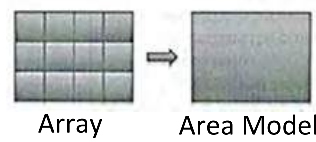
3.MD.5, 3.MD.6, 3.MD.7

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:	4	
Coherence -Links from:	G2–M2	Addition and Subtraction of Length Units
	G3–M1	Properties of Multiplication and Division and Solving Problems with Units of 2–5 and 10
	G3–M3	Multiplication and Division with Units of 0, 1, 6–9, and Multiples of 10
-Links to:	G4–M3	Multi-Digit Multiplication and Division
	G4–M7	Exploring Multiplication

In previous lessons, students tiled given rectangles. 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.



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.

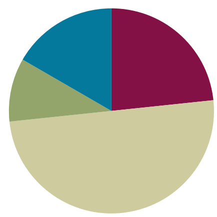
A Teaching Sequence Towards Mastery of Concepts of Area Measurement	
Objective 1:	**Form rectangles by tiling with unit squares to make arrays. (Lesson 5)**
Objective 2:	**Draw rows and columns to determine the area of a rectangle, given an incomplete array. (Lesson 6)**
Objective 3:	**Interpret area models to form rectangular arrays. (Lesson 7)**
Objective 4:	**Find the area of a rectangle through multiplication of the side lengths. (Lesson 8)**

Lesson 5

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

Suggested Lesson Structure

Fluency Practice	(14 minutes)
Application Problem	(6 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (14 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Products in an Array **3.OA.3** (3 minutes)
- Find the Common Products **3.OA.7** (8 minutes)

Group Counting (3 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Threes to 30
- Sixes to 60
- Sevens to 70
- Nines to 90

Products in an Array (3 minutes)

Materials: (S) Personal white boards

Note: This fluency anticipates relating multiplication with area in G3–M4–Topic B.

T: (Project an array with 4 rows of 3 stars.) How many rows of stars do you see?
S: 4 rows.
T: How many stars are in each row?
S: 3 stars.
T: On your boards, write two multiplication sentences that can be used to find the total number of stars.

S: (Write 4 × 3 = 12 and 3 × 4 = 12.)

Continue with the following possible sequence: 3 × 6, 7 × 5, 8 × 4, and 9 × 6.

Find the Common Products (8 minutes)

Materials: (S) Blank paper

Note: This fluency reviews multiplication patterns from G3–Module 3.

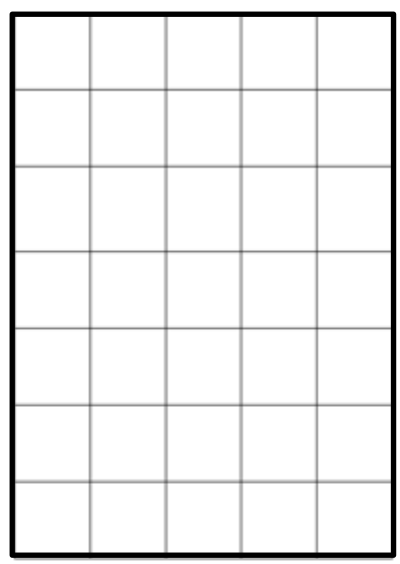
T: (List the multiples of 4 and 8.) Draw a line to match the numbers that appear in both columns.
S: (Match 8, 16, 24, 32, and 40.)
T: (Write 2 × 4 = 8, etc., next to each matched number on the left half of the paper.) Write the rest of the number sentences like I did.
T: (Write 8 = 1 × 8, etc., next to each matched number on the right half of the paper.) Write the rest of the equations like I did.
S: (Write equations.)
T: (Write 4 × 2 = ___ × 8.) Say the true equation.
S: 2 × 4 = 1 × 8.
T: (Write 2 × 4 = 1 × 8.) Write the remaining equal facts as equations.
S: (Write 4 × 4 = 2 × 8, 6 × 4 = 3 × 8, 8 × 4 = 4 × 8, 10 × 4 = 5 × 8.)
T: Discuss the patterns in your equations.
S: Each multiple of 8 is also a multiple of 4.

4	8 = 1x8
2x4 = 8	16 = 2x8
12	24 = 3x8
4x4 = 16	32 = 4x8
20	40 = 5x8
6x4 = 24	48
28	56
8x4 = 32	64
36	72
10x4 = 40	80

2 x4 = 1x8
4 x4 = 2x8
6 x4 = 3x8
8x4 = 4x8
10x4 = 5x8

Application Problem (6 minutes)

Candice uses square-centimeter tiles to find the side lengths of a rectangle as shown. She says the side lengths are 5 centimeters and 7 centimeters. Her partner, Luis uses a ruler to check Candice's work and says that the side lengths are 5 centimeters and 6 centimeters. Who is right? How do you know?



Candice is right because she used square centimeter tiles to find the side lengths and when I counted the tiles there were 5 on one side 7 on the other side. That means that the side lengths are 5 cm and 7 cm.

Note: This problem reviews G3–M4–Lesson 4, specifically the relationship between the number of tiles and the side length. Invite the students to discuss what Luis might have done wrong.

Concept Development (30 minutes)

Materials: (S) 15 square-inch tiles per student, personal white board, straight edge, blank paper

Concrete: Understand the relationship between side lengths and area.

(Draw or project the rectangle and side length shown to the right.)

2 in


T: Use square-inch tiles to show this rectangle as an array. What information do we know?

S: There are 2 rows. → A side length is 2 inches.

T: At your table, place tiles to make the known side.

S: (Make 1 column of 2 tiles.)

T: (Write below the diagram: *Area = 12 sq in*.) How many total tiles will we use to make our rectangle?

S: 12 tiles.

T: How many twos are in 12?

S: 6 twos.

T: Use your tiles to make 6 twos, then skip-count to check your work.

S: (Make 6 groups of 2 tiles and skip-count.) 2, 4, 6, 8, 10, 12.

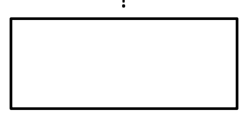
T: Push your twos together to make a rectangle. (After students do so, add a question mark to the diagram as shown at right.) What is the unknown side length?

S: Six. → Six tiles. → Six inches.

T: (Replace the question mark with *6 in* on the diagram.) Tell your partner about the relationship between the side lengths and the area. Write an equation to show your thinking. Be sure to include the units.

S: 2 inches × 6 inches = 12 square inches, so the area is the product of the side lengths. (Write *2 in × 6 in = 12 sq in*.)

?

2 in


Area = 12 sq in

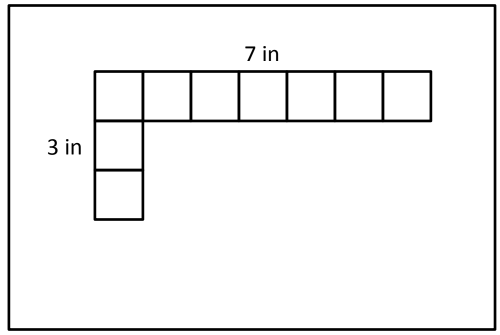
NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Simplify and clarify your script for English language learners and others. Rephrase, "What information do we know?" to "How many rows of inch squares? How do you know?"

Place the opaque 2 by 6 rectangle pictured above over a square grid. As an alternate way to check work, lift the rectangle to show the 12 squares covered.

Repeat the process using a rectangle with a known side length of 5 inches and an area of 15 square inches. Ask students to write an unknown factor problem, 5 × ___= 15, then use the tiles to solve.

Concrete/Pictorial: Form rectangles and determine area or side lengths by drawing to make arrays.



T: Lay tiles on your personal board to make a side 3 inches tall. Trace the outline of all 3 tiles. Then, draw horizontal lines to show where they connect.

S: (Draw image shown at right.)

T: Label the side length.

S: (Label *3 in*, as shown.)

T: Use your tiles to make another side, 7 inches long.

S: (Add tiles horizontally, using the corner tile as one of the 7.)

T: Trace the outline of the tiles. Draw vertical lines to show where they connect. Label the side length.

S: (Drawing shown to the right, label *7 in* as shown.)

T: How many threes will be in this rectangle?

S: 7 threes.

T: Talk to your partner. Which strategy might you use to find the total area of the rectangle?

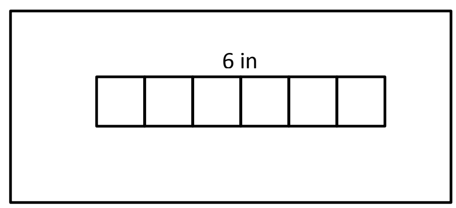
S: We can draw in the rest of the squares and count them all. → Or, just skip-count 7 threes. → It would be easier to just multiply 7 inches × 3 inches and get 21 square inches.

T: Many students suggested multiplying the side lengths to find the area. Let's check this strategy by drawing in the rest of squares. Use your straight edge to draw the rest of the tiles in the rectangle, then skip-count to find the total area.

S: (Follow the grid lines to make the other tiles, then skip-count.) 3, 6, 9, 12, 15, 18, 21.

T: Does 7 inches × 3 inches = 21 square inches accurately give the area of the rectangle?

S: Yes!



T: Clear your board and use your tiles to make a side length of 6 inches. Trace the outline of all 6 tiles. Then draw horizontal lines to show where they connect.

S: (Draw image shown at right.)

T: Label the side length.

S: (Label *6 in*, as shown.)

T: Write 6 × __ = 24 on your board. Talk to a partner, how can you use this equation to help you find the other side length?

S: From the equation, I know that the area is 24, so I can add rows of 6 tiles until I have 24 tiles. Then, I can count the rows to find the side length. → I can skip-count by 6 to get to 24, and then I know the other side length will be equal to the number of times I skip-count. → I know 6 × 4 = 24, so I know that the other side length is 4.

T: Choose a strategy to find the other side length and then fill in the blank in the equation. (Allow time for students to work.) What is the other side length?

S: 4 inches!

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Some learners may benefit from alternatives to drawing tiles inside rectangles on the Problem Set. Consider the following:

- Magnify the worksheet to ease small motor tasks.
- Provide virtual or concrete manipulatives.
- Allow students to draw their own rectangles, perhaps with larger tiles, perhaps with smaller areas.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

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

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

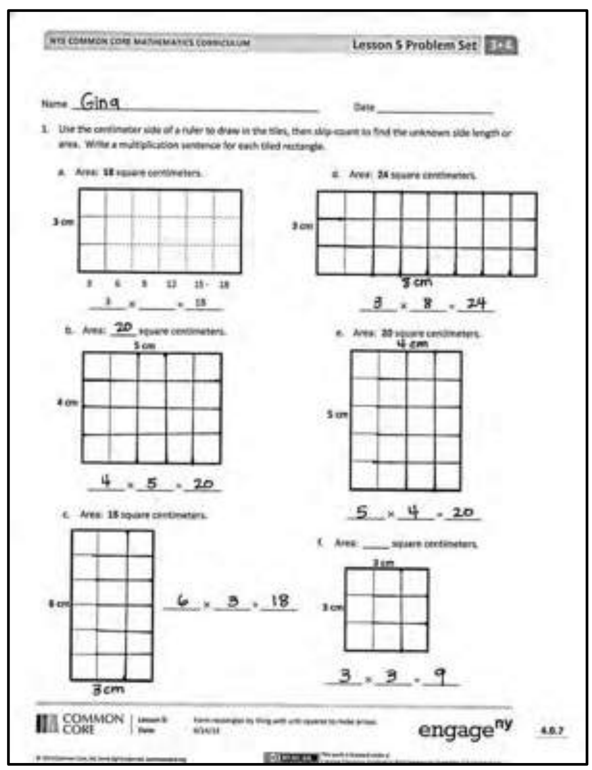
Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- Compare Problems 1(b) and 1(e), and Problems 1(a) and 1(c). How does each pair show commutativity?
- How many more threes does the array in Problem 1(d) have than the array in Problem 1(a)? How might the side lengths help you know that, even without seeing the tiled array?
- Compare Problems 1(c) and 1(f). How are the areas related? (The area of 1(f) is half the area of 1(c).) How might you have figured that out just by knowing the side lengths of each array?

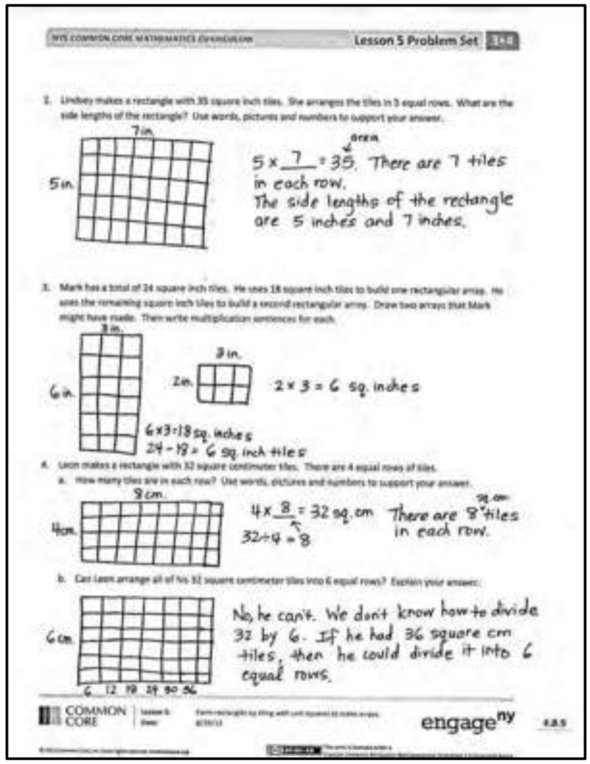
MP.8

- Students may have different solutions for Problem 3. Invite them to share and compare their work.
- In Problem 2, what strategy did you use to find the unknown side length? Is there another way you could have figured it out?



Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.


Lesson 5 Problem Set

2. Lindsey makes a rectangle with 35 square inch tiles. She arranges the tiles in 5 equal rows. What are the side lengths of the rectangle? Use words, pictures and numbers to support your answer.

7 in.
5 in.

$5 \times \underline{7} = 35$ (area). There are 7 tiles in each row.
The side lengths of the rectangle are 5 inches and 7 inches.

3. Mark has a total of 24 square inch tiles. He uses 18 square inch tiles to build one rectangular array. He uses the remaining square inch tiles to build a second rectangular array. Draw two arrays that Mark might have made. Then write multiplication sentences for each.

3 in.
6 in.
3 in.
2 in.

$2 \times 3 = 6$ sq. inches

$6 \times 3 = 18$ sq. inches
$24 - 18 = 6$ sq. inch tiles

4. Leon makes a rectangle with 32 square centimeter tiles. There are 4 equal rows of tiles.

a. How many tiles are in each row? Use words, pictures and numbers to support your answer.

8 cm.
4 cm.

$4 \times \underline{8} = 32$ sq. cm
$32 \div 4 = 8$

There are 8 sq. cm tiles in each row.

b. Can Leon arrange all of his 32 square centimeter tiles into 6 equal rows? Explain your answer.

6 cm.
6 12 18 24 30 36

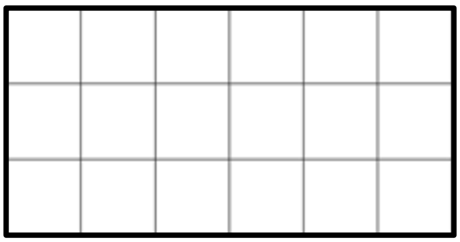
No, he can't. We don't know how to divide 32 by 6. If he had 36 square cm tiles, then he could divide it into 6 equal rows.

Name ____ Date ______________________

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

a. Area: **18** square centimeters.

3 cm



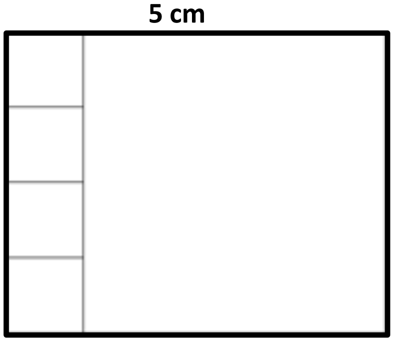
3 6 9 12 15 18

__3__ × _______ = __18__

b. Area: _____ square centimeters.

5 cm

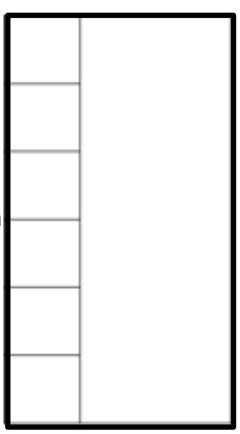
4 cm



_______ × _______ = _______

c. Area: **18** square centimeters.

6 cm



_______ × _______ = _______

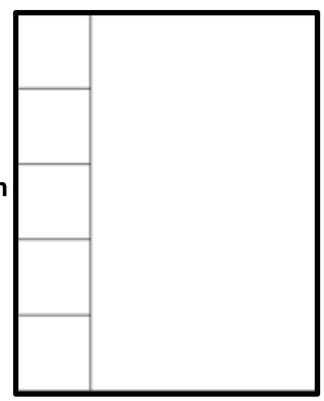
d. Area: **24** square centimeters.

3 cm

_______ × _______ = _______

e. Area: **20** square centimeters.

5 cm

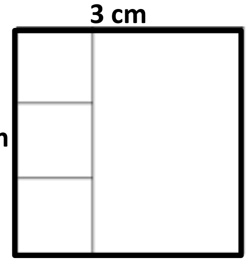


_______ × _______ = _______

f. Area: _____ square centimeters.

3 cm

3 cm



_______ × _______ = _______

2. Lindsey makes a rectangle with 35 square-inch tiles. She arranges the tiles in 5 equal rows. What are the side lengths of the rectangle? Use words, pictures, and numbers to support your answer.

3. Mark has a total of 24 square-inch tiles. He uses 18 square-inch tiles to build one rectangular array. He uses the remaining square-inch tiles to build a second rectangular array. Draw two arrays that Mark might have made. Then write multiplication sentences for each.

4. Leon makes a rectangle with 32 square-centimeter tiles. There are 4 equal rows of tiles.
   a. How many tiles are in each row? Use words, pictures, and numbers to support your answer.

   b. Can Leon arrange all of his 32 square-centimeter tiles into 6 equal rows? Explain your answer.

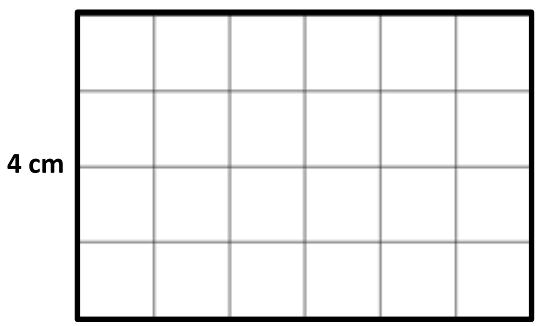
Name ______________________________________ Date ____________________

Darren has a total of 28 square-centimeter tiles. He arranges them into 7 equal rows. Draw Darren's rectangle. Label the side lengths, and write a multiplication equation to find the total area.

Name ______________________________ Date ________________

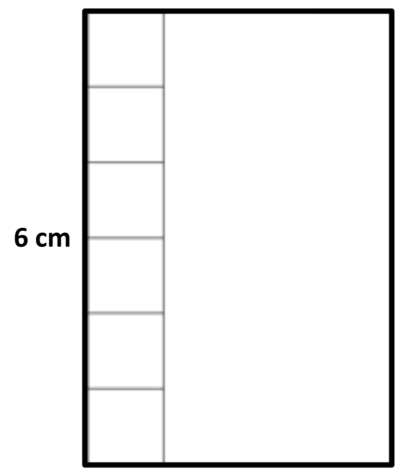
1. Use the centimeter side of a ruler to draw in the tiles, then skip-count to find the unknown side length or area. Write a multiplication sentence for each tiled rectangle.

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



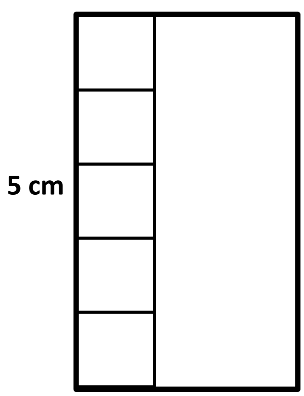
___4___ × _______ = ___24___

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



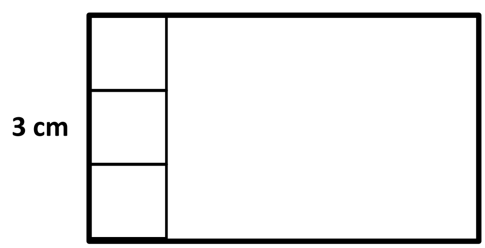
_______ × _______ = _______

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



_______ × _______ = _______

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



_______ × _______ = _______

2. Ally makes a rectangle with 45 square-inch tiles. She arranges the tiles in 5 equal rows. How many square-inch tiles are in each row? Use words, pictures, and numbers to support your answer.

3. Leon makes a rectangle with 36 square-centimeter tiles. There are 4 equal rows of tiles.
   a. How many tiles are in each row? Use words, pictures, and numbers to support your answer.

   b. Can Leon arrange all of his 36 square-centimeter tiles into 6 equal rows? Use words, pictures, and numbers to support your answer.

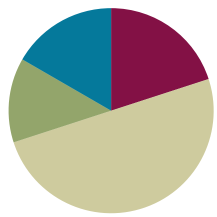
   c. Do the rectangles in (a) and (b) have the same total area? Explain how you know.

Lesson 6

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

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(8 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Group Counting **3.OA.1** (4 minutes)
- Write the Multiplication Fact **3.MD.7** (4 minutes)
- Products in an Array **3.OA.3** (4 minutes)

Group Counting (4 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Sixes to 60
- Sevens to 70
- Eights to 80
- Nines to 90

Write the Multiplication Fact (4 minutes)

Materials: (S) Personal white boards

Note: This fluency reviews relating multiplication with area from G3–M4–Lesson 5.

T: (Project a 5 by 3 square-unit tiled rectangle. Write ___ × ___ = 15.) There are 15 tiles altogether. How many rows are there?

S: 5 rows.

T: (Write 5 × ___ = 15.) On your boards, fill in the blank to make a true equation.

S: (Write 5 × 3 = 15.)

T: (Project a 3 by 4 square-unit tiled rectangle. Write ___ × ___= 12.) There are 12 tiles altogether. How many columns are there?

S: 4 columns.

T: (Write ___ × 4 = 12.) On your boards, fill in the blank to make a true equation.

S: (Write 3 × 4 = 12.)

Continue with the following possible sequence, asking the students to first name either the number of rows or the number of columns: 4 by 6, 6 by 7, 5 by 8, and 7 by 8.

Products in an Array (4 minutes)

Materials: (S) Personal white boards

Note: This fluency supports the relationship between multiplication and area.

T: (Project an array with 2 rows of 6 stars.) How many rows of stars do you see?

S: 2 rows.

T: How many stars are in each row?

S: 6 stars.

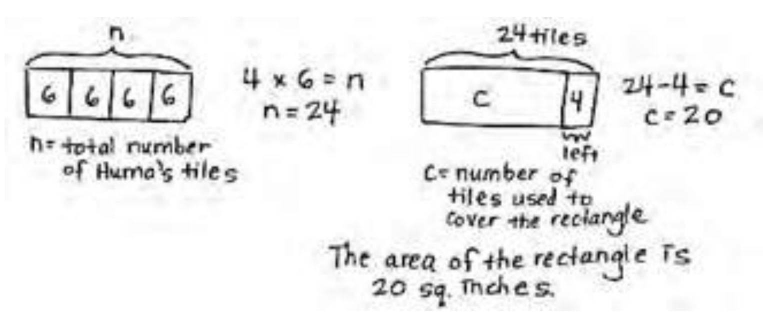
T: On your boards, write two multiplication sentences that can be used to find the total number of stars.

S: (Write 2 × 6 = 12 and 6 × 2 = 12.)

Continue with the following possible sequence: 3 by 7, 6 by 5, 8 by 6, and 4 by 9.

Application Problem (8 minutes)

Huma has 4 bags of square-inch tiles with 6 tiles in each bag. She uses them to measure the area of a rectangle on her homework. After covering the rectangle, Huma has 4 tiles left. What is the area of the rectangle?



NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Adjust the numbers in the Application Problem to challenge students working above grade level.

Note: This problem reviews multi-step word problems in the context of using square tiles to measure area.

Concept Development (30 minutes)

Materials: (S) Personal white board, straight edge, Problem Set, array template

Part 1: Estimate to draw the missing square units inside an array.

Students have the array template in their personal boards, looking at Array 1.

T: How can an array of square units help you find the area of a rectangle?

S: You can count the total number of square units inside the rectangle. → You can skip-count the rows to find the total.

T: (Project or display the image at right.) What do you notice about the array inside of this rectangle?

S: Some of the square units are missing.

T: What do you notice about the top row?

S: It has 4 square units and a rectangle.

MP.2

T: Look at the second row. Can you use those square units to help you know how many square units make the top row?

S: The second row has 1 more square unit than the top row. You can just follow the line it makes to divide the rectangle into 2 square units.

T: Use your straight edge to draw that line now.

S: (Draw as shown at right.)

T: Talk to your partner: Use the top row to figure out how many square units will fit in each of the rows below. How do you know?

S: Each row should have 6 square units, because rows in an array are equal!

T: Use the lines that are already there as guides, and with your straight edge, draw lines to complete the array.

S: (Draw.)

T: How many rows of 6 are in this array?

S: 4 rows of 6.

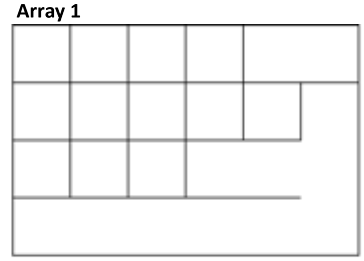
T: What equation can be used to find the area of the rectangle?

S: 4 × 6 = 24.

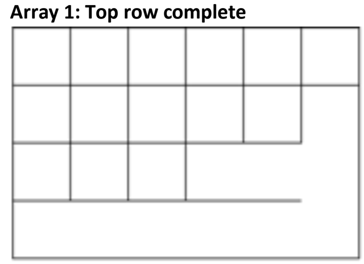
NOTES ON MULTIPLE MEANS FOR ACTION AND EXPRESSION:

Scaffold the following sequence further by beginning with a basic 2 by 2 rectangle in which 2 tiles are missing. Graduate to a 2 by 3 rectangle in which tiles or lines are missing. Continue step by step until students are ready for rectangles with larger areas. Also consider adding color to alternating tiles to assist counting or to distinguish tiles from rectangles or blank space.

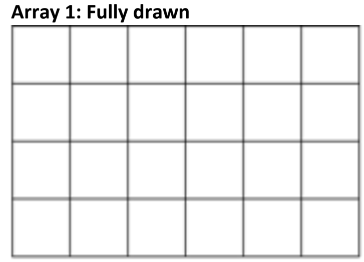
Array 1



Array 1: Top row complete

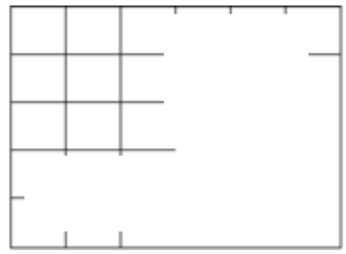


Array 1: Fully drawn

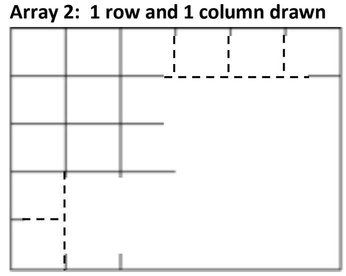


Part 2: Draw rows and columns to determine the area.

Array 2



Array 2: 1 row and 1 column drawn



T: (Project the rectangle shown at right.) Turn your array template over. Can we estimate to draw unit squares inside the rectangle?

S: Yes.

T: It might take us longer, because fewer units are given. A quicker way to find the area is to figure out the number of rows and the number of columns. Let's start by finding the number of rows in our array. How can we find the number of rows?

S: The first column shows you how many rows there are.

T: With your finger, show your partner what you'll draw to find the number of rows. Then draw.

S: (Show and draw.)

T: How can we find the number of columns?

S: The first row shows you how many columns there are.

T: Use your straight edge to complete the first row. Label the side lengths of the rectangle, including units.

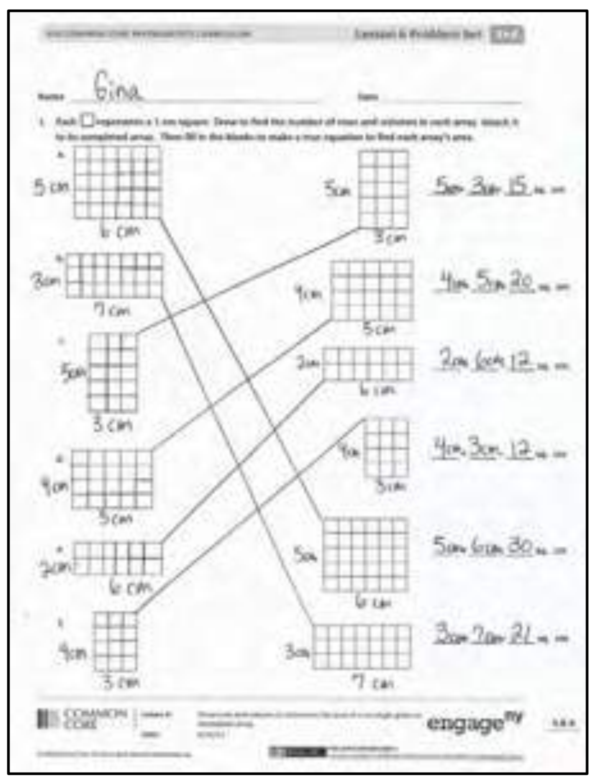
S: (Draw and label side lengths 5 units and 6 units.)

T: What number sentence can be used to find the area?

S: 5 × 6 = 30.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

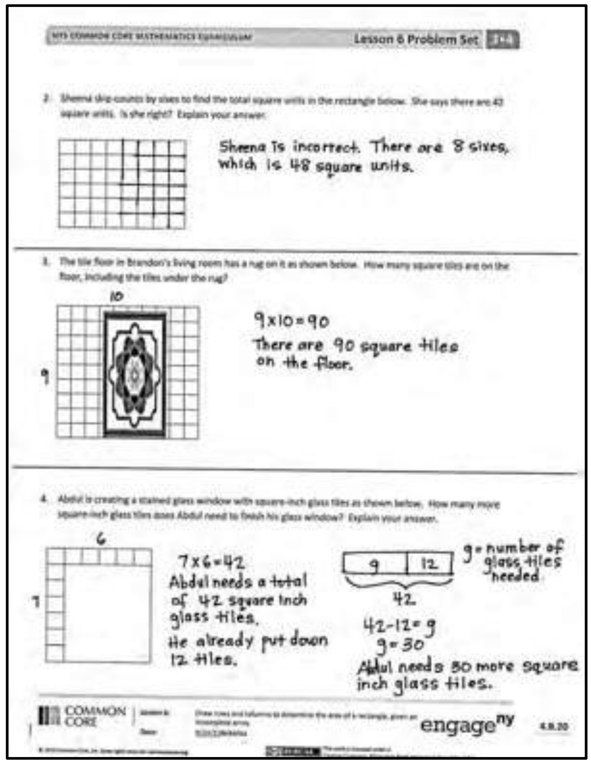


Student Debrief (10 minutes)

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

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.



You may choose to use any combination of the questions below to lead the discussion.

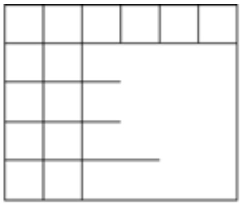
- How did you know where to draw the columns and rows in Problem 1?
- To find area, why don't we need to draw all of the square units in an incomplete array?
- What mistake did Sheena make in Problem 2?
- Is it necessary to have the rug to solve Problem 3? Why or why not?
- In Problem 3, how many tiles does the rug touch?
- There are multiple ways to find a solution to Problem 4. Invite students to share how they found the answer.

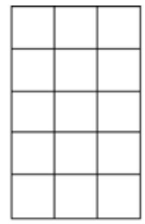
Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

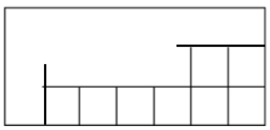
Name ____ Date ______________________

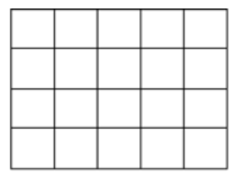
1. Each ☐ represents a 1-cm square. Draw to find the number of rows and columns in each array. Match it to its completed array. Then fill in the blanks to make a true equation to find each array's area.

a. 

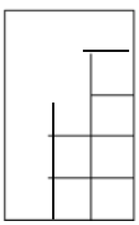


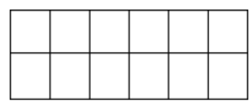
_____ × _____ = _____ sq cm

b. 

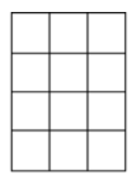


_____ × _____ = _____ sq cm

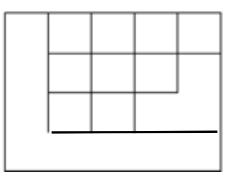
c. 

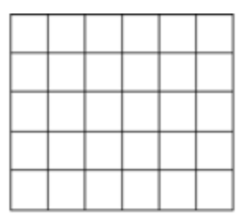


_____ × _____ = _____ sq cm

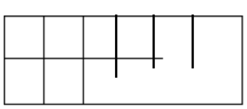


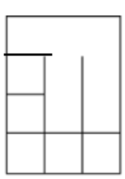
_____ × _____ = _____ sq cm

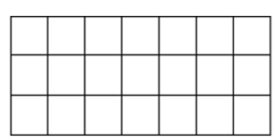
d. 



_____ × _____ = _____ sq cm

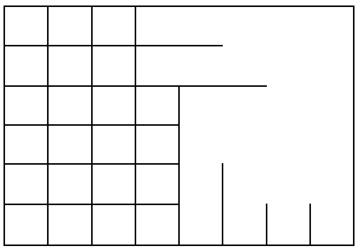
e. 

f. 

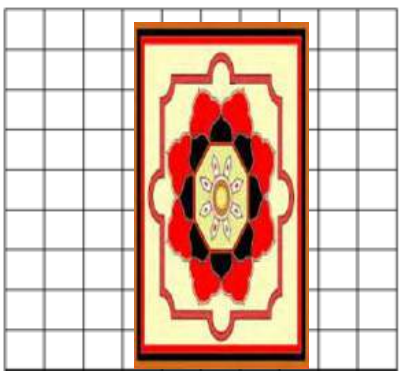


_____ × _____ = _____ sq cm

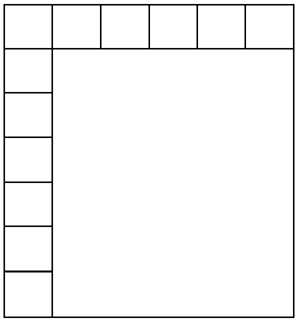
2. Sheena skip-counts by sixes to find the total square units in the rectangle below. She says there are 42 square units. Is she right? Explain your answer.



3. The tile floor in Brandon's living room has a rug on it as shown below. How many square tiles are on the floor, including the tiles under the rug?

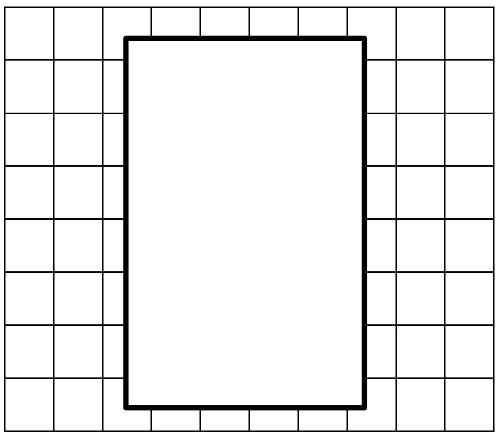


4. Abdul is creating a stained glass window with square-inch glass tiles as shown below. How many more square-inch glass tiles does Abdul need to finish his glass window? Explain your answer.



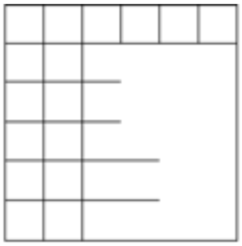
Name ____ Date _____________________

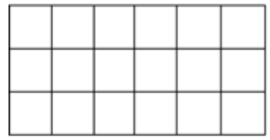
The tiled floor in Cayden's dining room has a rug on it as shown below. How many square tiles are on the floor, including the tiles under the rug?



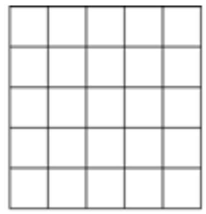
Name ____ Date ____________________

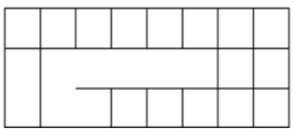
1. Each ☐ represents a 1-cm square. Draw to find the number of rows and columns in each array. Match it to its completed array. Then fill in the blanks to make a true equation to find each array's area.

a. 



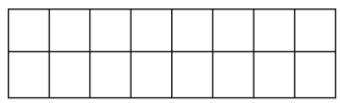
_____ × _____ = _____ sq cm



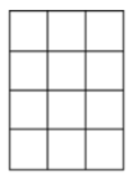
b. 

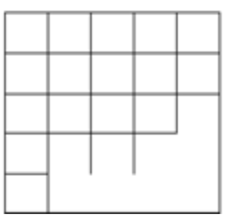
_____ × _____ = _____ sq cm

c. 

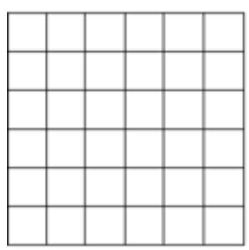


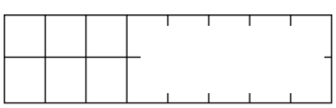
_____ × _____ = _____ sq cm



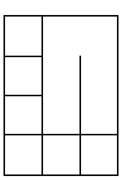
d. 

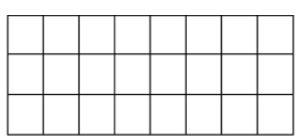
_____ × _____ = _____ sq cm



e. 

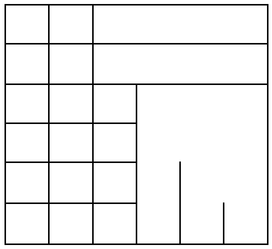
_____ × _____ = _____ sq cm

f. 

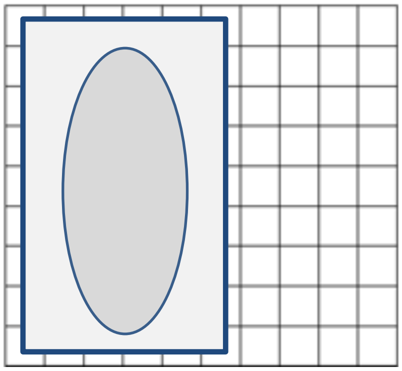


_____ × _____ = _____ sq cm

2. Minh skip-counts by sixes to find the total square units in the rectangle below. She says there are 36 square units. Is she correct? Explain your answer.

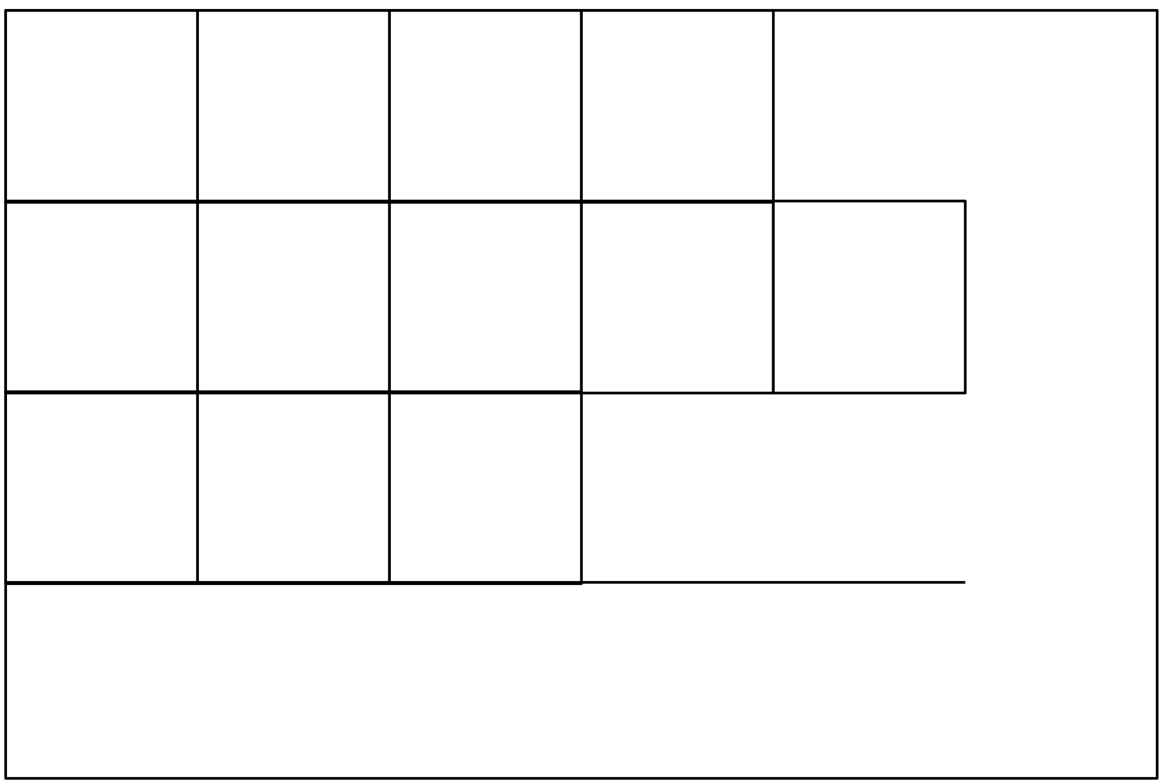


3. The tub in Paige's bathroom covers the tile floor as shown below. How many square tiles are on the floor, including the tiles under the tub?

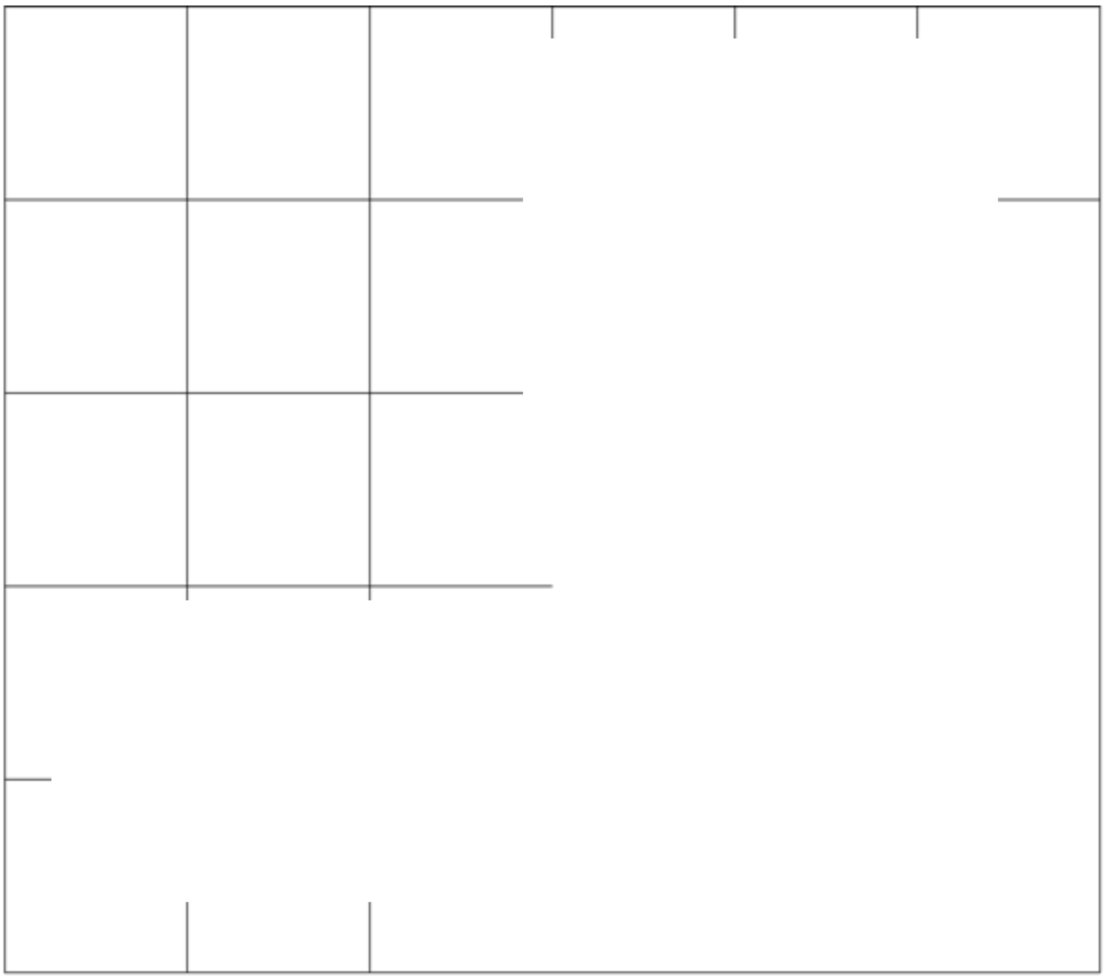


4. Frank sees a book on top of his chessboard. How many squares are covered by the book? Explain your answer.

Array 1



Array 2

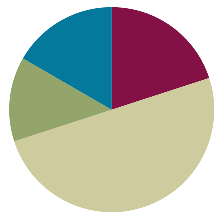


Lesson 7

Objective: Interpret area models to form rectangular arrays.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(8 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Group Counting **3.OA.1** (4 minutes)
- Draw Rectangles **3.MD.5** (4 minutes)
- Draw Rectangular Arrays **3.MD.5** (4 minutes)

Group Counting (4 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Sixes to 60
- Sevens to 70
- Eights to 80
- Nines to 90

Draw Rectangles (4 minutes)

Materials: (S) Grid paper

Note: This fluency reviews drawing a rectangle from a known area. Show student work that is correct, but looks different (e.g., a 6 × 2 unit rectangle juxtaposed with a 4 × 3 unit rectangle).

T: Draw a rectangle that has an area of 6 square units.
S: (Draw a 6 square unit rectangle.)

Continue with the following possible sequence: 10 square units, 12 square units, 16 square units, 24 square units, and 35 square units.

Draw Rectangular Arrays (4 minutes)

Materials: (S) Grid paper

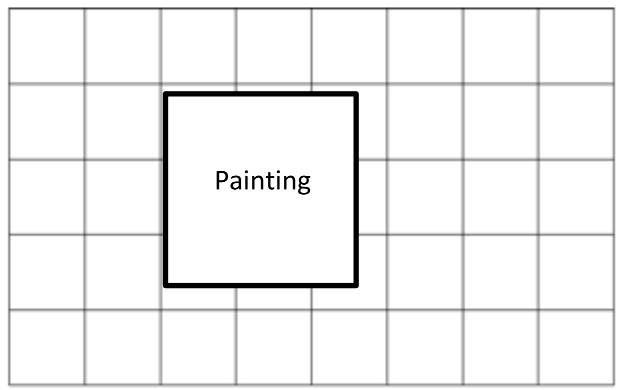
Note: This fluency reviews finding area using side lengths.

T: Draw a 4 × 2 rectangular array using the squares on your grid paper.
T: How many square units are in your array?
S: 8 square units.

Continue with the following possible sequence: 6 × 2 units, 4 × 3 units, 6 × 3 units, 9 × 2 units, 6 × 4 units, and 3 × 8 units.

Application Problem (8 minutes)

Lori wants to replace the square tiles on her wall. The square tiles are sold in boxes of 8 square tiles. Lori buys 6 boxes of tiles. Does she have enough to replace all the tiles, including the tiles under the painting? Explain your answer.



$8 \times 6 = 48$
She bought 48 square tiles.

$5 \times 8 = 40$
The area of the wall is 40 square tiles.

Yes, Lori will have enough tiles because she only needs 40 tiles, but she bought 48 tiles.

Note: This problem reviews multi-step word problems in the context of using square tiles to measure area. It also reviews finding the array of an incomplete array from G3–M4–Lesson 6.

Concept Development (30 minutes)

Materials: (T) Meter stick, 12-inch ruler, pad of square sticky notes (S) 1 set per pair of 12 square-inch and 12 square-centimeter paper tiles from G3–M4–Lesson 2, personal white boards, rulers, area model template

Part 1: Explore the relationship between units and area.

T: One partner will use square inches, and the other will use square centimeters. Work together to decide on how to arrange your tiles to make the same shape rectangle. Then make that rectangle with your pieces.

S: (Decide on a rectangle and represent it using square inches and square centimeters.)

T: You and your partner each made the same shape rectangle. Is the area also the same?

S: Yes, because we both used the same number of pieces. → Yeah, but my pieces are smaller than yours. They're square centimeters, and look, my shape takes up less space on the table. → The area of the shape with square inches is bigger because inches are bigger than centimeters.

T: Turn your personal board horizontal and write the area of your rectangle.

S: (Write either 12 sq in or 12 sq cm.)

T: (Draw 1 square meter on the board.) This is 1 square meter. Suppose you used 12 square-meter tiles to make your rectangle instead. Would this rectangle have a larger area or a smaller area than your original rectangle?

MP.6

S: It would be much larger!

T: (Draw 1 square foot on the board.) How would your rectangle compare if you made it from 12 square feet?

S: It would be bigger than 12 square inches or centimeters, but smaller than 12 square meters.

T: (Hold up a pad of square sticky notes.) How about if you had used 12 sticky notes?

S: Still bigger than 12 square inches or centimeters, but smaller than 12 square feet or meters.

T: Why is it important to label the unit when you're talking about area?

S: Because how much area there is changes if the unit is small or big. → If you don't know the unit, you don't really know what the area means. → It's just like with length. Twelve of a shorter unit is shorter than 12 of a longer unit.

Part 2: Relate area to multiplication to draw rectangular arrays.

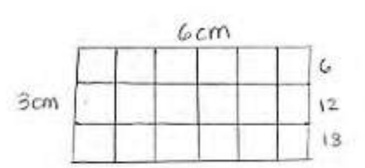
T: Let's draw a rectangular array with an area of 18 square centimeters. How might we find the side lengths?

S: We could use our tiles to make the array and see. → If you multiply side lengths you get area, so we can think about what numbers you can multiply to make 18.

T: Work with your partner to make a list of multiplication facts that equal 18.

S: (Possible list: 1×18, 18×1, 2×9, 9×2, 3×6, 6×3.)

T: Let's draw a 3 cm by 6 cm rectangular array. Use a ruler to measure the side lengths on your board. Draw hash marks for each centimeter and connect them to draw in all of the squares.



T: After you've drawn your squares, check your work by skip-counting the rows to find the total number of tiles you drew.

S: (Draw, label, and skip-count tiles in array.)

T: Turn your board so that it's vertical. Does the rectangle still have the same area?

S: Yes.

T: But the side lengths switched places! Tell your partner how you know the area is the same.

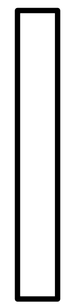
S: The side lengths didn't change, they just moved. → It's the commutative property. We learned before you can turn an array and it doesn't change how much is in it; the rows just turn into columns and columns turn into rows.

Part 3: Interpret area models to find area.

T: The grid you drew inside of your 3 cm by 6 cm rectangle shows a picture of all the tiles that make up the area. Carefully erase the grid lines in your rectangle. (Pause.) The empty rectangle with labeled side lengths that's left is called an **area model**. How can you find the total area just using the labeled side lengths?

S: I can multiply! → I can multiply the side lengths, 3 cm and 6 cm, to get the area, 18 square cm.

T: (Project or draw the area model at right.) What is the total area of my pictured rectangle?



S: 18 square cm.

T: Tell your partner how you figured out the area.

S: It's easy. One side length is 18 and the other is 1. $18 \times 1 = 18$. The labels tell you the unit is centimeters, so the area is square centimeters.

T: (Pass out the area model template.) Slip the area model template into your board. Use your ruler to measure the side lengths of one of the squares on the grid. (Allow students time to measure.) What unit is this grid made up of?

S: Square inches!

T: The side lengths of this area model aren't labeled. Let's draw a grid inside it to help us find the side lengths. Earlier we drew a grid inside a rectangle by drawing hash marks and using our ruler to connect the hash marks. Do we need to draw hash marks on the area model to draw a grid inside it?

S: No, we can just use the grid lines. → No, the lines on the grid can act as hash marks because the area model is lined up with the grid.

T: Use your ruler and the lines on the grid to draw squares inside the area model. (Allow students time to work.) What size are the units inside the area model?

S: Square inches. → They're square inches because we used the square-inch grid paper to help us draw the squares.

T: Find and label the side lengths, then write an equation to find the area.

S: (Write $2 \times 4 = 8$ or $4 \times 2 = 8$.)

T: What is the area?

S: 8 square inches!

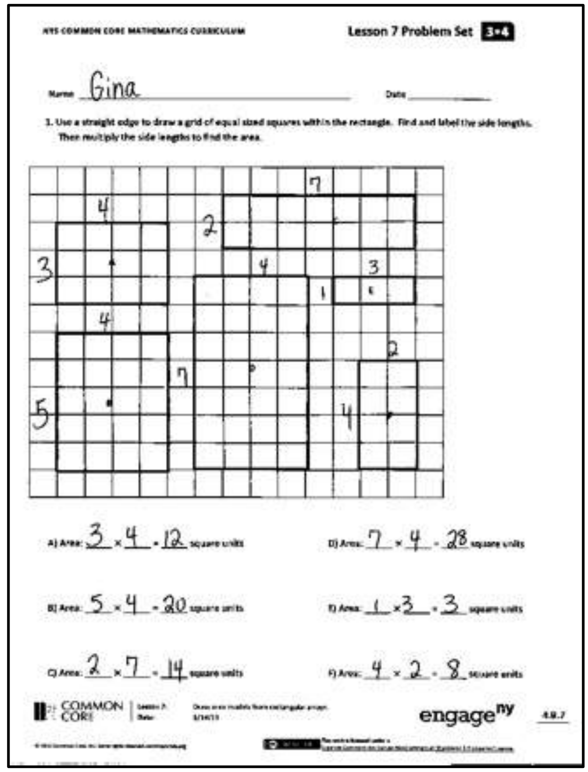
NOTES ON MULTIPLE MEANS FOR ACTION AND EXPRESSION:

Consider offering the following adaptations of the Problem Set:

- Prompt students to approach Rectangle E first. Offer practice with 1 by *n* rectangles to build fluency and confidence.
- Remove side lengths to encourage closer investigation.
- Challenge students to devise an alternate method to finding the area of Benjamin's bedroom floor.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.


Name Gina

A) Area: 3 × 4 = 12 square units

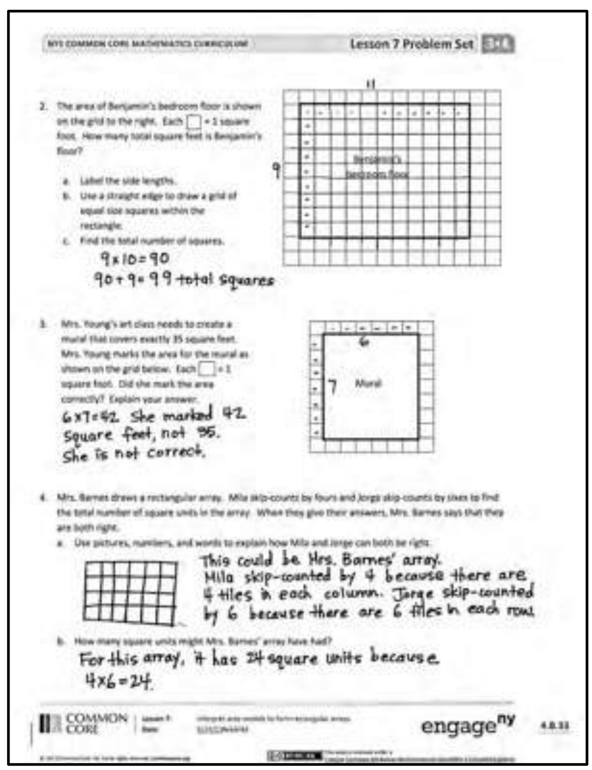
B) Area: 5 × 4 = 20 square units

C) Area: 2 × 7 = 14 square units

D) Area: 7 × 4 = 28 square units

E) Area: 1 × 3 = 3 square units

F) Area: 4 × 2 = 8 square units


9×10=90
90+9=99 total squares

6×7=42. She marked 42 square feet, not 35. She is not correct.

This could be Mrs. Barnes' array. Mila skip-counted by 4 because there are 4 tiles in each column. Jorge skip-counted by 6 because there are 6 tiles in each row.

For this array, it has 24 square units because 4×6=24.

Student Debrief (10 minutes)

Lesson Objective: Interpret area models to form rectangular arrays.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

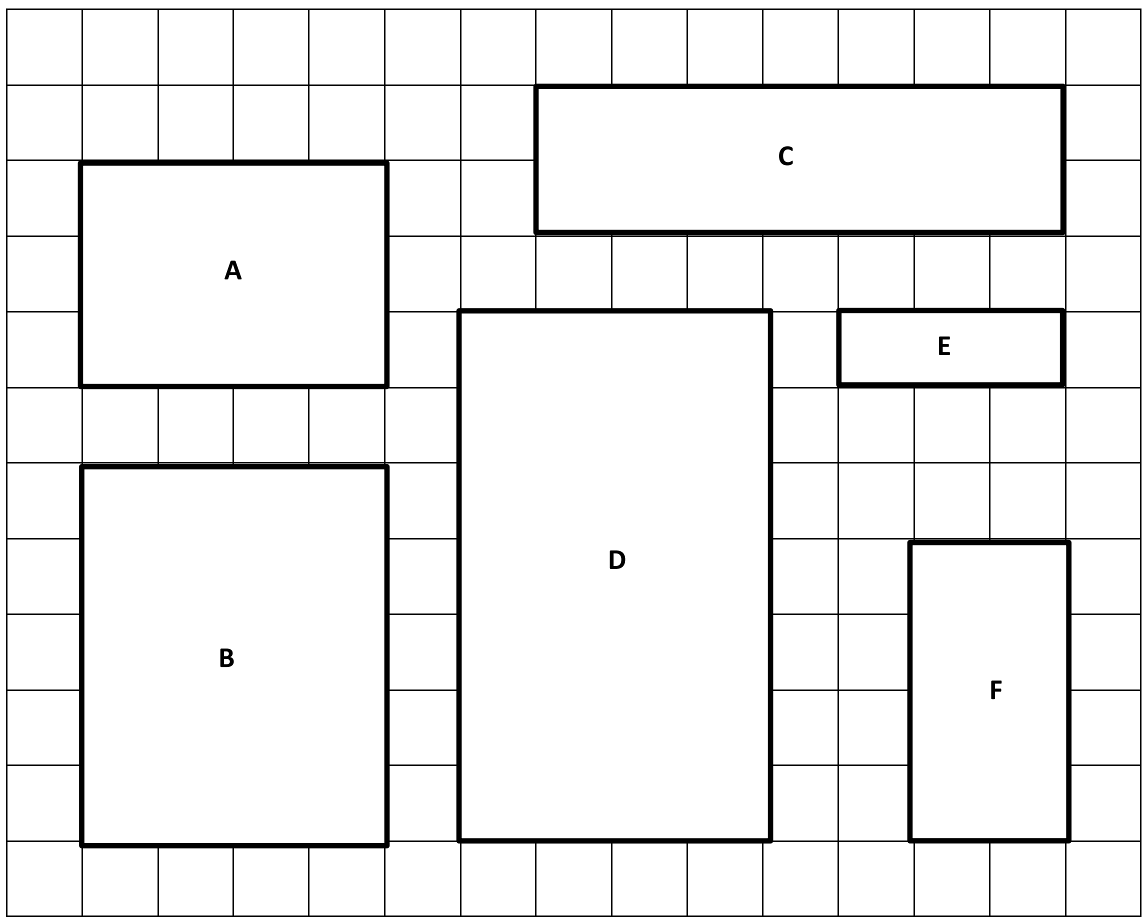
- What was your strategy for finding the total number of squares in Problem 2(c)?
- Invite students who drew arrays that demonstrate commutativity for Problem 4(a) (possibly 4 × 6 and 6 × 4) to share their work. Guide students to articulate understanding that commutativity still applies in the context of area.
- For Problem 4(b), most students answered that Mrs. Barnes' array probably had 24 squares. Is there another answer that makes sense? (For example, 12, 48, 72.)
- Compare the **area model** to the array. How are they the same and different? (Guide discussion to include the commutativity of both models.)

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name ____ Date ____________________

1. Use a straight edge to draw a grid of equal size squares within the rectangle. Find and label the side lengths. Then multiply the side lengths to find the area.



A. Area: _____ × _____ = _____ square units

B. Area: _____ × _____ = _____ square units

C. Area: _____ × _____ = _____ square units

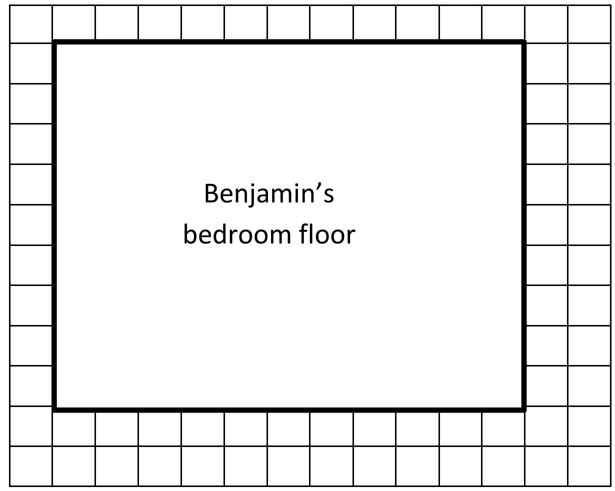
D. Area: _____ × _____ = _____ square units

E. Area: _____ × _____ = _____ square units

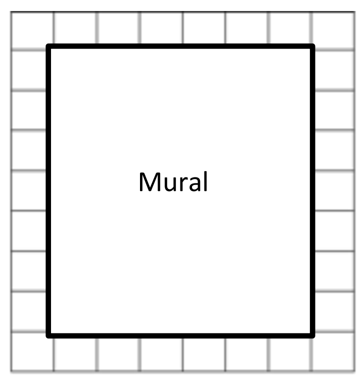
F. Area: _____ × _____ = _____ square units

2. The area of Benjamin's bedroom floor is shown on the grid to the right. Each □ = 1 square foot. How many total square feet is Benjamin's floor?

   a. Label the side lengths.
   b. Use a straight edge to draw a grid of equal size squares within the rectangle.
   c. Find the total number of squares.



3. Mrs. Young's art class needs to create a mural that covers exactly 35 square feet. Mrs. Young marks the area for the mural as shown on the grid below. Each □ = 1 square foot. Did she mark the area correctly? Explain your answer.



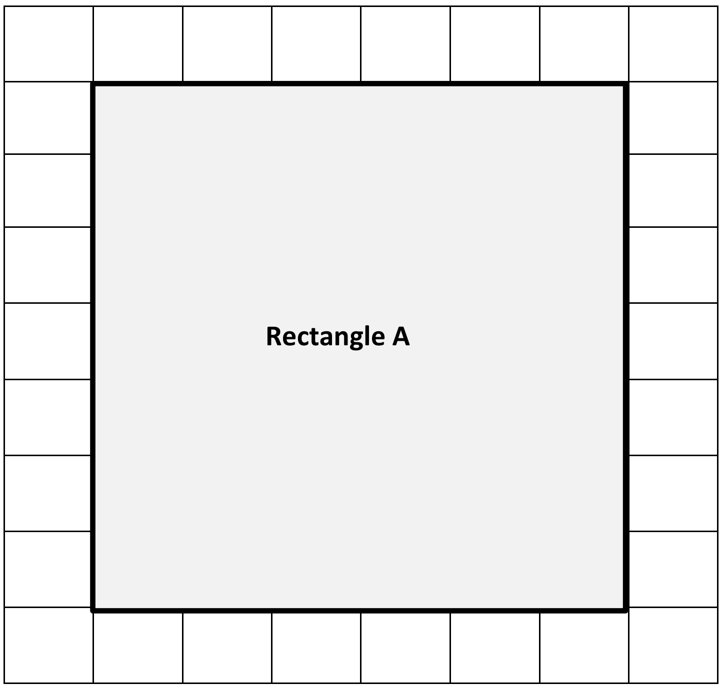
4. Mrs. Barnes draws a rectangular array. Mila skip-counts by fours and Jorge skip-counts by sixes to find the total number of square units in the array. When they give their answers, Mrs. Barnes says that they are both right.

   a. Use pictures, numbers, and words to explain how Mila and Jorge can both be right.

   b. How many square units might Mrs. Barnes' array have had?

Name ____ Date ____________________

1. Label the side lengths of Rectangle A on the grid below. Use a straight edge to draw a grid of equal size squares within Rectangle A. Find the total area of Rectangle A.

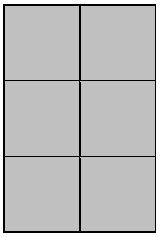
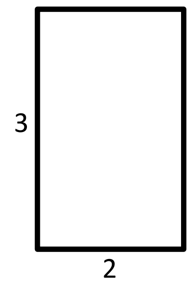
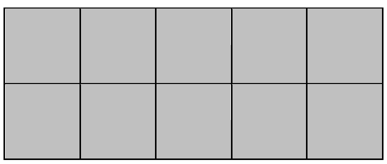
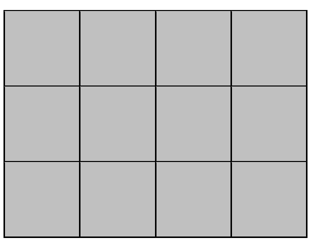
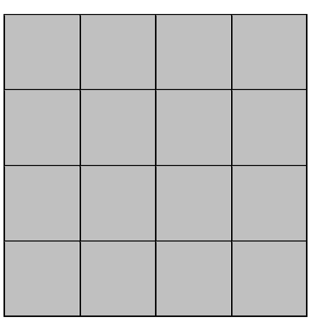
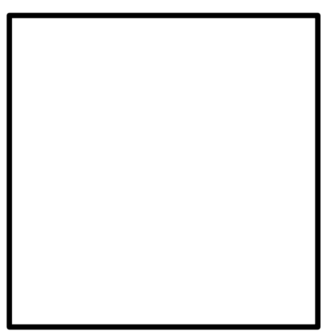


Area: ________ square units

2. Mark makes a rectangle with 36 square-centimeter tiles. Gia makes a rectangle with 36 square-inch tiles. Whose rectangle has a bigger area? Explain your answer.

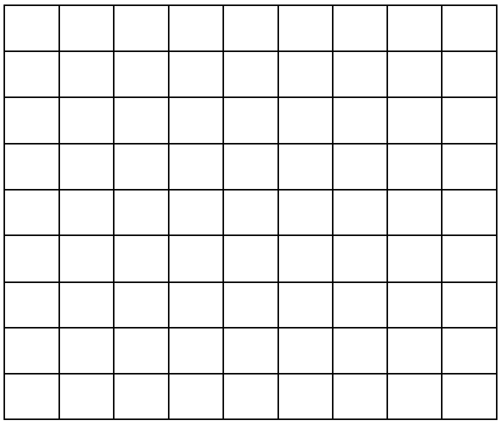
Name ____ Date ______________________

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.

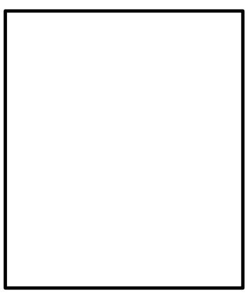
Rectangular Arrays	**Area Models**
a.  _______ square units	 $3 \times$ _______ = _______
b.  _______ square units	 _______ $\times$ _______ = _______
c.  _______ square units	 _______ $\times$ _______ = _______
d.  _______ square units	 _______ $\times$ _______ = _______

3. Jillian arranges square pattern blocks into a 7 by 4 array. Draw Jillian's array on the the grid below. How many square units are in Jillian's rectangular array?

a.

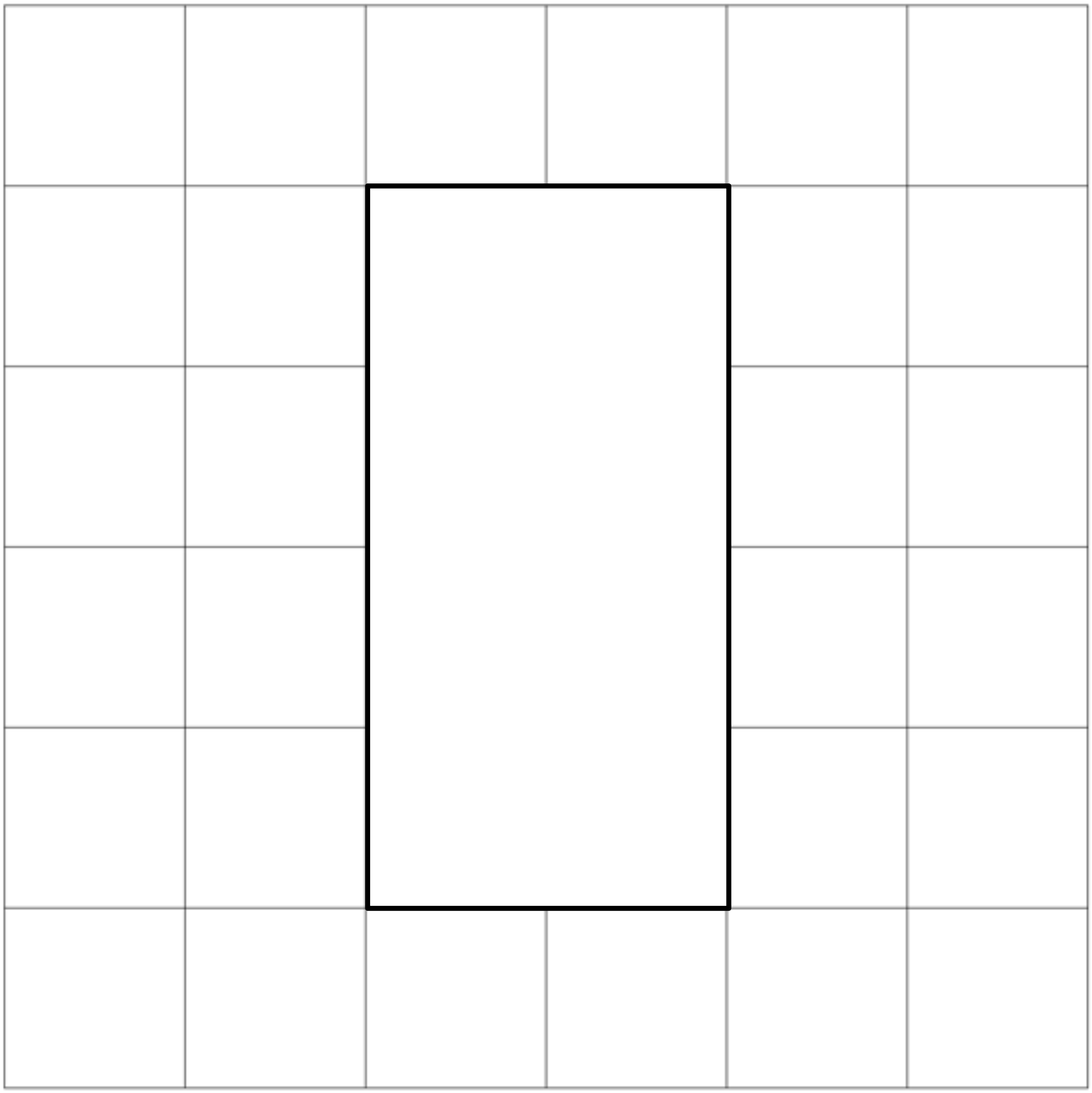


b. Label the side lengths of Jillian's array from Part (a) on the rectangle below. Then write a multiplication sentence to represent the area of the rectangle.



4. Fiona draws a 24 square-centimeter rectangle. Gregory draws a 24 square-inch rectangle. Whose rectangle is larger in area? How do you know?

Area Model Template

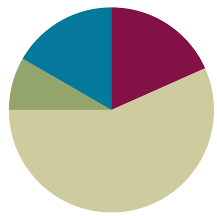


Lesson 8

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

Suggested Lesson Structure

Fluency Practice	(11 minutes)
Application Problem	(5 minutes)
Concept Development	(34 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (11 minutes)

- Multiply by 6 **3.OA.7** (8 minutes)
- Group Counting **3.OA.1** (3 minutes)

Multiply by 6 (8 minutes)

Materials: (S) Multiply by 6 Pattern Sheet (6–10)

Note: This activity builds fluency with multiplication facts using units of 6. It works toward students knowing from memory all products of two one-digit numbers. See G3–M4–Lesson 2 for the directions for administration of a *Multiply By* pattern sheet.

T: (Write 7 × 6 = ____.) Let's skip-count up by sixes. (Count with fingers to 7 as students count.)

S: 6, 12, 18, 24, 30, 36, 42.

T: Let's see how we can skip-count down to find the answer, too. (Show 10 fingers.) Start at 60. (Count down with your fingers as students say numbers.)

S: 60, 54, 48, 42.

Continue with the following possible sequence: 9 × 6, 6 × 6, and 8 × 6.

T: (Distribute Multiply by 6 Pattern Sheet.) Let's practice multiplying by 6. Be sure to work left to right across the page.

Group Counting (3 minutes)

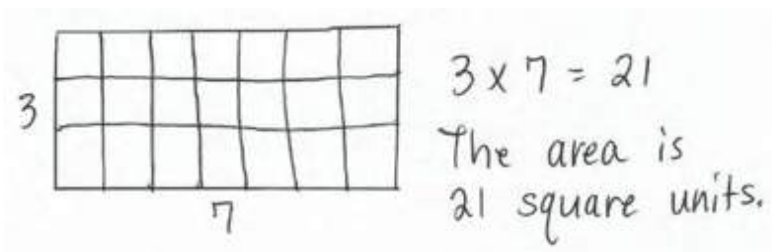
Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Fours to 40
- Sevens to 70
- Eights to 80
- Nines to 90

Application Problem (5 minutes)

Marnie and Connor both skip-count square units to find the area of the same rectangle. Marnie counts, "3, 6, 9, 12, 15, 18, 21." Connor counts, "7, 14, 21." Draw what the rectangle might look like, then label the side lengths and find the area.

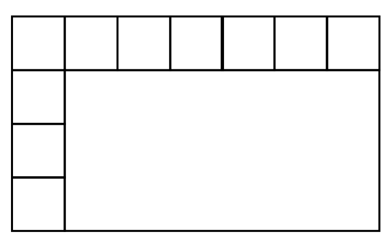


Note: This problem reinforces G3–M4–Lesson 7 and sets the foundation for today's Concept Development. Invite students to share their drawings and discuss how they are similar and how they are different.

Concept Development (34 minutes)

Materials: (S) Personal white board, inch ruler, grid template

Part 1: Relate side lengths to area.



T: (Project image shown to the right.) How many rows are in the incomplete array?

S: 4 rows.

T: How many square units are there in each row?

S: 7 square units.

T: Talk to your partner: Do we need to complete the array to find the area of the rectangle? Why or why not?

S: Yes, then we can skip-count each row to find the total. → No, we already know the side lengths!

T: How are the side lengths related to the area?

S: If you multiply the side lengths together, the product is the same as the area.

T: Talk to a partner: Can you multiply any two side lengths to find the area?

MP.8 S: No, you have to multiply the side length that shows the number of rows times the side length that shows the number of squares in each row.

T: What multiplication equation can be used to find the area of this rectangle?

S: 4 × 7 = 28.

T: In order to check our answer, use your grid template to trace and shade in an area model that is 4 units high and 7 units wide. Label each side length.

S: (Draw and label.)

T: Was our answer correct?

S: Yes, I used the grid paper to count 28 squares inside. → I skip-counted 4 sevens to make 28.

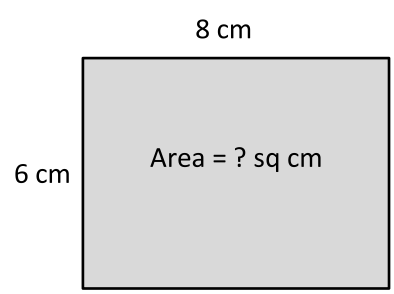
NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

You may want to help English language learners relate the number of square units in each row to the word *columns,* and relate *columns* and *rows* to side lengths. To some students it may appear that these words are used interchangeably. Help clarify meaning.

Continue with the following possible sequence: 6 by 5, 8 by 7, and 9 by 6.

Part 2: Use side lengths to find area.

(Draw or project the rectangle shown at right.)



T: What do you notice about this rectangle?

S: We know the side lengths, but there is no grid inside. → It's an area model.

T: Do we still have enough information to find the area of this rectangle, even without the grid lines inside?

S: Yes! We know both side lengths.

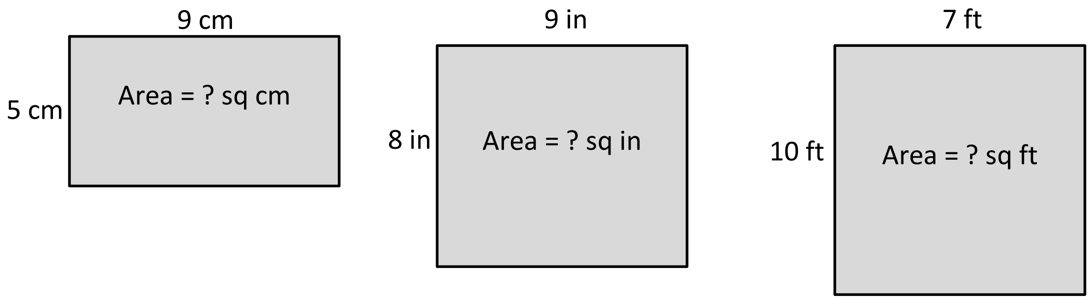
T: Write the multiplication equation to find the area of this rectangle.

S: 6 × 8 = 48.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

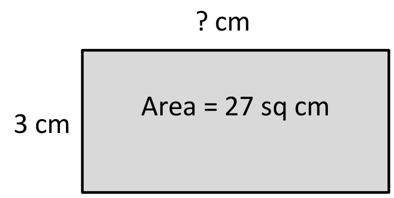
You may choose to have students work through these examples independently or in pairs.

Continue with the following suggested examples:



Part 3: Use area and side length to find unknown side length.

(Draw or project the rectangle shown at right.)



T: What do you notice about this rectangle?

S: We know the area, but not both side lengths. → One of the side lengths is unknown.

T: Write a multiplication equation on your board to show how to find the area of this rectangle. Use a question mark for the unknown side length.

S: (Write 3 × ? = 27.)

T: What is the value of the question mark?

S: 9!

T: How do you know?

S: I know that 3 times 9 equals 27!

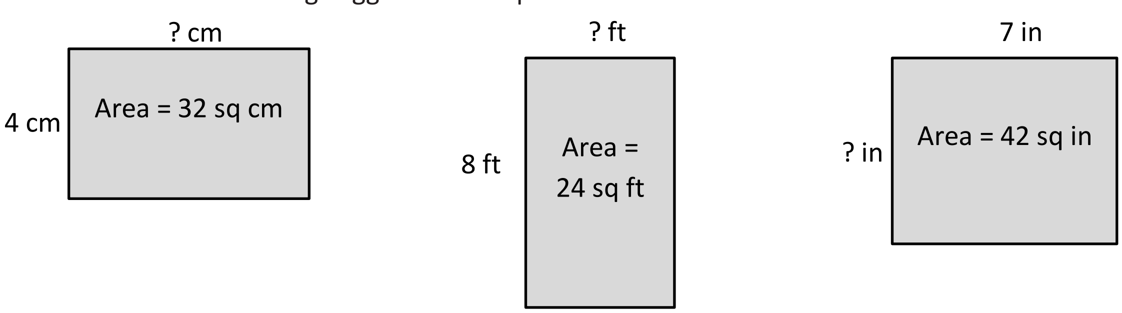
T: So what is the unknown side length?

S: 9 centimeters!

T: Write the related division equation on your board.

S: (Write 27 ÷ 3 = 9.)

Continue with the following suggested examples:

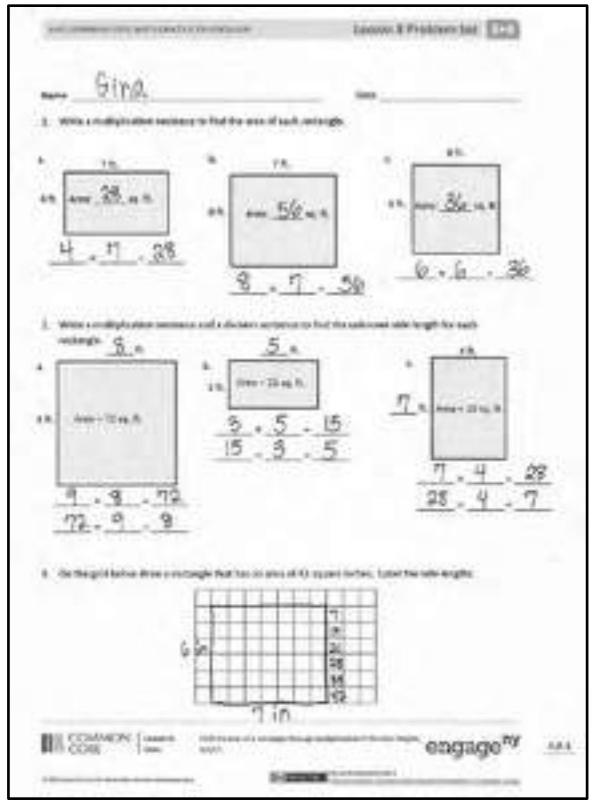


T: When you know the area and one side length of a rectangle, how can you find the other side length?

S: I can think of it as a multiplication equation with a missing factor. → Or, I can divide the area by the known side length.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.


Lesson 8 Problem Set

Gina

Area: 28 sq ft
4 × 7 = 28

Area: 56 sq ft
8 × 7 = 56

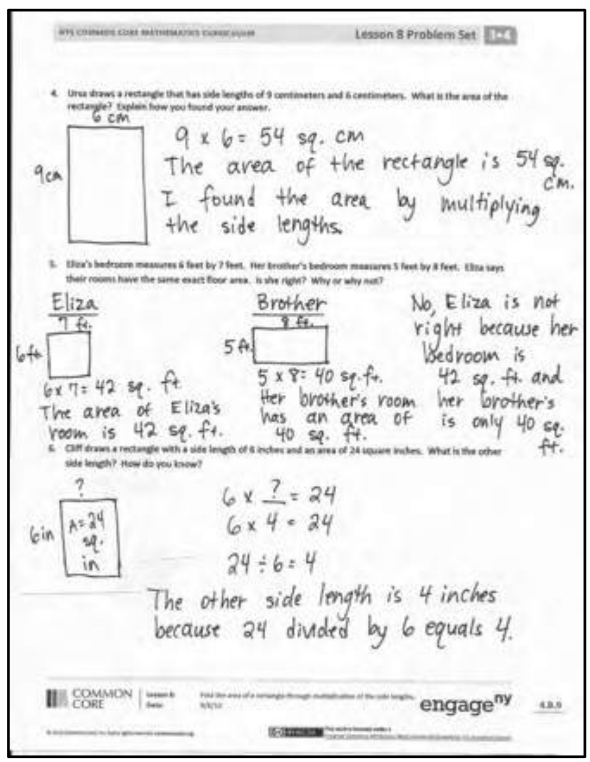
Area: 36 sq ft
6 × 6 = 36

9 ft
9 × 8 = 72
72 ÷ 9 = 8

5 ft
3 × 5 = 15
15 ÷ 3 = 5

7 ft
7 × 4 = 28
28 ÷ 4 = 7

6 in
7 in


Lesson 8 Problem Set

4. Ursa draws a rectangle that has side lengths of 9 centimeters and 6 centimeters. What is the area of the rectangle? Explain how you found your answer.

6 cm
9 cm

9 x 6 = 54 sq. cm
The area of the rectangle is 54 sq. cm.
I found the area by multiplying the side lengths.

5. Eliza's bedroom measures 6 feet by 7 feet. Her brother's bedroom measures 5 feet by 8 feet. Eliza says their rooms have the same exact floor area. Is she right? Why or why not?

Eliza
7 ft.
6 ft.
6 x 7 = 42 sq. ft
The area of Eliza's room is 42 sq. ft.

Brother
8 ft.
5 ft.
5 x 8 = 40 sq. ft.
Her brother's room has an area of 40 sq. ft.

No, Eliza is not right because her bedroom is 42 sq. ft. and her brother's is only 40 sq. ft.

6. Cliff draws a rectangle with a side length of 6 inches and an area of 24 square inches. What is the other side length? How do you know?

?
6 in
A = 24 sq. in

6 x ? = 24
6 x 4 = 24
24 ÷ 6 = 4
The other side length is 4 inches because 24 divided by 6 equals 4.

Student Debrief (10 minutes)

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

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- In what way is the area of Problem 1(b) related to the area of Problem 1(a)? (It is double.) How could you use the side lengths to help you figure out that 8 × 7 is double 4 × 7?
- Explain how you can tell a shape is a square just by looking at the side lengths (Problem 1(c)).
- How are the rectangles in Problem 1(a) and 2(c) similar? How are they different?
- Address the following possible misconception in Problem 4. Even though Eliza's bedroom has 1 side length (6 feet) that is 1 more than her brother's bedroom (5 feet), and 1 side length (7 feet) that is 1 less than her brother's bedroom (8 feet), the floor areas are not equal.
- Why is there a connection between a rectangle's side lengths and its area?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

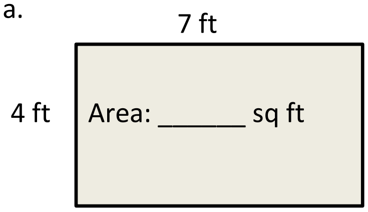
Multiply.

6 x 1 = ______	6 x 2 = ______	6 x 3 = ______	6 x 4 = ______
6 x 5 = ______	6 x 6 = ______	6 x 7 = ______	6 x 8 = ______
6 x 9 = ______	6 x 10 = ______	6 x 5 = ______	6 x 6 = ______
6 x 5 = ______	6 x 7 = ______	6 x 5 = ______	6 x 8 = ______
6 x 5 = ______	6 x 9 = ______	6 x 5 = ______	6 x 10 = ______
6 x 6 = ______	6 x 5 = ______	6 x 6 = ______	6 x 7 = ______
6 x 6 = ______	6 x 8 = ______	6 x 6 = ______	6 x 9 = ______
6 x 6 = ______	6 x 7 = ______	6 x 6 = ______	6 x 7 = ______
6 x 8 = ______	6 x 7 = ______	6 x 9 = ______	6 x 7 = ______
6 x 8 = ______	6 x 6 = ______	6 x 8 = ______	6 x 7 = ______
6 x 8 = ______	6 x 9 = ______	6 x 9 = ______	6 x 6 = ______
6 x 9 = ______	6 x 7 = ______	6 x 9 = ______	6 x 8 = ______
6 x 9 = ______	6 x 8 = ______	6 x 6 = ______	6 x 9 = ______
6 x 7 = ______	6 x 9 = ______	6 x 6 = ______	6 x 8 = ______
6 x 9 = ______	6 x 7 = ______	6 x 6 = ______	6 x 8 = ______

Name ______________________________ Date ________________

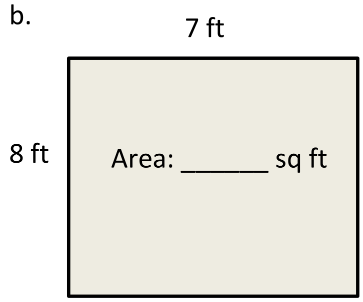
1. Write a multiplication sentence to find the area of each rectangle.

a.



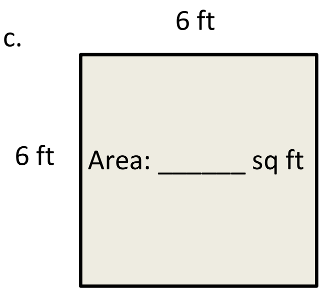
_______ × _______ = _______

b.



_______ × _______ = _______

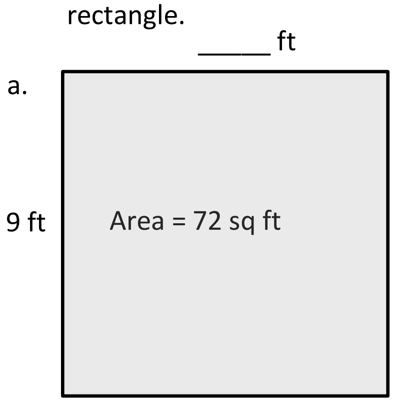
c.



_______ × _______ = _______

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

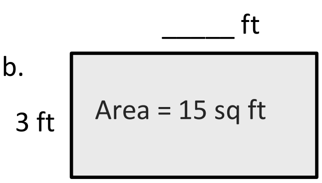
a.



_______ × _______ = _______

_______ ÷ _______ = _______

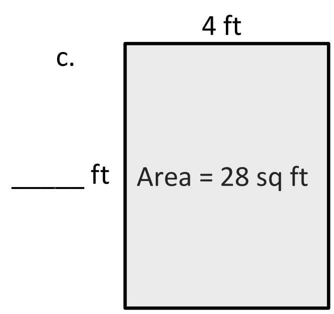
b.



_______ × _______ = _______

_______ ÷ _______ = _______

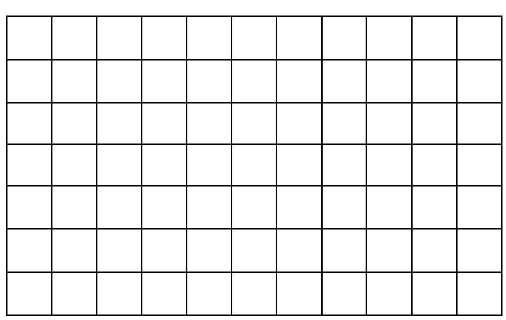
c.



_______ × _______ = _______

_______ ÷ _______ = _______

3. On the grid below, draw a rectangle that has an area of 42 square inches. Label the side lengths.



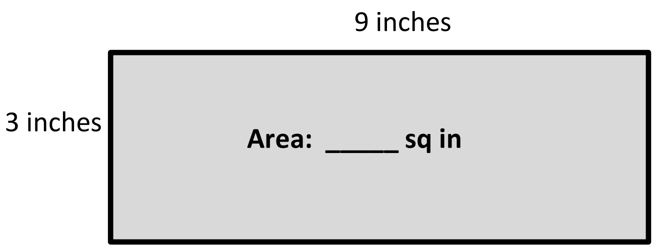
4. Ursa draws a rectangle that has side lengths of 9 centimeters and 6 centimeters. What is the area of the rectangle? Explain how you found your answer.

5. Eliza's bedroom measures 6 feet by 7 feet. Her brother's bedroom measures 5 feet by 8 feet. Eliza says their rooms have the same exact floor area. Is she right? Why or why not?

6. Cliff draws a rectangle with a side length of 6 inches and an area of 24 square inches. What is the other side length? How do you know?

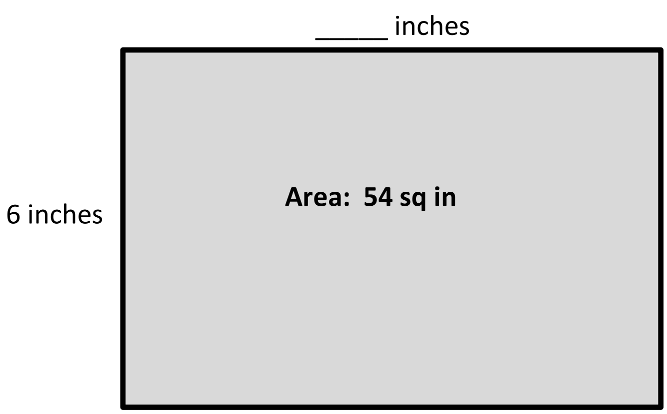
Name ____ Date ______________________

1. Write a multiplication sentence to find the area of the rectangle below.



_______ × _______ = _______

2. Write a multiplication sentence and a division sentence to find the unknown side length for the rectangle below.



_______ × _______ = _______

_______ ÷ _______ = _______

Name ______________________________________ Date ____________________

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

a.

8 cm

3 cm

Area: ______ sq cm

_______ × _______ = _______

b.

8 cm

6 cm

Area: ______ sq cm

_______ × _______ = _______

c.

4 ft

4 ft

Area: ______ sq ft

_______ × _______ = _______

d.

7 ft

4 ft

Area: ______ sq ft

_______ × _______ = _______

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

a.

_____ ft.

3 ft

Area: 24 sq ft

_______ × _______ = _______

_______ ÷ _______ = _______

b.

9 ft

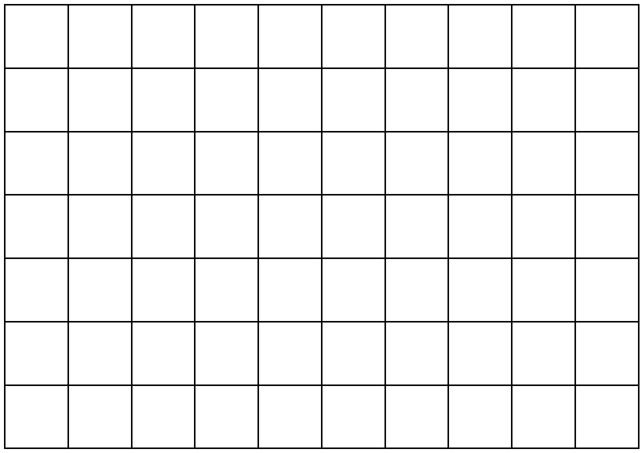
_____ ft

Area: 36 sq ft

_______ × _______ = _______

_______ ÷ _______ = _______

2. On the grid below draw a rectangle that has an area of 32 square centimeters. Label the side lengths.



3. Patricia draws a rectangle that has side lengths of 4 centimeters and 9 centimeters. What is the area of the rectangle? Explain how you found your answer.

4. Charles draws a rectangle with a side length of 9 inches and an area of 27 square inches. What is the other side length? How do you know?

Topic C

Arithmetic Properties Using Area Models

3.MD.5, 3.MD.6, 3.MD.7

Focus Standard:	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. 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:	3	
Coherence -Links from:	G2–M2	Addition and Subtraction of Length Units
	G3–M1	Properties of Multiplication and Division and Solving Problems with Units of 2–5 and 10
	G3–M3	Multiplication and Division with Units of 0, 1, 6–9, and Multiples of 10
-Links to:	G4–M3	Multi-Digit Multiplication and Division
	G4–M7	Exploring Multiplication

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 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 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.

A Teaching Sequence Towards Mastery of Arithmetic Properties Using Area Models

Objective 1: Analyze different rectangles and reason about their area.
(Lesson 9)

Objective 2: Apply the distributive property as a strategy to find the total area of a larger rectangle by adding two products.
(Lesson 10)

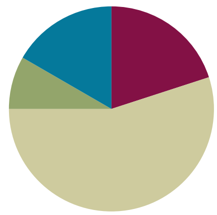
Objective 3: Demonstrate the possible whole number side lengths of rectangles with areas of 24, 36, 48, or 72 square units using the associative property.
(Lesson 11)

Lesson 9

Objective: Analyze different rectangles and reason about their area.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problems	(5 minutes)
Concept Development	(33 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Group Counting **3.OA.1** (4 minutes)
- Find the Area **3.MD.6** (4 minutes)
- Decompose the Multiplication Sentence **3.OA.5** (4 minutes)

Group Counting (4 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Fours to 40
- Sevens to 70
- Eights to 80Nines to 90

Find the Area (4 minutes)

Note: This fluency reviews strategies for finding the area of a rectangle.

T: (Project a rectangular array with 2 rows of 4 units. Write 1 tile = 1 square meter.) What does 1 tile equal?

S: 1 square meter.

T: (Point to the side length of 4 units.) This is the **length** of the rectangle. What is its value?

S: 4 meters.

T: (Point to the side length of 2 units.) This is the **width** of the rectangle. What is its value?

S: 2 meters.

T: Write a multiplication sentence to represent the area of the rectangle.

S: (Write 2 m × 4 m = 8 sq m or 4 m × 2 m = 8 sq m.)

Continue with the following possible sequence: 3 rows of 5 units, 3 rows of 7 units, 4 rows of 6 units, 4 rows of 9 units, and 6 rows of 8 units.

Decompose the Multiplication Sentence (4 minutes)

Materials: (S) Personal white boards

Note: This activity anticipates the distributive property used in G3–M4–Lesson 10, while reviewing G3–Module 3 concepts.

T: (Write 8 × 6 = (5 + ___) × 6.) On your boards, complete the number sentence.

S: (Write 8 × 6 = (5 + 3) × 6.)

T: (Write = (___ × 6) + (___ × 6).) Complete the number sentence.

S: (Write (5 × 6) + (3 × 6).)

T: Solve the multiplication problems and write an addition sentence. Below it, write your answer.

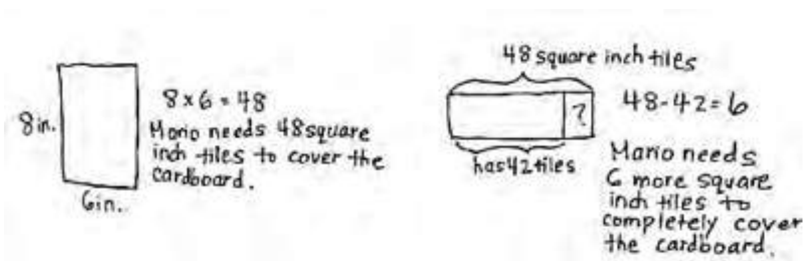
S: (Write 30 + 18 and 48 below it.)

$$
\begin{aligned}
\mathbf{8 \times 6} \quad &= (5 + 3) \times 6 \\
&= (5 \times 6) + (3 \times 6) \\
&= 30 + 18 \\
&= 48
\end{aligned}
$$

Continue with the following possible sequence: 7 × 6, 6 × 6, and 9 × 6.

Application Problem (5 minutes)

Mario plans to completely cover his 8-inch by 6-inch cardboard with square-inch tiles. He has 42 square-inch tiles. How many more square-inch tiles does Mario need to cover the cardboard without any gaps or overlap? Explain your answer.



Note: This problem reviews the concept of finding area. Students will likely solve by multiplying side lengths (shown above), having just practiced this strategy in G3–M4–Lesson 8.

Concept Development (33 minutes)

Materials: (S) Centimeter grid, personal white boards, Problem Set

Problems 1 and 2 in the Problem Set:

T: How can we cut this grid to get 2 equal rectangles?

S: Cut it in half. → If we cut on the line between the fifth and sixth squares, we'll have 2 equal rectangles. → If we fold the grid in half and cut along the fold, we can make 2 equal rectangles.

T: Do that now, and then answer Problem 1(a).

T: How can you find the area of one of the rectangles?

S: Multiply the side lengths. → Multiply 5 times 10.

T: Answer Problem 1(b). (Allow students time to work.) What is the area of one of the rectangles?

S: 50 square centimeters!

T: What is the area of the other rectangle? How do you know?

S: 50 square centimeters because the rectangles are equal.

T: How can you find the total area of the rectangles?

S: Add 50 square centimeters plus 50 square centimeters.

T: Answer Problem 1(c). (Allow students time to work.) What is the total area?

S: 100 square centimeters.

T: Place your rectangles next to each other to make 1 long rectangle. Talk to a partner. What do you think the area of this long rectangle is? Why?

S: 100 square centimeters because I added 50 square centimeters plus 50 square centimeters. → 100 square centimeters because that's the total area of the smaller rectangles and that doesn't change when we move them to make the longer rectangle.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Cutting paper with scissors may be a challenge for some learners. Precision is important to this lesson. Please try the following tips:

- Provide centimeter grids on cardstock or thicker paper.
- Darken and thicken the cutting lines.
- Provide left-handed, loop, spring, self-opening, or other adaptive scissors, if needed.
- Instruct students to turn the paper, not the scissors.
- Offer precut centimeter grids.

T: Let's see if you are right! Answer Problem 2(a). (Allow students time to work.) What multiplication fact can help you find the area of this longer rectangle?

S: 5 × 20.

T: How can you solve this multiplication fact?

S: We can think of it as 5 times 2 tens. → We could think of it as 5 × (2 × 10), which is the same as (5 × 2) × 10. → We can think of it the same way as before, as 2 equal rectangles.

T: Choose a strategy and use it to answer Problem 2(b). (Allow students time to work.) What is the area of this longer rectangle?

S: 100 square centimeters!

MP.3

T: Was your prediction about the area of this longer rectangle correct?

S: Yes!

Repeat this process, instructing students to fold 2 columns behind one of the rectangles, so they now have a 5 by 8 rectangle and a 5 by 10 rectangle. They can use their boards to record the total area of the 2 separate rectangles and the area of the longer rectangle that is made by joining the 2 smaller rectangles.

T: What did you notice about the sum of the areas of the 2 small rectangles and the area of the longer rectangle?

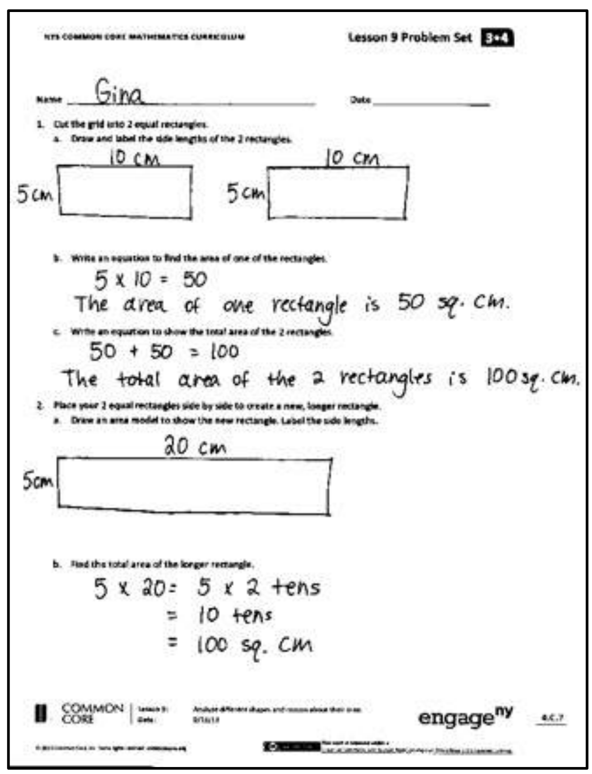
S: They're the same!

T: How can we use the areas of 2 small rectangles that form a longer rectangle to find the area of the longer rectangle?

S: Add the areas of the smaller rectangles!

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 9 Problem Set 3•4

Name Gina Date

1. Cut the grid into 2 equal rectangles.
   a. Draw and label the side lengths of the 2 rectangles.

   b. Write an equation to find the area of one of the rectangles.

5 x 10 = 50
The area of one rectangle is 50 sq. cm.

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

50 + 50 = 100
The total area of the 2 rectangles is 100 sq. cm.

2. Place your 2 equal rectangles side by side to create a new, longer rectangle.
   a. Draw an area model to show the new rectangle. Label the side lengths.

   b. Find the total area of the longer rectangle.

5 x 20 = 5 x 2 tens
= 10 tens
= 100 sq. cm

Student Debrief (10 minutes)

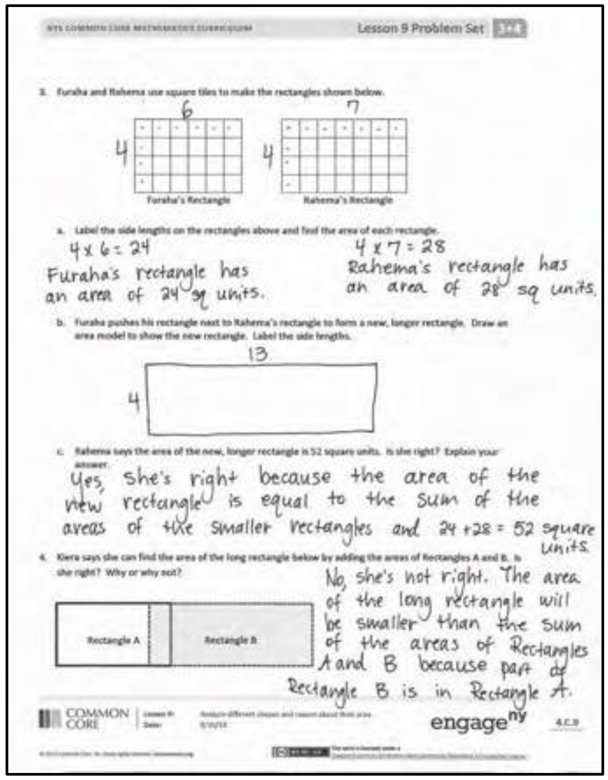
Lesson Objective: Analyze different rectangles and reason about their area.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- Talk to a partner: In Problem 1(a) how does knowing the side lengths of the grid help you find the side lengths of the small rectangles without counting?
- Did anyone use the break apart and distribute strategy to solve Problem 2(b)? Explain what you broke apart. Why did you make that choice? (In anticipation of G3–M4–Lesson 10, which uses the distributive property, ask students how the paper rectangles show the distributive property.)
- Compare the equations you used to solve Problems 1(b) and 2(b). How are they the same? How are they different?
- Explain to a partner how you found the **length** and **width** for the new rectangle in Problem 3(b).
- Did anyone multiply the side lengths to solve Problem 3(c)? What strategy did you use to multiply 4 × 13?
- How was Problem 4 different from the rest of the problems?


Lesson 9 Problem Set 3•4

3. Furaha and Rahema use square tiles to make the rectangles shown below.

Furaha's Rectangle 6 4

Rahema's Rectangle 7 4

a. Label the side lengths on the rectangles above and find the area of each rectangle.

4 x 6 = 24
Furaha's rectangle has an area of 24 sq units.

4 x 7 = 28
Rahema's rectangle has an area of 28 sq units.

b. Furaha pushes his rectangle next to Rahema's rectangle to form a new, longer rectangle. Draw an area model to show the new rectangle. Label the side lengths.

13 4

c. Rahema says the area of the new, longer rectangle is 52 square units. Is she right? Explain your answer.

Yes, she's right because the area of the new rectangle is equal to the sum of the areas of the smaller rectangles and 24 + 28 = 52 square units.

4. Kiera says she can find the area of the long rectangle below by adding the areas of Rectangles A and B. Is she right? Why or why not?

Rectangle A Rectangle B

No, she's not right. The area of the long rectangle will be smaller than the sum of the areas of Rectangles A and B because part of Rectangle B is in Rectangle A.

COMMON CORE engage^ny 4.C.9

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name ____ Date ____________________

1. Cut the grid into 2 equal rectangles.
   a. Draw and label the side lengths of the 2 rectangles.

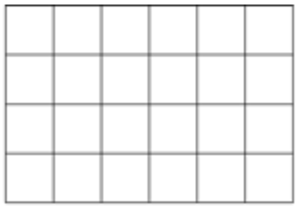
   b. Write an equation to find the area of 1 of the rectangles.

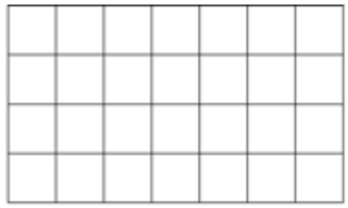
   c. Write an equation to show the total area of the 2 rectangles.

2. Place your 2 equal rectangles side by side to create a new, longer rectangle.
   a. Draw an area model to show the new rectangle. Label the side lengths.

   b. Find the total area of the longer rectangle.

3. Furaha and Rahema use square tiles to make the rectangles shown below.


Furaha's Rectangle

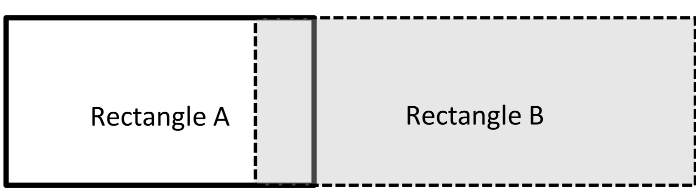

Rahema's Rectangle

a. Label the side lengths on the rectangles above and find the area of each rectangle.

b. Furaha pushes his rectangle next to Rahema's rectangle to form a new, longer rectangle. Draw an area model to show the new rectangle. Label the side lengths.

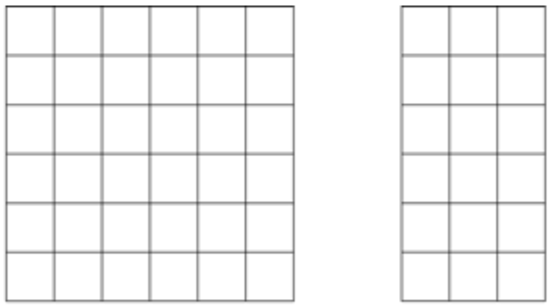
c. Rahema says the area of the new, longer rectangle is 52 square units. Is she right? Explain your answer.

4. Kiera says she can find the area of the long rectangle below by adding the areas of Rectangles A and B. Is she right? Why or why not?



Name ____ Date ____________________

Lamar uses square tiles to make the 2 rectangles shown below.



a. Label the side lengths of the 2 rectangles.

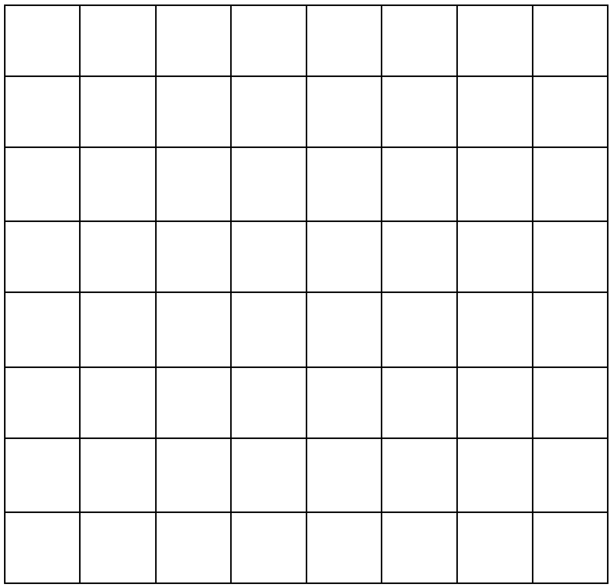
b. Write equations to find the areas of the rectangles.

Area of Rectangle A: _______________ Area of Rectangle B: _______________

c. Lamar pushes Rectangle A next to Rectangle B to make a bigger rectangle. What is the area of the bigger rectangle? How do you know?

Name ______________________________ Date ____________________

1. Use the grid to answer the questions below.



a. Draw a line to show how to divide the grid into 2 equal rectangles. Shade in 1 of the rectangles.

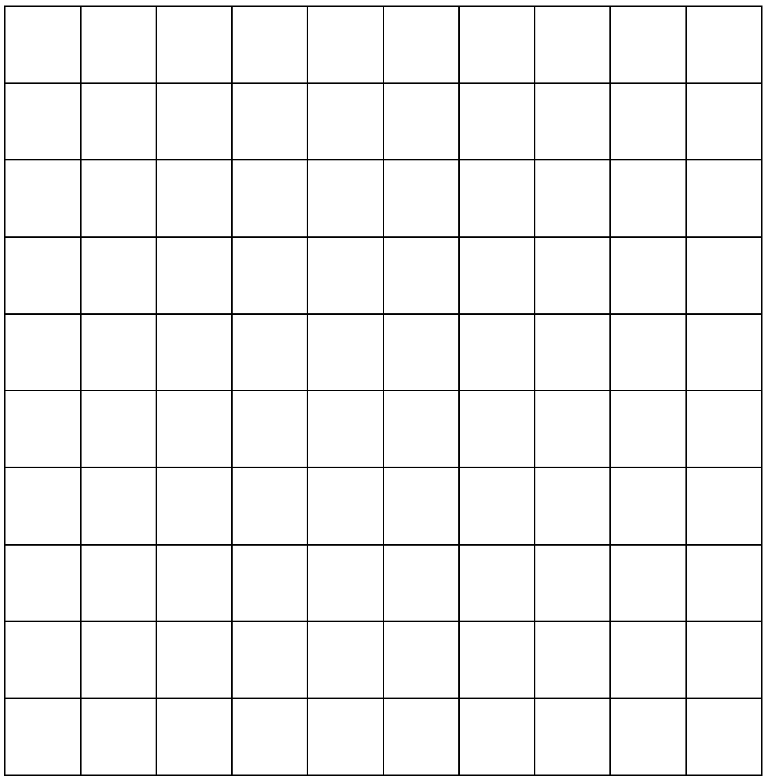
b. Label the side lengths of each rectangle.

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

2. Alexa cuts out the 2 equal rectangles from Problem 1(a) and puts the two shorter sides together.
   a. Draw Alexa's new rectangle and label the side lengths below.

   b. Find the total area of the new, longer rectangle.

   c. Is the area of the new, longer rectangle equal to the total area in Problem 1(c)? Explain why or why not.

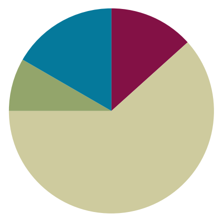


Lesson 10

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

Suggested Lesson Structure

Fluency Practice	(8 minutes)
Application Problem	(5 minutes)
Concept Development	(37 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (8 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Find the Unknown Factor **3.OA.4** (5 minutes)

Group Counting (3 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Sixes to 60
- Sevens to 70
- Eights to 80
- Nines to 90

Find the Unknown Factor (5 minutes)

Materials: (S) Personal white boards

Note: This fluency anticipates finding all possible side lengths of rectangles with areas of 12, 24, 36, 48, and 72 square units in G3–M4–Lesson 11.

T: (Write 4 × ___= 12.) Fill in the unknown factor to make a true number sentence.
S: 4 × 3 = 12.

Continue with the following possible sequence: 6 × ___ = 12, 2 × ___ = 12, and 3 × ___ = 12.

T: (Write 8 × ___ = 24.) Fill in the unknown factor to make a true number sentence.
S: (Write 8 × 3 = 24.)

Continue with the following possible sequence:

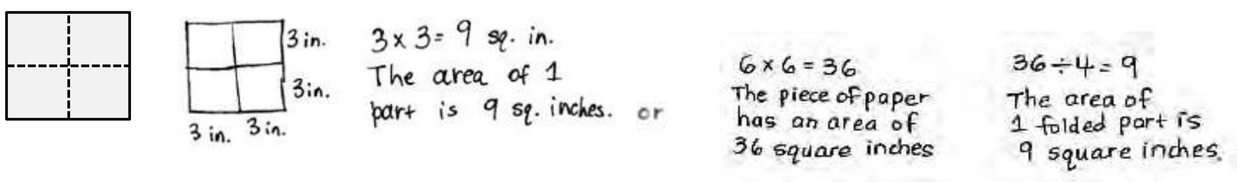
6 × ___ = 24, 3 × ___= 24, 6 × ___= 36, 9 × ___= 36, 4 × ___= 24,
4 × ___= 36, 8 × ___= 72, 8 × ___= 48, 9 × ___= 72, 6 × ___= 48,
2 × ___= 24, 12 × ___= 24, 12 × ___= 36, 12 × ___= 48,
12 × ___= 72, 3 × ___= 36, 4 × ___= 48, 6 × ___= 72, and
3 × ___= 72.

A NOTE ON 12 AS A FACTOR:

The suggested sequence for this fluency activity leads students to solve number sentences with 12 as a factor. While some students might be fluent with these facts, others might rely on the distributive property to write true number sentences. The expectation is for students to become familiar with 12 as a factor, since these number sentences will be seen in G3–M4–Lesson 11.

Application Problem (5 minutes)

Sonya folds a 6 by 6 square inch piece of paper into 4 equal parts, shown below. What is the area of 1 of the parts?



Note: This problem reviews the concept of finding area.

Concept Development (37 minutes)

Materials: (S) Personal white boards, square-centimeter tiles, tiling template

Students start with the tiling template in their personal white boards.

T: (Project the tiling template.) There are 3 rectangles we are going to focus on: the large rectangle (trace the outside of the large rectangle with your finger), the shaded rectangle (trace the shaded rectangle), and the unshaded rectangle (trace the unshaded rectangle).

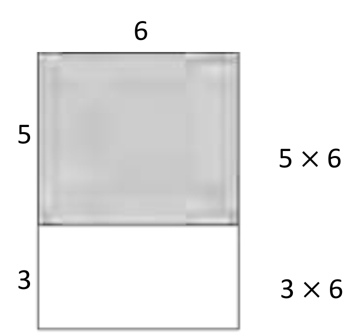
T: Use square-centimeter tiles to find the area of the large rectangle. (Allow students time to work.) What is the area of the large rectangle?

S: 48 square centimeters!

T: Use square-centimeter tiles to find the side lengths of the shaded rectangle. (Allow students time to work.) What are the side lengths?

S: 5 centimeters and 6 centimeters!

T: Label the side lengths. (Allow students time to label the side lengths.) What multiplication expression can you



(5 × 6) + (3 × 6)
= 30 + 18
= 48 square units

use to find the area of the shaded rectangle?

S: 5×6!

T: Write that expression next to the shaded rectangle. (Allow students time to write expression.) What side length do we already know for the unshaded rectangle?

S: 6 centimeters!

T: Use square-centimeter tiles to find the other side length of the unshaded rectangle. (Allow students time to work.) What is the other side length?

S: 3 centimeters!

T: Label the side length. (Allow students time to label the side length.) What multiplication expression can you use to find the area of the unshaded rectangle?

S: 3×6!

T: Write that expression next to the unshaded rectangle. (Allow students time to write expression.) How can we use these two expressions to help us find the area of the large rectangle?

S: We can add them! → The area of the shaded rectangle plus the area of the unshaded rectangle equals the area of the large rectangle.

T: Write an expression on your board to show this.

S: (Write $(5 \times 6) + (3 \times 6)$.)

T: Read your expression to a partner, and then find its value. (Allow students time to solve.) What is the area of the large rectangle?

S: 48 square units!

T: Is that the answer you got when you tiled the large rectangle?

S: Yes!

T: Write the value of the length of the large rectangle as an addition expression.

S: (Write $5 + 3$.)

T: What will you multiply by to find the area?

S: 6!

T: Write that in your expression. Where should we put parentheses?

S: Around $5 + 3$, because we need to add first to find the side length, then we can multiply.

MP.7

T: Add the parentheses to your expression. What is $5 + 3$?

S: 8!

T: What is the new expression?

S: 8×6.

T: What is the area?

S: 48 square units!

T: Is that the same answer we just got?

S: Yes!

T: (Write the expressions as shown.) How are these three expressions related?

8×6
$(5 + 3) \times 6$
$(5 \times 6) + (3 \times 6)$

S: They all show the area of the large rectangle. → Oh

MP.7

look, they show the break apart and distribute strategy! → Yeah, they show that the side length 8 is broken apart into 5 plus 3. Then 5 and 3 are multiplied by the other side length, 6.

T: Discuss with a partner how the large rectangle on your board also shows the break apart and distribute strategy.

S: (Discuss.)

Repeat the process with the following possible suggestions, providing pictures of rectangles with grid lines:

- A 15 by 8 rectangle. (Students can partition as (10 + 5) × 8. This will help students see that this strategy is helpful when they cannot multiply the side lengths because they do not know these facts.)
- An 18 by 9 rectangle. (Students can decompose as double 9 × 9 or (10 + 8) × 9.)

T: We broke apart the 18 by 9 rectangle into two 9 by 9 rectangles. What other ways could we break apart this rectangle?

S: I would do 10 by 9 and 8 by 9 rectangles.

T: Explain to a partner the process you use to decide how to break apart a side length.

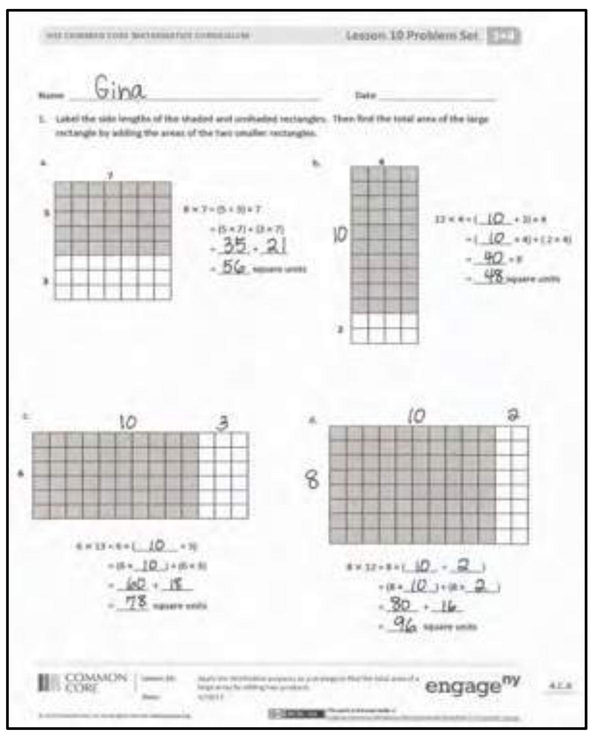
S: I look for facts I know. → I try to find a way to make a 5 or 10 because they're easy facts.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Consider directing students who may not complete the Problem Set within the allotted time to Problem 2 for valuable application and demonstration of understanding of today's objective. Offer planning and strategy development support to learners, if needed. Model a think-aloud in which you consider two or more possibilities, reason about your selection, and solve.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.



Student Debrief (10 minutes)

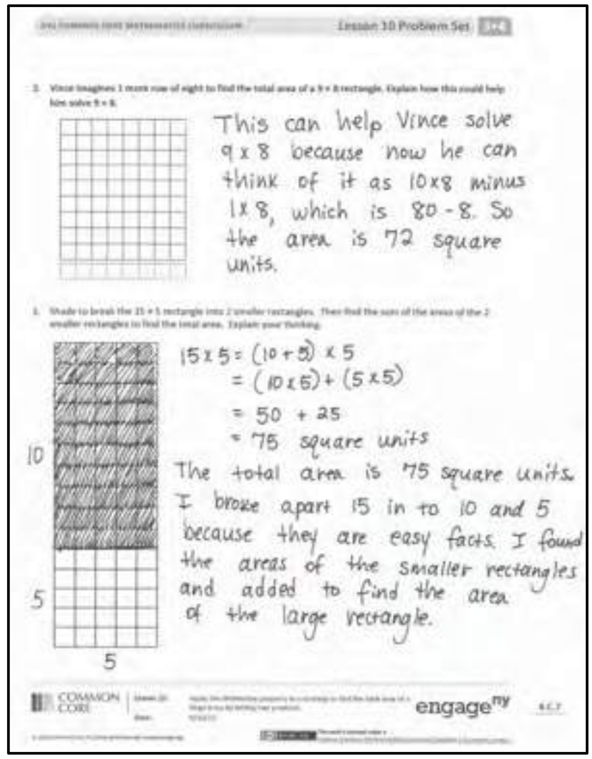
Lesson Objective: Apply the distributive property as a strategy to find the total area of a large rectangle by adding two products.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- What are the side lengths of the large rectangle in Problem 1(c)? Can you multiply these side lengths to find the area? How does the break apart and distribute strategy help you?
- Without multiplying the side lengths of the large rectangle in Problem 1(d), how could you check to make sure your answer is right? (Students might say count the squares or skip-count by eight 12 times.) Discuss with a partner, which strategy is most efficient, counting squares, skip-counting, or using the break apart and distribute strategy?
- How was setting up and solving Problem 2 different from the rest of the problems?
- What side length did you break apart in Problem 3, and how did you break it apart? Why?
- With a partner, list as many possibilities as you can for how you could use the break apart and distribute strategy to find the area of a rectangle with side lengths of 20 and 7. Can we break it into 3 parts if we want to? Which one of your possibilities would you use to solve this problem? Why?


Lesson 10 Problem Set

This can help Vince solve 9 x 8 because now he can think of it as 10 x 8 minus 1 x 8, which is 80 - 8. So the area is 72 square units.

15 x 5 = (10 + 5) x 5
= (10 x 5) + (5 x 5)
= 50 + 25
= 75 square units

The total area is 75 square units. I broke apart 15 in to 10 and 5 because they are easy facts. I found the areas of the smaller rectangles and added to find the area of the large rectangle.

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name ____ Date ______________________

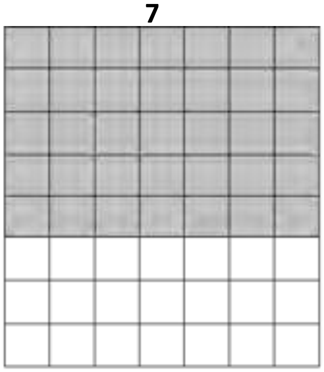
1. Label the side lengths of the shaded and unshaded rectangles. Then find the total area of the large rectangle by adding the areas of the two smaller rectangles.

a.

7

5

3



8 × 7 = (5 + 3) × 7

= (5 × 7) + (3 × 7)

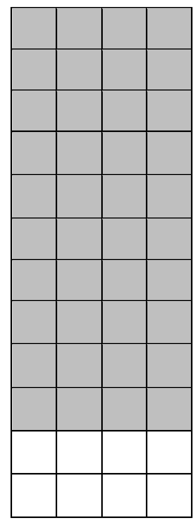
= ______ + _____

= ______ square units

b.

4

2



12 × 4 = (______ + 2) × 4

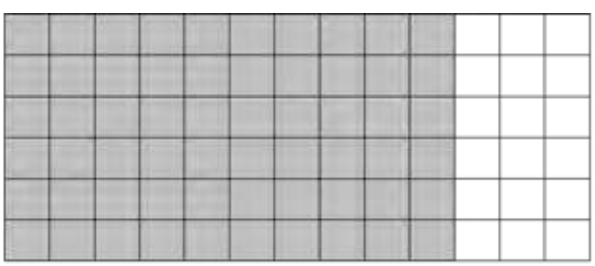
= (______ × 4) + (2 × 4)

= ______ + 8

= _____ square units

c.

6



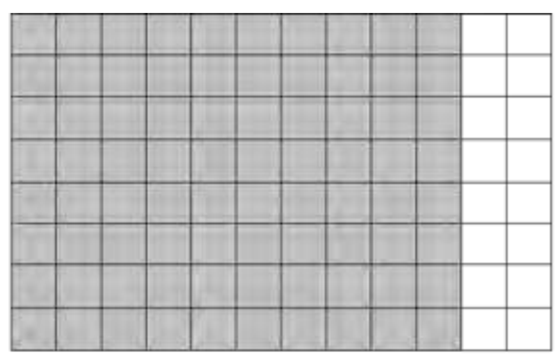
6 × 13 = 6 × (________ + 3)

= (6 ×______) + (6 × 3)

= ______ + ______

= ______ square units

d.



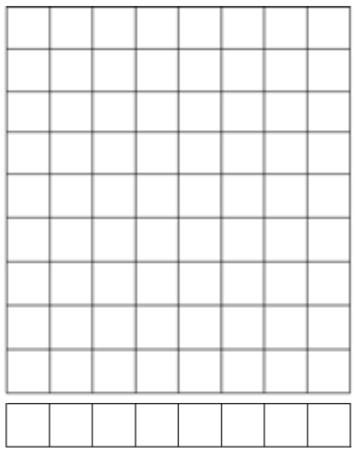
8 × 12 = 8 × (____ + _____)

= (8 × ____) + (8 × ____)

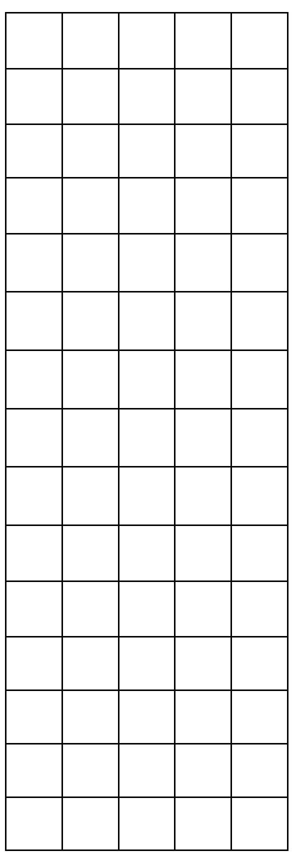
= ______ + ______

= ______ square units

2. Vince imagines 1 more row of eight to find the total area of a 9 × 8 rectangle. Explain how this could help him solve 9 × 8.



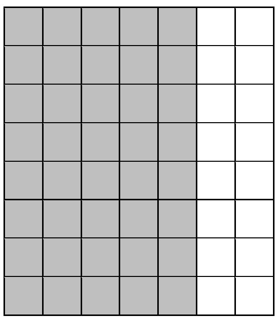
3. Shade to break the 15 × 5 rectangle into 2 smaller rectangles. Then find the sum of the areas of the 2 smaller rectangles to find the total area. Explain your thinking.



Name ____ Date ____________________

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.



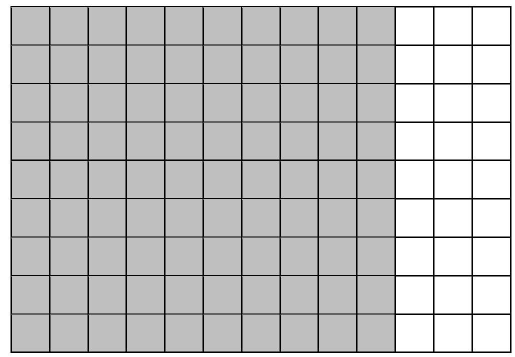
8 × 7 = 8 × (_____ + _____)

= (8 ×_____) + (8 ×_____)

= ______ + ______

= ______ square units

b.



9 × 13 = 9 × (_____ + _____)

= (____ × _____) + (_____×_____)

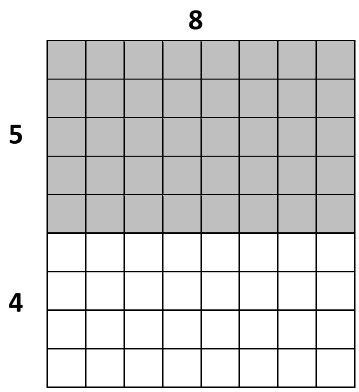
= ______ + ______

= ______ square units

Name ______________________________ Date ________________

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.



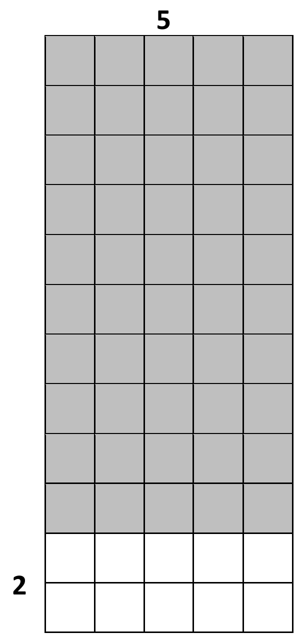
9 × 8 = (5 + 4) × 8

= (5 × 8) + (4 × 8)

= ______ + _____

= ______ square units

b.



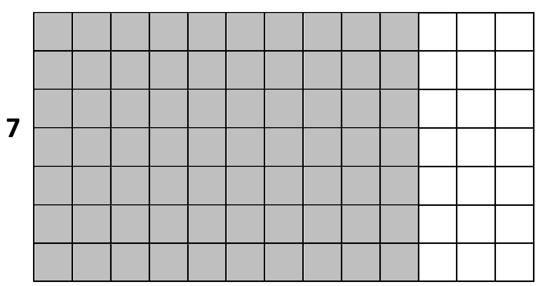
12 × 5 = (______ + 2) × 5

= (______ × 5) + (2 × 5)

= ______ + 10

= ______square units

c.



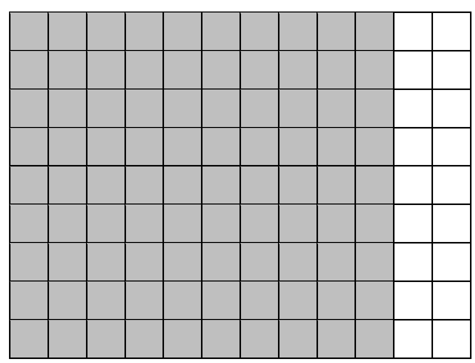
7 × 13 = 7 × (_______ + 3)

= (7 × _____) + (7 × 3)

= ______ + ______

= ______ square units

d.



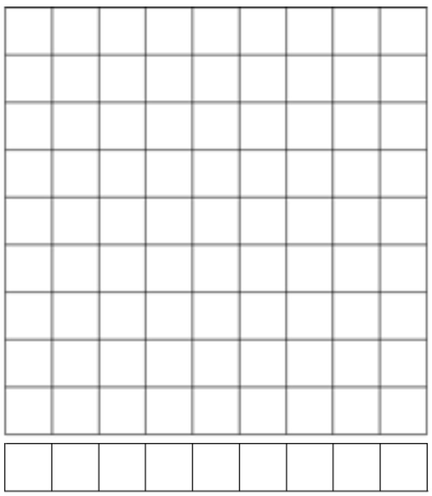
9 × 12 = 9 × (_____ + _____)

= (9 × _____) + (9 × _____)

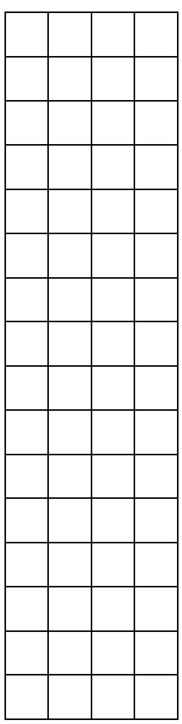
= ______ + ______

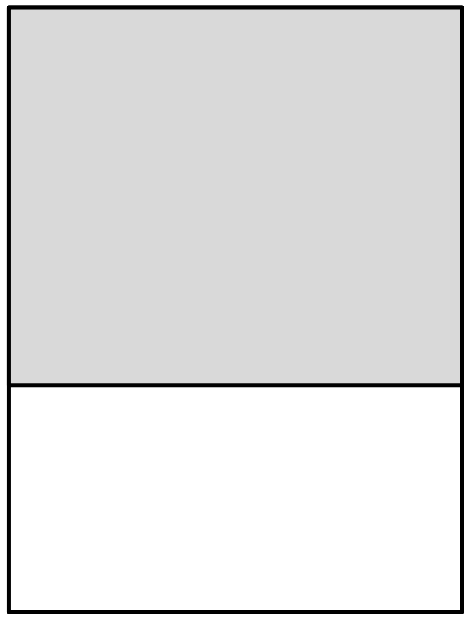
= ______ square units

2. Finn imagines 1 more row of nine to find the total area of 9 × 9 rectangle. Explain how this could help him solve 9 × 9.



3. Shade to break the 16 × 4 rectangle into 2 smaller rectangles. Then find the sum of the areas of the 2 smaller rectangles to find the total area. Explain your thinking.



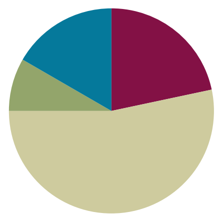


Lesson 11

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

Suggested Lesson Structure

Fluency Practice	(13 minutes)
Application Problem	(5 minutes)
Concept Development	(32 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (13 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Find the Unknown Factor **3.OA.4** (5 minutes)
- Find the Area **3.MD.7** (5 minutes)

Group Counting (3 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Sixes to 60
- Sevens to 70
- Eights to 80
- Nines to 90

Find the Unknown Factor (5 minutes)

Materials: (S) Personal white boards

Note: This fluency anticipates the objective of today's lesson.

T: (Write 6 × ___ = 12.) Fill in the unknown factor to make a true number sentence.
S: 6 × 2 = 12.

Continue with the following possible sequence: 4 × ___= 12, 2 × ___= 12, and 3 × ___= 12.

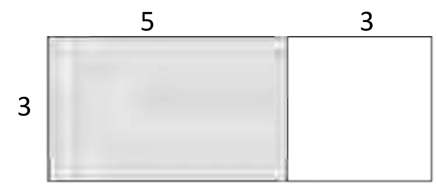
T: (Write 3 × ___= 24.) Fill in the unknown factor to make a true number sentence.
S: (Write 3 × 8 = 24.)

Continue with the following possible sequence: 4 × ___= 24, 8 × ___= 24, 6 × ___= 36, 4 × ___= 36, 6 × ___= 24, 9 × ___= 36, 9 × ___= 72, 6 × ___= 48, 8 × ___= 72, 8 × ___= 48, and 2 × ___= 24.

Find the Area (5 minutes)

Materials: (S) Personal white boards

Note: This fluency reviews using the distributive property from G3–M4–Lesson 10.



T: (Project the rectangle as shown.) On your boards, write an expression that we could use to find the area of the shaded rectangle.

S: (Write 3 × 5.)

T: On your boards, write an expression that we could use to find the area of the unshaded rectangle.

S: (Write 3 × 3.)

T: How can you use these expressions to find the area of the large rectangle?

S: Add them!

T: Write an equation, showing the sum of the shaded and unshaded rectangles. Below it, write the area of the entire rectangle.

S: (Write 15 + 9 = 24 square units.)

(3 × 5) + (3 × 3)
= 15 + 9
= 24 square units

Continue with the following possible sequence: 9 × 5 = (5 × 5) + (4 × 5), 13 × 4 = (10 × 4) + (3 × 4), and 17 × 3 = (10 × 3) + (7 × 3).

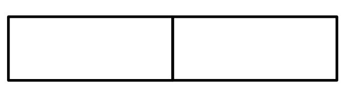
NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

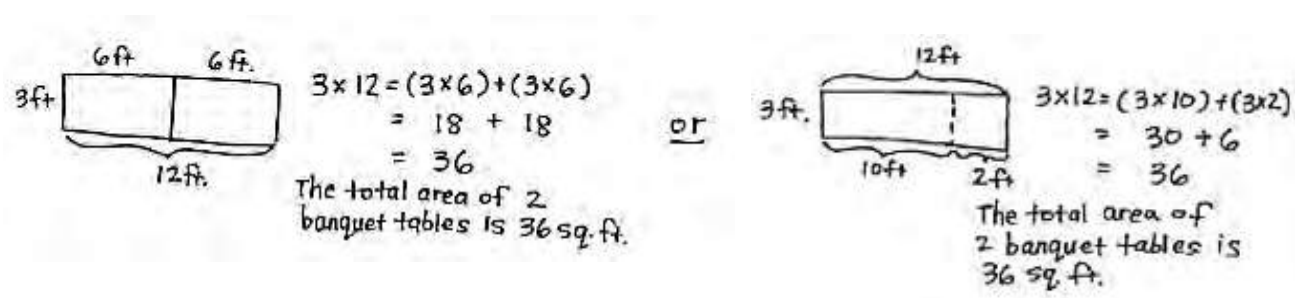
Alternatively, challenge students working above grade level with this *length unknown* version:

One fourth of the banquet table has an area of 9 square feet. If the width of the table is 3 feet, what is the length? What is the area of the table?

Application Problem (5 minutes)

The restaurant's banquet table measures 3 feet by 6 feet. For a large party, workers at the restaurant place 2 banquet tables side by side to create 1 long table. Find the area of the new, longer table.

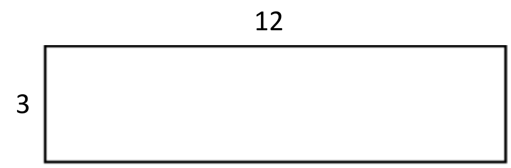




Note: This problem reviews G3–M4–Lesson 10's concept of applying the distributive property to find the total area of a large rectangle by adding two products. It also reviews factors of 36 and multiples of 12 that lead into the Concept Development.

Concept Development (32 minutes)

Materials: (S) Personal white boards



T: Write an expression to show how to find the area of a rectangle with side lengths 3 and 12.

S: (Write 3 × 12.)

T: In the Application Problem, you found that 3 times 12 is?

S: 36!

T: So, the area of this rectangle is?

S: 36 square units!

T: (Write 3 × (2 × 6).) Is this expression equal to the one you just wrote?

S: Yes, you just wrote 12 as 2 × 6.

T: Write this expression on your board with the parentheses in a different place. At my signal, show me your board. (Signal.)

S: (Show (3 × 2) × 6.)

T: Solve 3 × 2 and write the new expression on your board. (Allow students time to work.) Whisper the new expression to a partner.

S: 6 × 6.

T: What new side lengths did we find for a rectangle with an area of 36 square units?

S: 6 and 6!

T: Let's look at our expression, (3 × 2) × 6, again. Use the commutative property and switch the order of the factors in the parentheses.

S: (Write (2 × 3) × 6.)

T: Will you be able to find new side lengths by moving the parentheses?

S: (Write 2 × (3 × 6).) Yes, it'll be 2 and 18!

T: (Write 3 × (3 × 4).) Is this expression equal to our first one, 3 × 12?

S: Yes, now you wrote 12 as 3 × 4.

T: Write this expression on your board with the parentheses in a different place. At my signal, show me your board. (Signal.)

S: (Show (3 × 3) × 4.)

T: Solve 3 × 3 and write the expression on your board. (Allow students time to work.) Whisper the new expression to a partner.

S: 9 × 4.

T: What new side lengths did we find for a rectangle with an area of 36 square units?

S: 9 and 4!

T: Let's look at our expression, (3 × 3) × 4 again. If I use the commutative property and switch the order of the factors in the parentheses, will I be able to find new side lengths by moving the parentheses?

S: No, it'll still be 9 and 4. → No, because both factors in the parentheses are 3, so switching their order won't change the numbers you get when you move the parentheses.

MP.3

T: Do you think we found all the possible whole number side lengths for this rectangle?

S: Yes. → I'm not sure.

T: Let's look at our side lengths. Do you have a side length of 1?

S: No! We forgot the easiest one. → It's 1 and 36!

T: Do we have a side length of 2?

S: Yes.

T: 3?

S: Yes.

T: Work with a partner to look at the rest of your side lengths to see if you have the numbers 4 through 10. (Allow students time to work.) Which of these numbers, 4 through 10, aren't included in your side lengths?

S: 5, 7, 8, and 10.

T: Discuss with a partner why these numbers aren't in your list of side lengths.

S: 5, 7, 8, and 10 can't be side lengths because there aren't any whole numbers we can multiply these numbers by to get 36.

T: Would any two-digit times two-digit number work?

S: No, they would be too big. → No, because we know 10 × 10 equals 100 and that's bigger than 36.

T: Now do you think we found all the possible side whole number side lengths for a rectangle with an area of 36 square units?

S: Yes!

Repeat the process with rectangles that have areas of 24, 48, and 72 square units.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Extend Problem 1 for students working above grade level by inviting experimentation and choice in placing parentheses, as well as number order, in the multiplication sentences. For example, ask, "What would happen if we changed it to 4 × 6 × 2?" Encourage students to discuss or journal about their discoveries.

Assist English language learners by rephrasing Problem 4 in multiple ways. You might ask, "How does the difference between the length and width of the rectangle change the shape?"

Student Debrief (10 minutes)

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

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

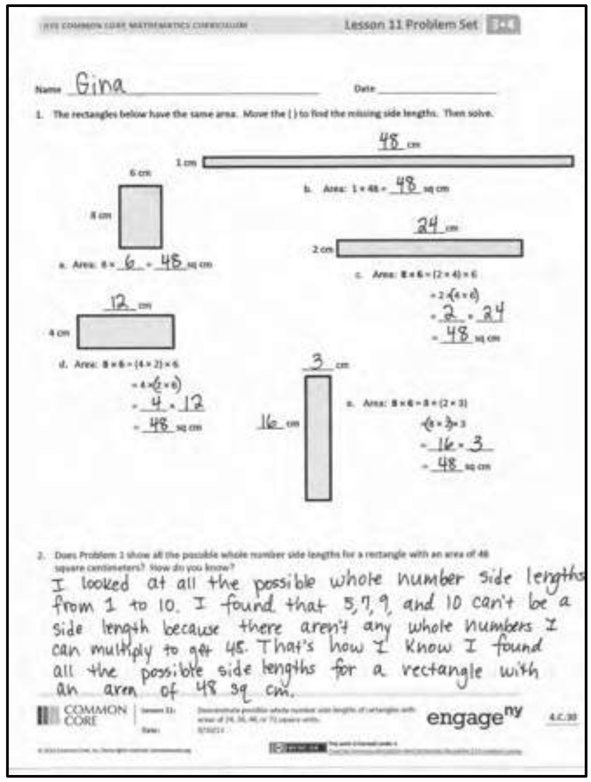
Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- Turn your paper horizontally and look at Problem 1. What property does this show?
- Share your answer to Problem 2.
- Discuss your answer to Problem 4 with a partner. What would the rectangle look like if the difference between side lengths was 0? How do you know?
- Compare your answer to Problem 5(c) with a partner's. Did you both come up with the same side lengths? Why or why not?
- Explain to a partner how to use the strategy we learned today to find all possible side lengths for a rectangle with an area of 60 square units.

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 11 Problem Set 3•4

Name Gina Date

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

a. Area: 8 × 6 = 48 sq cm

b. Area: 1 × 48 = 48 sq cm

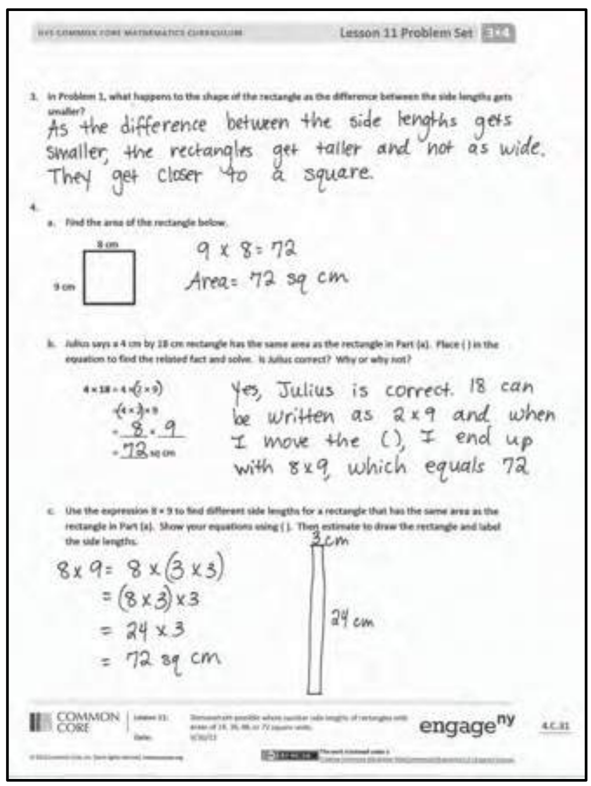
c. Area: 8 × 6 = (2 × 4) × 6 = 2 × (4 × 6) = 2 × 24 = 48 sq cm

d. Area: 8 × 6 = (4 × 2) × 6 = 4 × (2 × 6) = 4 × 12 = 48 sq cm

e. Area: 8 × 6 = 8 × (2 × 3) = (8 × 2) × 3 = 16 × 3 = 48 sq cm

2. Does Problem 1 show all the possible whole number side lengths for a rectangle with an area of 48 square centimeters? How do you know?

I looked at all the possible whole number side lengths from 1 to 10. I found that 5, 7, 9, and 10 can't be a side length because there aren't any whole numbers I can multiply to get 48. That's how I know I found all the possible side lengths for a rectangle with an area of 48 sq cm.


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 11 Problem Set 3•4

3. In Problem 1, what happens to the shape of the rectangle as the difference between the side lengths gets smaller?

As the difference between the side lengths gets smaller, the rectangles get taller and not as wide. They get closer to a square.

4.

a. Find the area of the rectangle below.

9 x 8 = 72
Area = 72 sq cm

b. Julius says a 4 cm by 18 cm rectangle has the same area as the rectangle in Part (a). Place ( ) in the equation to find the related fact and solve. Is Julius correct? Why or why not?

4 × 18 = 4 × (2 × 9) = (4 × 2) × 9 = 8 × 9 = 72 sq cm

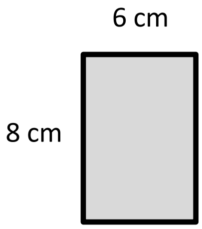
Yes, Julius is correct. 18 can be written as 2 x 9 and when I move the ( ), I end up with 8 x 9 which equals 72

c. Use the expression 8 × 9 to find different side lengths for a rectangle that has the same area as the rectangle in Part (a). Show your equations using ( ). Then estimate to draw the rectangle and label the side lengths.

8 x 9 = 8 x (3 x 3)
= (8 x 3) x 3
= 24 x 3
= 72 sq cm

Name ____ Date ____________________

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



b. Area: 1 × 48 = ______ sq cm

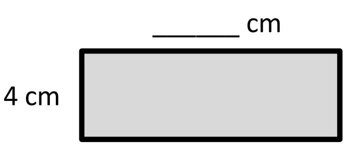
a. Area: 8 × _____ = ______sq cm

c. Area: **8 × 6** = (2 × 4) × 6

= 2 × 4 × 6

= _____ × _____

= ______ sq cm

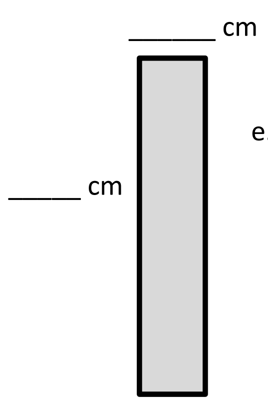


d. Area: **8 × 6** = (4 × 2) × 6

= 4 × 2 × 6

= _____ × _____

= ______ sq cm



e. Area: **8 × 6** = 8 × (2 × 3)

= 8 × 2 × 3

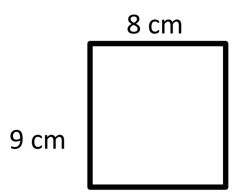
= _____ × _____

= ______ sq cm

2. Does Problem 1 show all the possible whole number side lengths for a rectangle with an area of 48 square centimeters? How do you know?

3. In Problem 1, what happens to the shape of the rectangle as the difference between the side lengths gets smaller?

4.
   a. Find the area of the rectangle below.



   b. Julius says a 4 cm by 18 cm rectangle has the same area as the rectangle in Part (a). Place ( ) in the equation to find the related fact and solve. Is Julius correct? Why or why not?

4 × 18 = 4 × 2 × 9

= 4 × 2 × 9

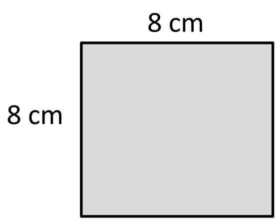
= _____ × _____

= _____ sq cm

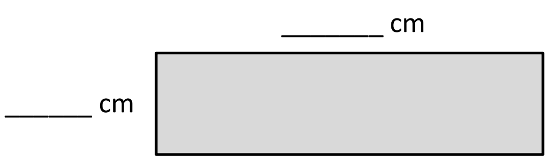
   c. Use the expression 8 × 9 to find different side lengths for a rectangle that has the same area as the rectangle in Part (a). Show your equations using ( ). Then estimate to draw the rectangle and label the side lengths.

Name ____ Date ____________________

1. Find the area of the rectangle.



2. The rectangle below has the same area as the rectangle in Problem 1. Move the ( ) to find the missing side lengths. Then solve.



Area: **8 × 8** = (4 × 2) × 8

= 4 × 2 × 8

= _____ × _____

= ______ sq cm

Name ______________________________________ Date ____________________

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

36 cm

1 cm

b. Area: 1 × 36 = ______ sq cm

9 cm

4 cm

a. Area: 4 × _____ = ______sq cm

______ cm

2 cm

b. Area: **4 × 9** = (2 × 2) × 9

= 2 × 2 × 9

= _____ × _____

= ______ sq cm

_____ cm

_____ cm

c. Area: **4 × 9** = 4 × (3 × 3)

= 4 × 3 × 3

= _____ × _____

= ______ sq cm

_____ cm

_____ cm

d. Area: **12 × 3** = (6 × 2) × 3

= 6 × 2 × 3

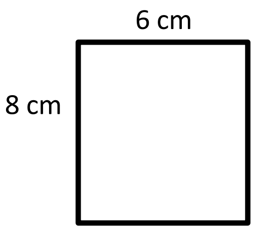
= _____ × _____

= ______ 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?

3.

a. Find the area of the rectangle below.



b. Hilda says a 4 cm by 12 cm rectangle has the same area as the rectangle in Part (a). Place ( ) in the equation to find the related fact and solve. Is Hilda correct? Why or why not?

4 × 12 = 4 × 2 × 6

= 4 × 2 × 6

= _____ × _____

= _____ sq cm

c. Use the expression 8 × 6 to find different side lengths for a rectangle that has the same area as the rectangle in Part (a). Show your equations using ( ). Then estimate to draw the rectangle and label the side lengths.

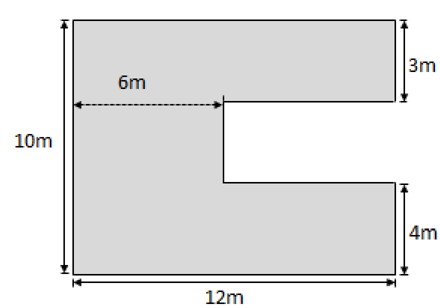
Topic D

Applications of Area Using Side Lengths of Figures

3.MD.6, 3.MD.7, 3.MD.5

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:	5	
Coherence -Links from:	G2–M2	Addition and Subtraction of Length Units
	G3–M1	Properties of Multiplication and Division and Solving Problems with Units of 2–5 and 10
	G3–M3	Multiplication and Division with Units of 0, 1, 6–9, and Multiples of 10
-Links to:	G4–M3	Multi-Digit Multiplication and Division
	G4–M7	Exploring Multiplication

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 (**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 to determine areas of rooms in a given floor plan.

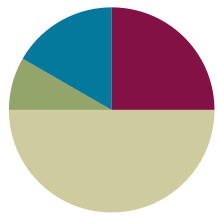
A Teaching Sequence Towards Mastery of Applications of Area Using Side Lengths of Figures	
Objective 1:	**Solve word problems involving area.** **(Lesson 12)**
Objective 2:	**Find areas by decomposing into rectangles or completing composite figures to form rectangles.** **(Lessons 13–14)**
Objective 3:	**Apply knowledge of area to determine areas of rooms in a given floor plan.** **(Lessons 15–16)**

Lesson 12

Objective: Solve word problems involving area.

Suggested Lesson Structure

Fluency Practice	(15 minutes)
Application Problem	(5 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (15 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Multiply by 7 **3.OA.7** (7 minutes)
- Find the Side Length **3.MD.7** (5 minutes)

Group Counting (3 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Fours to 40
- Sixes to 60
- Eights to 80
- Nines to 90

Multiply by 7 (7 minutes)

Materials: (S) Multiply by 7 Pattern Sheet (6–10)

Note: This activity builds fluency with multiplication facts using units of 7. It works toward students knowing from memory all products of two one-digit numbers. See G3–M4–Lesson 2 for the directions for administration of a *Multiply By* pattern sheet.

T: (Write 7 × 7 = ___.) Let's skip-count up by sevens. (Count with fingers to 7 as students count.)

S: 7, 14, 21, 28, 35, 42, 49.

T: Let's see how we can skip-count down to find the answer, too. (Show 10 fingers.) Start at 70. (Count down with your fingers as students say numbers.)

S: 70, 63, 56, 49.

Continue with the following possible sequence: 9 × 7, 6 × 7, and 8 × 7.

T: (Distribute Multiply by 7 Pattern Sheet.) Let’s practice multiplying by 7. Be sure to work left to right across the page.

Find the Side Length (5 minutes)

Materials: (S) Personal white boards

Note: This fluency reviews the relationship between side lengths and area.

T: (Project a rectangle with a width of 2 units and an unknown length. Inside the rectangle, write *Area = 10 square units*.) Say the area of the rectangle.

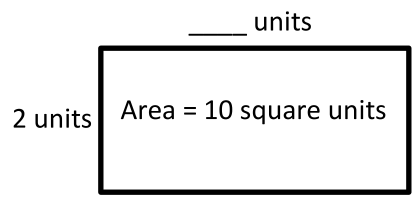
S: 10 square units.

T: What’s the width of the rectangle?

S: 2 units.

T: (Write 2 units × __ units = 10 square units.) On your boards, complete the equation, filling in the unknown length.

S: (Write 2 units × 5 units = 10 square units.**)**

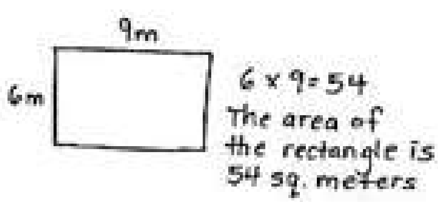


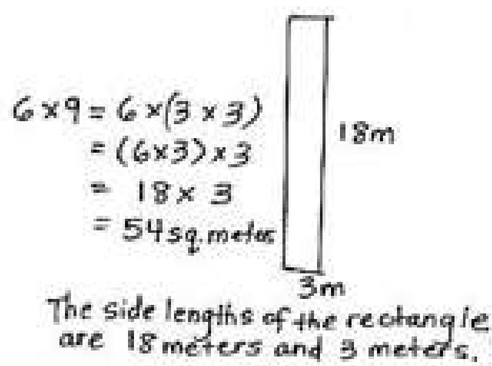
Continue with the following possible sequence: 1 unit × __ units = 8 square units, 5 units × __ = 15 square units, 3 units × __ units = 18 square units, and 6 units × __ units = 24 square units.

Application Problem (5 minutes)

a. Find the area of a 6 m by 9 m rectangle.

b. Use the side lengths, 6 m × 9 m, to find different side lengths for a rectangle that has the same area. Show your equations using parentheses. Then estimate to draw the rectangle and label the side lengths.





Note: This problem reviews using the associative property to generate whole number side lengths of rectangles with a given area.

Concept Development (30 minutes)

Materials: (S) Personal white boards

Problem 1: Solve area word problems with 1 side length unknown.

Write or project the following problem: The area of Theo's banner is 42 square feet. If the length of his banner measures 4 feet, how wide is his banner?

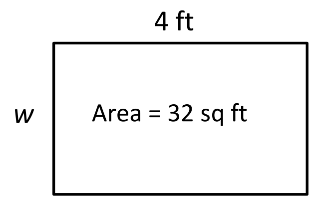
T: What information is known?

S: The area and length of Theo's banner.

T: What information is unknown?

S: The width.

T: I'll draw an area model and use a letter for the unknown. (Draw an incorrectly scaled model like the one shown at right.)



MP.6

T: If the length is 4 feet and the area is 32 square feet, can the width be less than 4 feet?

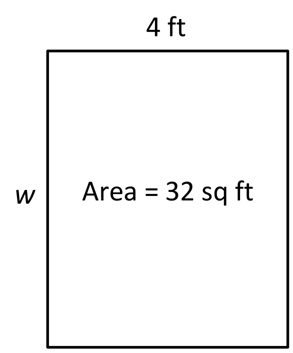
S: No, the width needs to be more than 4 feet. → The width should be more than 4 feet because 4 times 4 only equals 16, but the area is 32 square feet.

T: Talk to your partner: Is the area model I drew an accurate representation of the rectangle in the problem? How do you know?

S: No, because the width should be much longer than the length.

T: Work with your partner to correctly redraw my area model on your board.

S: (Draw as shown at right.)



T: How can we find the value of *w*?

S: Divide 32 by 4!

T: Write a division equation to find the value of *w*.

S: (Write $32 \div 4 = w$.)

T: What is the value of *w*?

S: 8!

T: So the width of Theo's banner is just 8? 8 what?

S: 8 feet!

Repeat the process with the following suggestions:

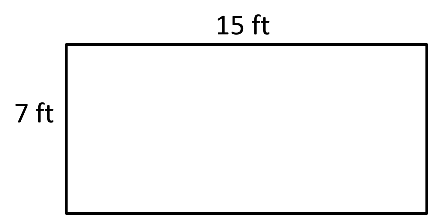
- The area of a piece of paper is 72 square inches. Margo measures the length of the paper and says it is 8 inches. What is the width of the piece of paper?
- Jillian needs to draw a rectangle with an area of 56 square centimeters and a width of 7 inches. What is the length of the rectangle that Jillian needs to draw?

Problem 2: Choose a strategy to find the area of a larger rectangle.

Write or project the following problem: Amir is getting carpet in his bedroom, which measures 7 feet by 15 feet. How many square feet of carpet will Amir need?

T: Draw an area model to represent Amir's bedroom. Write an expression that shows how to find the area.

S: (Draw as shown at right.)



Area: 7 × 15

T: Talk to your partner: How can we find the area of Amir's bedroom since the measurements are so large?

S: We can break the room up into two smaller rectangles and add their areas together. → We can also break apart one of the factors in 7 × 15 to come up with a multiplication sentence that is easier to solve.

T: Decide with your partner which strategy you'll use to find the area. Then solve.

S: (Decide on a strategy and solve.)

T: What is the area of Amir's bedroom?

S: 105 square feet!

Invite students to share which strategy they chose and why, and to articulate how they used the strategy to solve the problem. For the break apart and distribute strategy, students may have broken the rectangle apart several different ways.

Continue with the following suggested examples, encouraging students to try different strategies:

- Maya helps her family tile the bathroom wall. It measures 12 feet by 11 feet. How many square-foot tiles does Maya need to cover the wall?
- Francis washes all of the windows outside his parents' bookstore. There are 5 windows, each one is 6 feet wide and 8 feet high. What is the total area of the windows that Francis washes?

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Offer planning and strategy development support to learners if needed. Some learners may use a method simply because they are not fluent in an alternative method. Model a think-aloud in which you consider two or more strategies, reason about your selection, and solve. This may take more time than allotted here. You may want to pre-teach to preserve the pace of the lesson and to maximize every student's participation.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

During the Problem Set, extend Problem 4 for students working above grade level. Have students model all possible rectangles with an area of 64. Or, have students model up to eight ways of breaking their rectangle (Part b) into two smaller rectangles. Make it an exciting, perhaps timed, competition. Always offer challenges and extensions to learners as alternatives, rather than additional "busy" work.

Student Debrief (10 minutes)

Lesson Objective: Solve word problems involving area.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

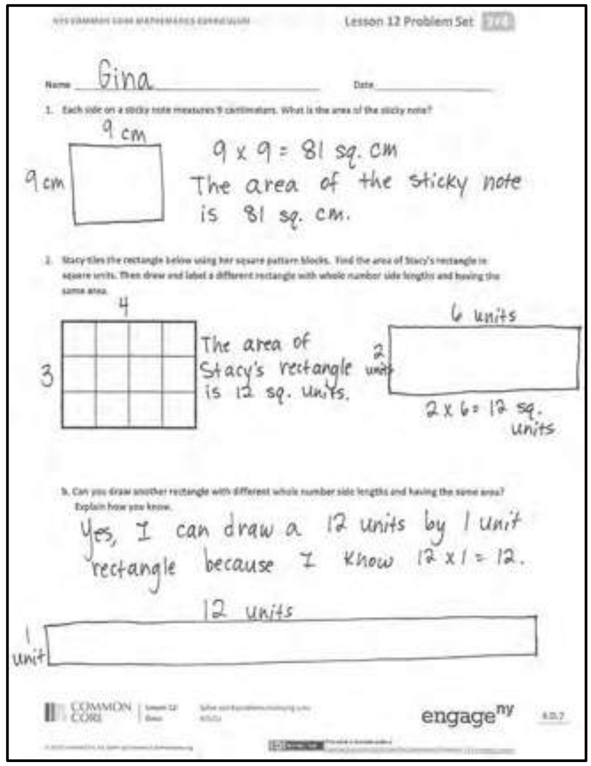
Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- What shape is the sticky note in Problem 1? How do you know?
- Share student explanations to Problem 2(b).
- What is another way the artist's mural in Problem 3 could have been broken apart?
- How did you identify Alana's pattern in Problem 4?
- Discuss how you found the area of two pieces of Jermaine's paper in Problem 5. Why was it necessary to find the missing side length first? Are there any other ways to find the area of the two pieces of paper? (81 – 27 = 54 sq cm.)
- How were all of today's word problems related? Does the unknown in a problem change the way you solve it? Why or why not?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.


Lesson 12 Problem Set

Name Gina

9 cm

9 cm

9 x 9 = 81 sq. cm

The area of the sticky note is 81 sq. cm.

4

3

The area of Stacy's rectangle is 12 sq. units.

6 units

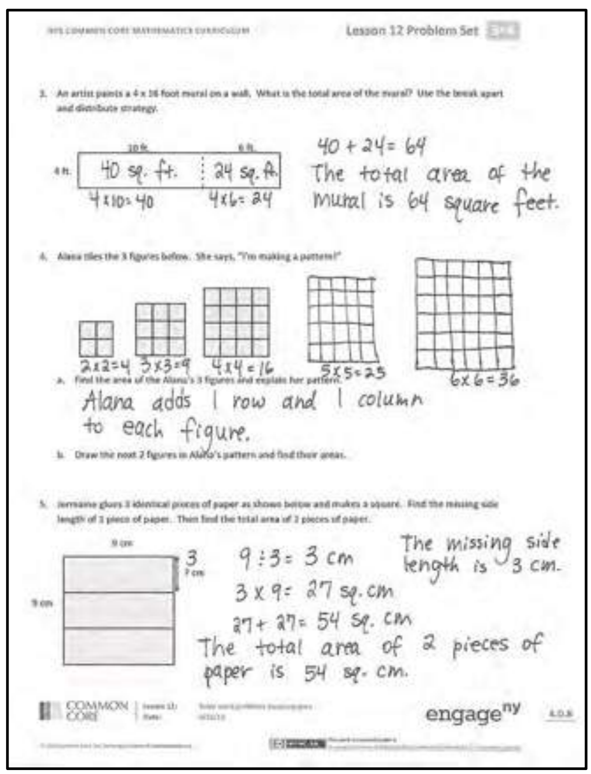
2 units

2 x 6 = 12 sq. units

Yes, I can draw a 12 units by 1 unit rectangle because I know 12 x 1 = 12.

12 units

1 unit


Lesson 12 Problem Set

10 ft. 6 ft.

4 ft.

40 sq. ft. 24 sq. ft.

4 x 10 = 40 4 x 6 = 24

40 + 24 = 64

The total area of the mural is 64 square feet.

2x2=4 3x3=9 4x4=16 5x5=25 6x6=36

Alana adds 1 row and 1 column to each figure.

9 cm

9 cm

3 cm

9 ÷ 3 = 3 cm

3 x 9 = 27 sq. cm

27 + 27 = 54 sq. cm

The missing side length is 3 cm.

The total area of 2 pieces of paper is 54 sq. cm.

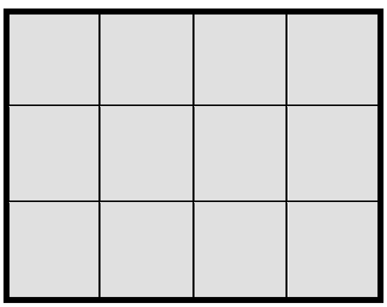
Multiply.

7 x 1 = ______	7 x 2 = ______	7 x 3 = ______	7 x 4 = ______
7 x 5 = ______	7 x 6 = ______	7 x 7 = ______	7 x 8 = ______
7 x 9 = ______	7 x 10 = ______	7 x 5 = ______	7 x 6 = ______
7 x 5 = ______	7 x 7 = ______	7 x 5 = ______	7 x 8 = ______
7 x 5 = ______	7 x 9 = ______	7 x 5 = ______	7 x 10 = ______
7 x 6 = ______	7 x 5 = ______	7 x 6 = ______	7 x 7 = ______
7 x 6 = ______	7 x 8 = ______	7 x 6 = ______	7 x 9 = ______
7 x 6 = ______	7 x 7 = ______	7 x 6 = ______	7 x 7 = ______
7 x 8 = ______	7 x 7 = ______	7 x 9 = ______	7 x 7 = ______
7 x 8 = ______	7 x 6 = ______	7 x 8 = ______	7 x 7 = ______
7 x 8 = ______	7 x 9 = ______	7 x 9 = ______	7 x 6 = ______
7 x 9 = ______	7 x 7 = ______	7 x 9 = ______	7 x 8 = ______
7 x 9 = ______	7 x 8 = ______	7 x 6 = ______	7 x 9 = ______
7 x 7 = ______	7 x 9 = ______	7 x 6 = ______	7 x 8 = ______
7 x 9 = ______	7 x 7 = ______	7 x 6 = ______	7 x 8 = ______

Name ______________________________________ Date ____________________

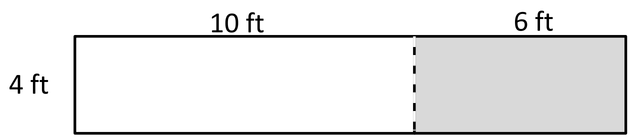
1. Each side on a sticky note measures 9 centimeters. What is the area of the sticky note?

2. Stacy tiles the rectangle below using her square pattern blocks. Find the area of Stacy's rectangle in square units. Then draw and label a different rectangle with whole number side lengths and having the same area.

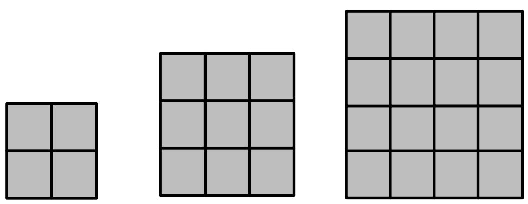


b. Can you draw another rectangle with different whole number side lengths and having the same area? Explain how you know.

3. An artist paints a 4 × 16 foot mural on a wall. What is the total area of the mural? Use the break apart and distribute strategy.



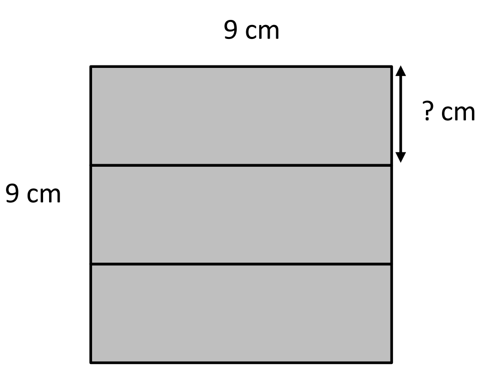
4. Alana tiles the 3 figures below. She says, "I'm making a pattern!"



a. Find the area of the Alana's 3 figures and explain her pattern.

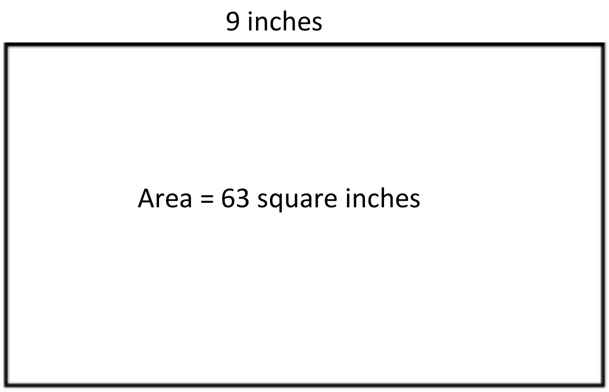
b. Draw the next 2 figures in Alana's pattern and find their areas.

5. Jermaine glues 3 identical pieces of paper as shown below and makes a square. Find the missing side length of 1 piece of paper. Then find the total area of 2 pieces of paper.



Name ______________________________ Date ________________

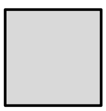
1. A painting has an area of 63 square inches. One side length is 9 inches. What is the other side length?

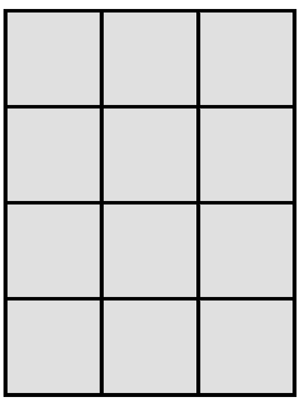


2. Judy's mini dollhouse measures 4 inches by 16 inches. What is the total area of the dollhouse?

Name ______________________________ Date ____________________

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

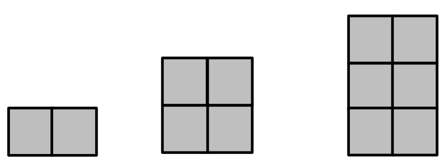
2. Each  is 1 square unit. Sienna uses the same square units to draw a 6 × 2 rectangle and says that it has the same area as the rectangle below. Is she correct? Explain why or why not.



3. The surface of an office desk has an area of 15 square feet. Its length is 5 feet. How wide is the office desk?

4. A rectangular garden has a total area of 48 square yards. Draw and label two possible rectangular gardens with different side lengths having the same area.

5. Lila makes the pattern below. Find and explain her pattern. Then draw the **fifth** figure in her pattern.



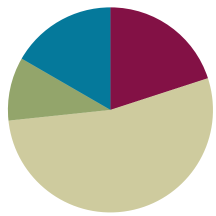
Lesson 13

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

Suggested Lesson Structure

- Fluency Practice (12 minutes)
- Application Problem (6 minutes)
- Concept Development (32 minutes)
- Student Debrief (10 minutes)

Total Time (60 minutes)



Fluency Practice (12 minutes)

- Group Counting **3.OA.1** (4 minutes)
- Find the Common Products **3.OA.7** (8 minutes)

Group Counting (4 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

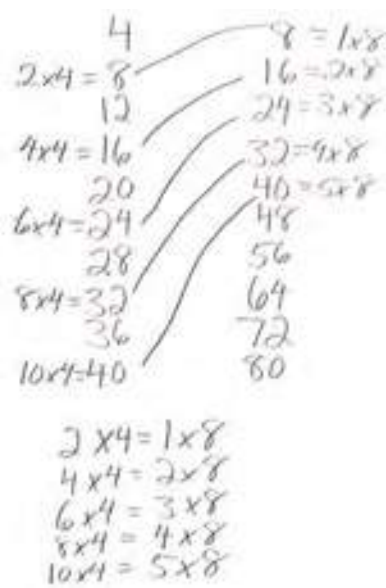
- Threes to 30
- Sixes to 60
- Eights to 80
- Nines to 90

Find the Common Products (8 minutes)

Materials: (S) Blank paper

Note: This fluency reviews multiplication patterns.

After listing the multiples of 4 and 8, guide students through the following steps.



T: Draw a line to match the numbers that appear in both columns.

S: (Match 8, 16, 24, 32, and 40.)

T: (Write 2 × 4 = 8, etc., next to each matched number on the left half of the paper.) Write the rest of the number sentences like I did.

S: (Write number sentences.)

T: (Write 8 = 1 × 8, etc., next to each matched number on the right half of the paper.) Write the rest of the number sentences like I did.

S: (Write number sentences.)

T: (Write 2 × 4 = __ × 8.) Say the true number sentence.

S: 2 × 4 = 1 × 8.

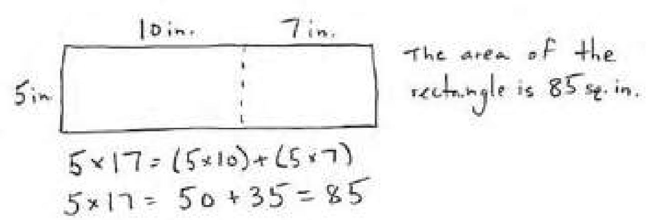
T: (Write 2 × 4 = 1 × 8.) Write the remaining equal facts as number sentences.

S: (Write 4 × 4 = 2 × 8, 6 × 4 = 3 × 8, 8 × 4 = 4 × 8, and 10 × 4 = 5 × 8.)

T: Discuss the patterns in your number sentences.

Application Problem (6 minutes)

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?



Note: This problem reinforces the strategy of breaking a larger shape apart into 2 smaller shapes to find the total area.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

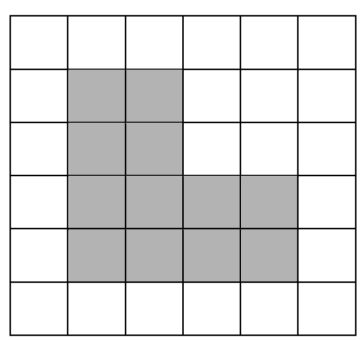
Students who solve the Application Problem quickly may enjoy comparing their solution strategy with others. They may discuss or journal about their reasoning.

Concept Development (32 minutes)

Materials: (S) Personal white boards, grid template

Problem 1: Add using the break apart strategy to find area of a composite shape.

Distribute one grid template to each student. Draw or project the shape shown at right.



T: Draw and shade the shape on your grid template.

S: (Draw and shade.)

T: How do you find the area of a rectangle?

S: Multiply the side lengths!

T: Talk to your partner: Can we find the area of the shaded figure by multiplying side lengths? How do you know?

S: No, because it isn't a rectangle. → We can count the unit squares inside, though.

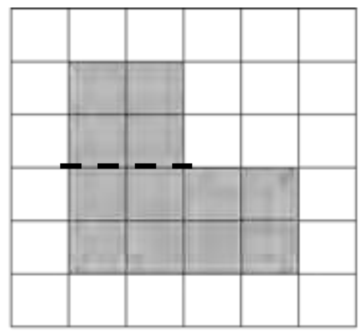
T: In the Application Problem, we used the break apart and distribute strategy to find the area of a larger rectangle by breaking it into smaller rectangles. Turn and talk to your partner: How might we use a strategy like that to find the area of the shaded figure?

S: We can break it into a square and a rectangle. → We can break it into three squares.

T: Draw a dotted line to show how to break the shaded figure apart into a square and rectangle.

S: (Draw.)

T: (Model as shown at right.) What equation tells you the area of the square on top?



S: 2 × 2 = 4!

T: What equation tells you the area of the rectangle on bottom?

S: 2 × 4 = 8!

T: How do we use those measurements to find the area of the shaded figure?

MP.7

S: Add them together!

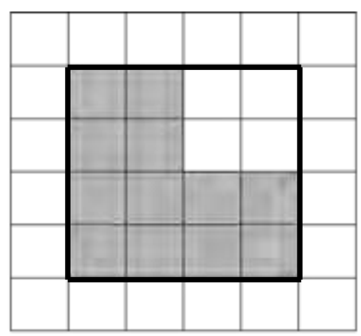
T: What is the sum of 8 and 4?

S: 12.

T: What is the area of the shaded figure?

S: 12 square units!

Draw or project the shape shown at right.

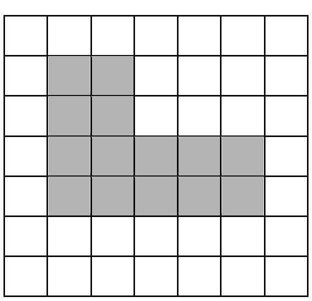


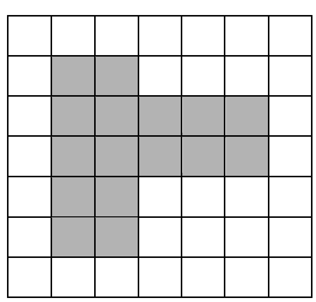
T: We can also find the area of the shaded figure by thinking about a 4 × 4 square with missing units. Turn and talk to your partner: How can we find the shaded area using our square?

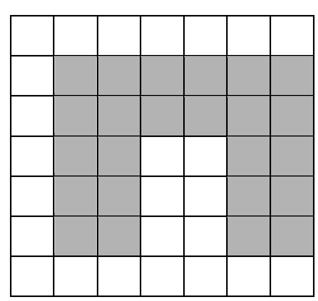
S: The area of the square is 16 square units. → Since the entire square isn't shaded, we need to subtract the 4 units that are unshaded. → 16 – 4 = 12 square units.

T: There are different strategies of finding the area of a figure. It just depends on how you choose to look at it.

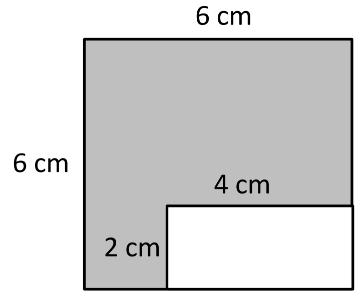
Continue with the following suggested examples:







Problem 2: Subtract to find area of a composite shape.



Draw or project the shape shown at right.

T: This figure shows a small rectangle cut out of a larger, shaded rectangle. How can we find the area of the shaded figure?

S: We can break apart the shaded part. → Or we can subtract the unshaded area from the shaded square.

T: (Shade in the white shape.) We now have a large, shaded square. Write a number sentence to find the area of the large square.

S: (Write 6 × 6 = 36.)

T: What is the area of the square?

S: 36 square centimeters.

T: (Erase the shading inside the white rectangle.) Beneath the number sentence you just wrote, write a number sentence to find the area for the shape we "cut out."

S: (Write 2 × 4 = 8.)

T: What is the area of the white shape?

S: 8 square centimeters.

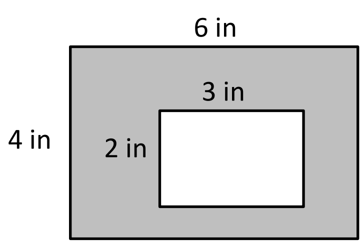
T: The area of the square is 36 square centimeters. We cut out, or took away, 8 square centimeters of shading. Turn and talk to you partner. How can we find the area of the shaded region?

S: Subtract 8 square centimeters from 36 square centimeters!

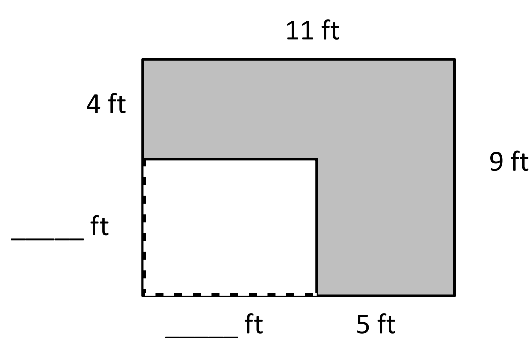
T: Write a number sentence to find the area of the shaded region.

S: (Write 36 – 8 = 28.)

Continue with the following example:



Problem 3: Subtract to find area of a composite shape with missing side lengths.



Draw or project the shape shown at right.

T: This figure also shows a small rectangle cut out of a larger, shaded rectangle, but what is missing?

S: The side lengths of the smaller rectangle.

T: Do we have enough information to find the side lengths of the smaller rectangle?

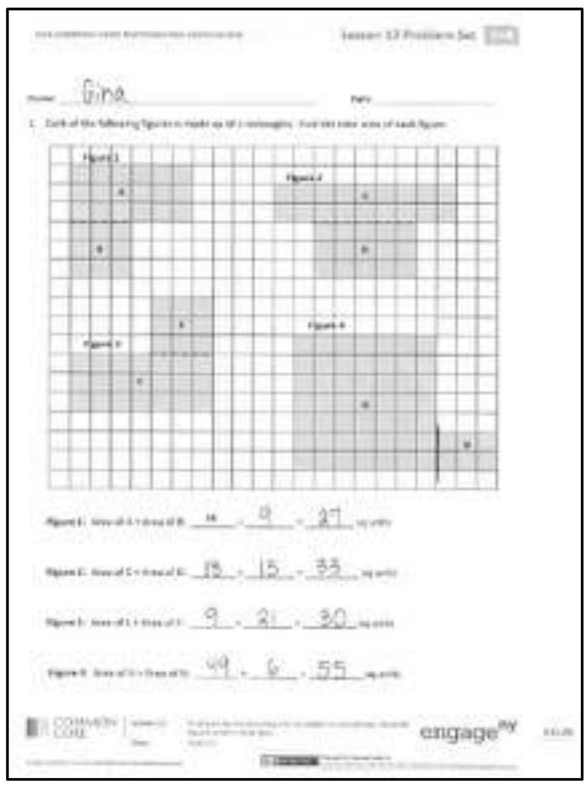
S: No, I don't think so. → We know the side lengths of the larger rectangle. → Maybe we can subtract to the find the missing side lengths.
T: Opposite sides of a rectangle are equal. Since we know the length of the rectangle is 9 feet, what is the opposite side length?
S: 9 feet.
T: You can then find the missing lengths by subtracting the total, 9 feet, from the known length, 4 feet.
S: The missing length is 5 feet!
T: Use the same strategy to find the missing width.
S: (Write 11 – 5 = 6.)
T: What is the missing width?
S: 6 feet!
T: Can we now find the area of the shaded figure?
S: Yes!
T: With your partner, find the area of the shaded figure.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Extend Problem 3 for students working above grade level. Challenge students to think about a real life scenario in which this model might be used and to write a word problem to match. Always offer challenges and extensions to learners as alternatives. Here, a student might be given the option of solving one other problem in addition to this extension. Another option would be to direct students to solve the problem you intend to discuss in the Student Debrief.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.



Student Debrief (10 minutes)

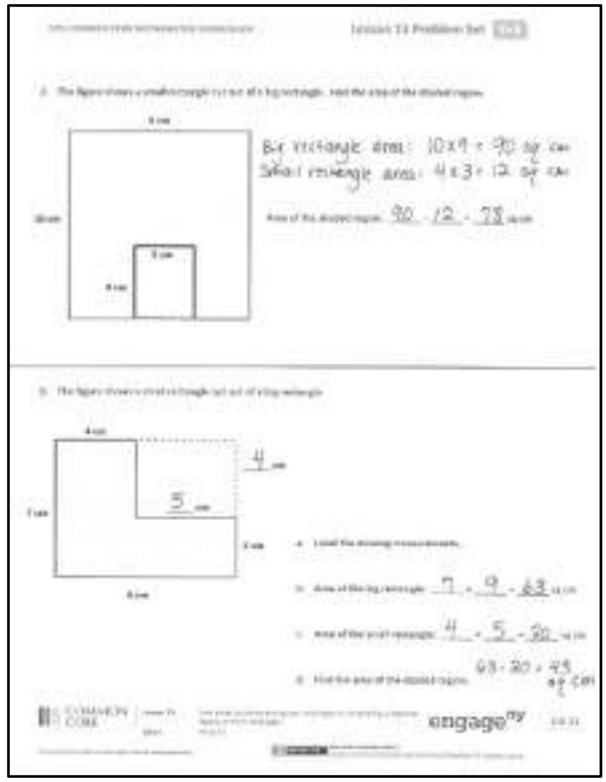
Lesson Objective: Find areas by decomposing into rectangles or completing composite figures to form rectangles.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- How did you break apart the rectangles in Figure 4?. Did anyone break apart the rectangles in a different way? (A rectangle of 10 by 2).
- In Problem 2, a 4-cm by 3-cm rectangle was cut out of a bigger rectangle. What other measurements could have been cut out to keep the same area for the shaded region?
- How did you find the unknown measurements in Problem 3?
- How were today's strategies examples of using what we know to solve new types of problems?



Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name ______________________________________ Date ____________________

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

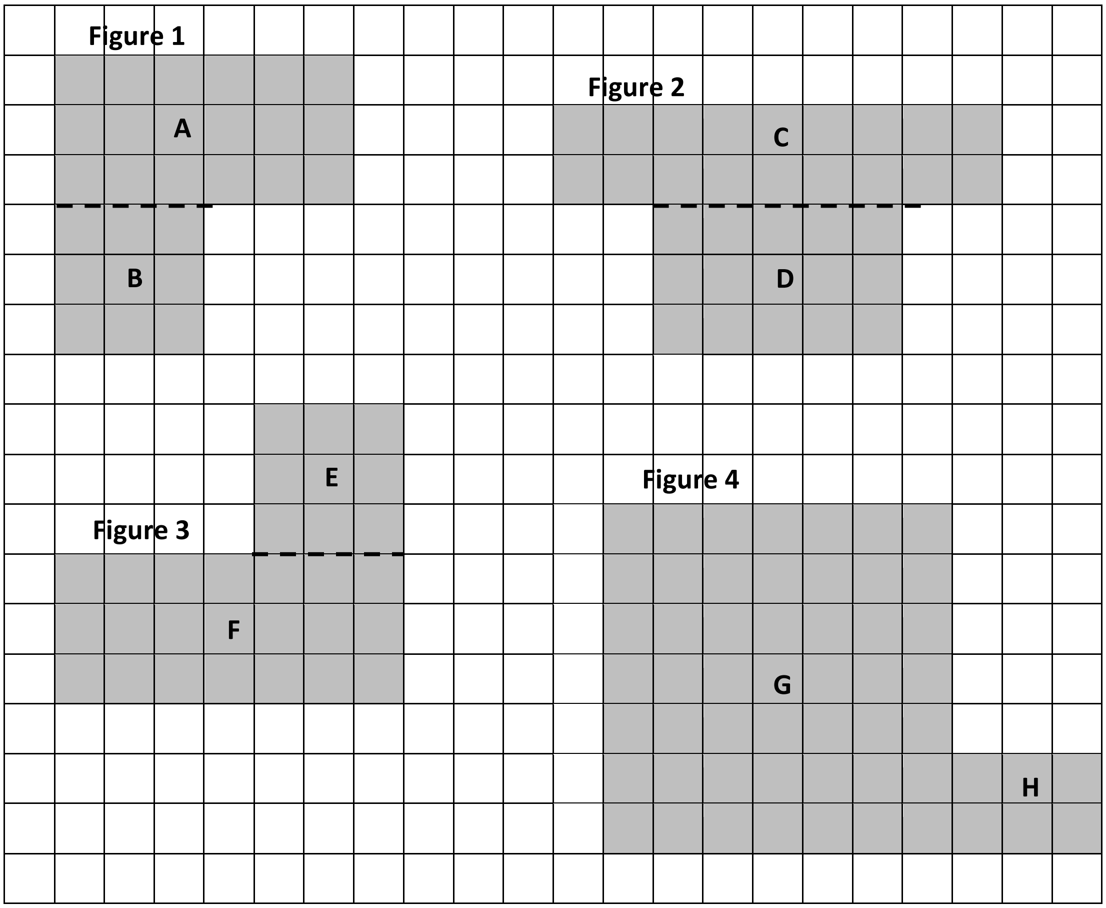


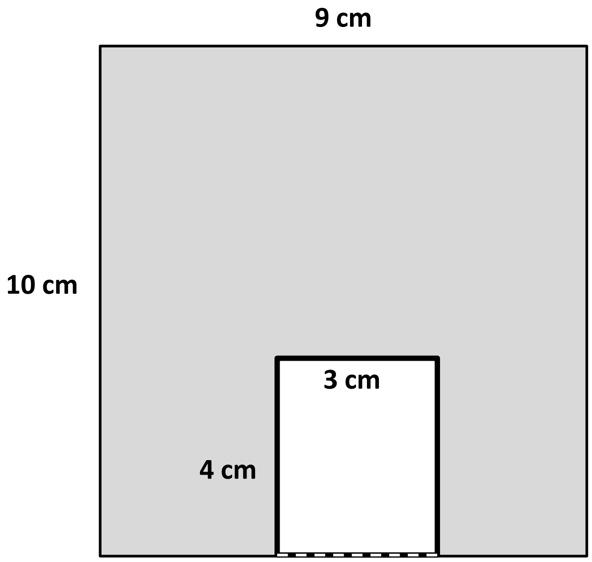
Figure 1: Area of A + Area of B: ___18___ + _________ = _________ sq units

Figure 2: Area of C + Area of D: ________ + _________ = __________ sq units

Figure 3: Area of E + Area of F: ________ + _________ = __________ sq units

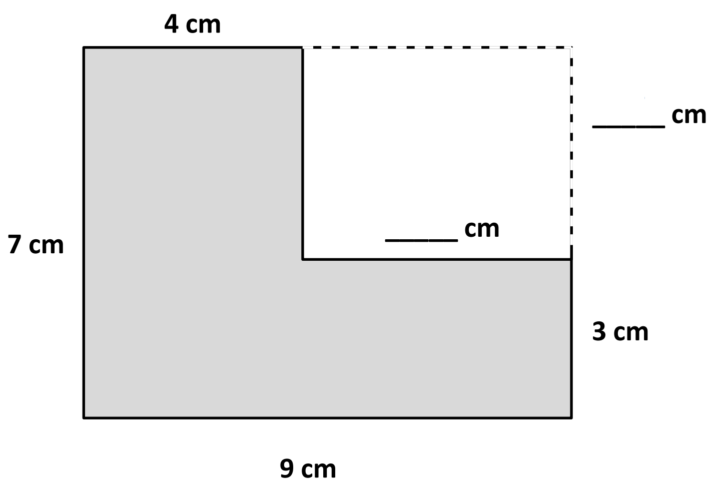
Figure 4: Area of G + Area of H: ________ + _________ = __________ sq units

2. The figure shows a small rectangle cut out of a big rectangle. Find the area of the shaded region.



Area of the shaded region: ______ – ______ = ______ sq cm

3. The figure shows a small rectangle cut out of a big rectangle.



a. Label the missing measurements.

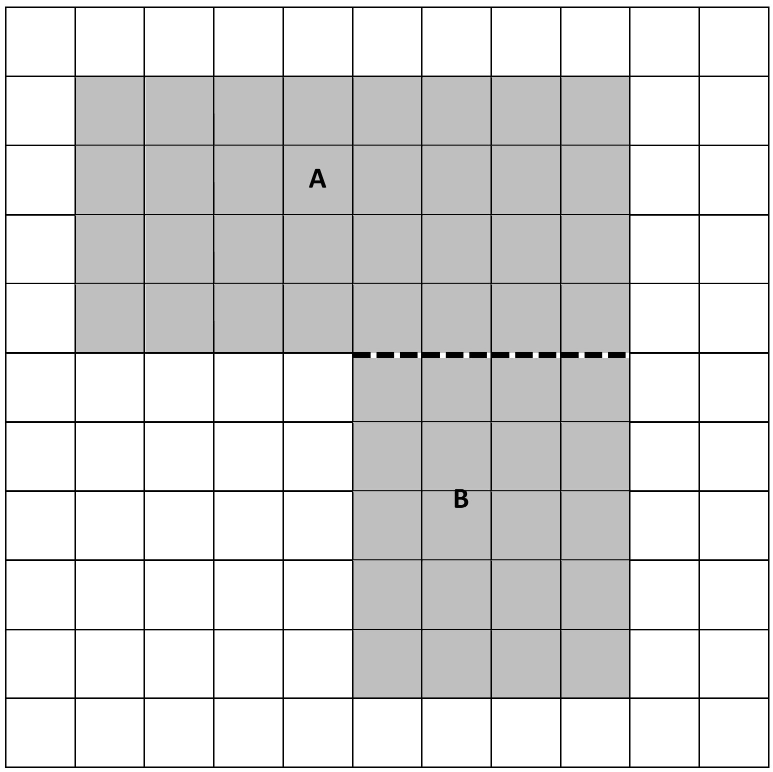
b. Area of the big rectangle: ______ × ______ = ______ sq cm

c. Area of the small rectangle: ______ × ______ = ______ sq cm

d. Find the area of the shaded region.

Name ____ Date ____________________

The following figure is made up of 2 rectangles. Find the total area of the figure.



Area of A + Area of B: ________ + _________ = _________ sq units

Name ____ Date ____________________

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

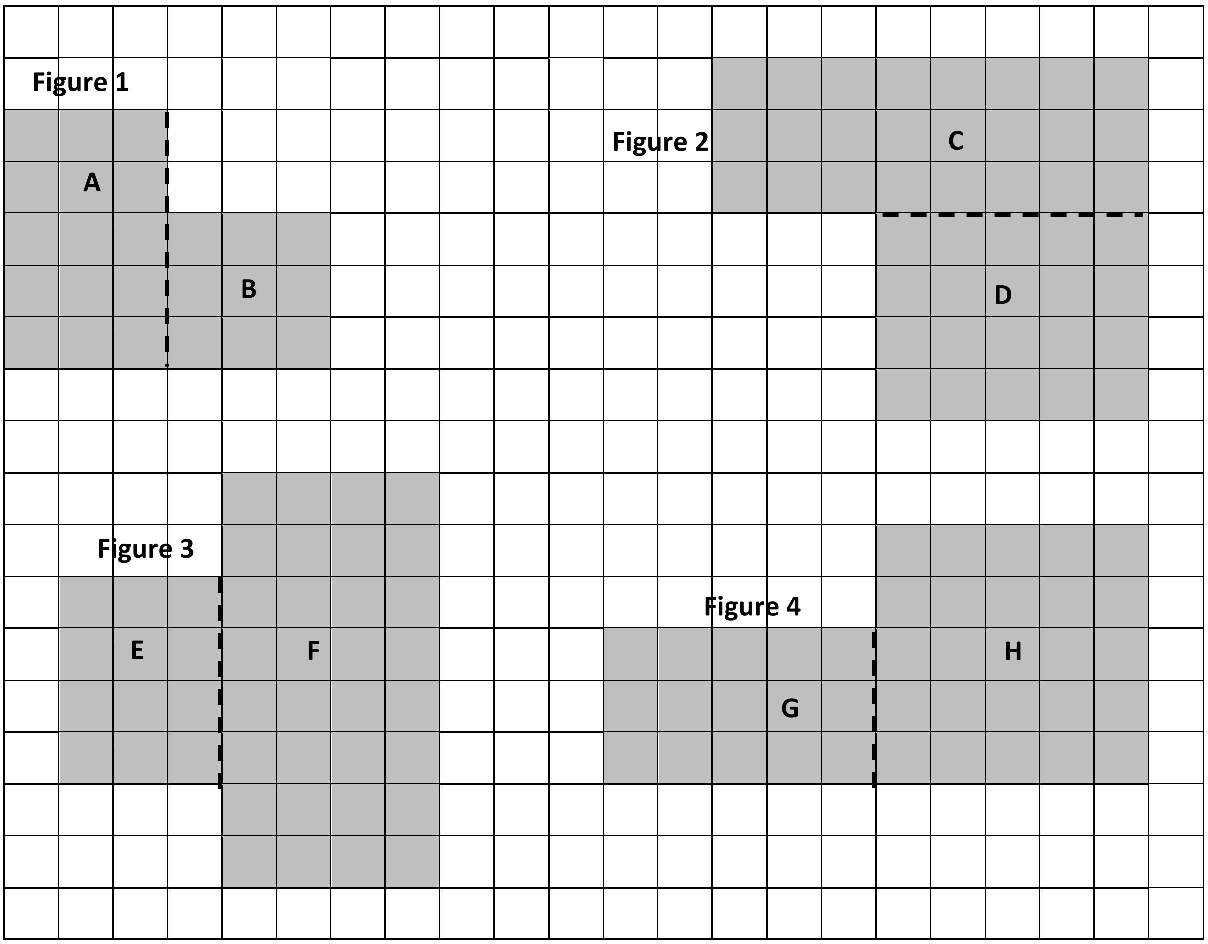


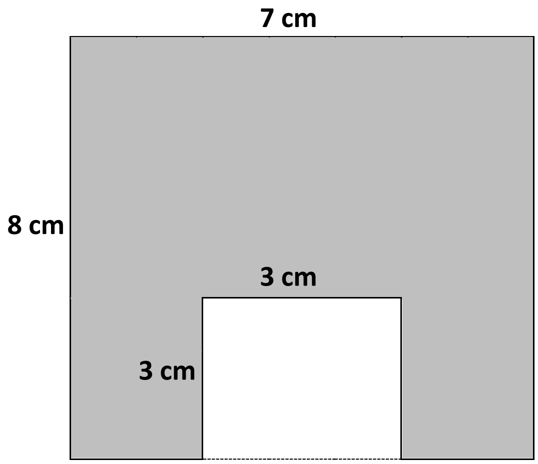
Figure 1: Area of A + Area of B: ________ + _________ = _________ sq units

Figure 2: Area of C + Area of D: ________ + _________ = __________ sq units

Figure 3: Area of E + Area of F: ________ + _________ = __________ sq units

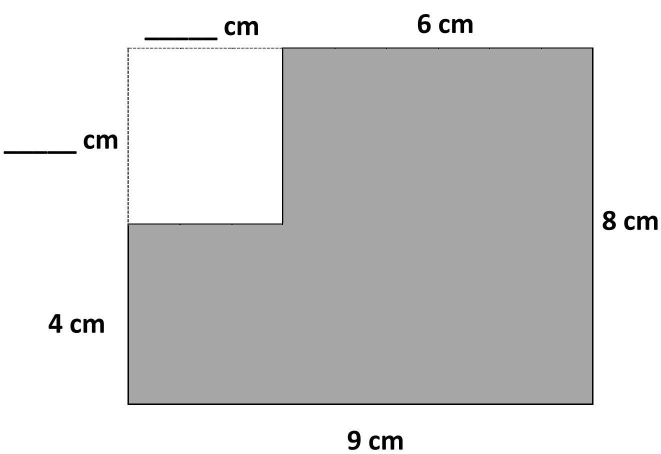
Figure 4: Area of G + Area of H: ________ + _________ = __________ sq units

2. The figure shows a small rectangle cut out of a big rectangle. Find the area of the shaded region.



Area of the shaded region: ______ - ______ = ______ sq cm

3. The figure shows a small rectangle cut out of a big rectangle.

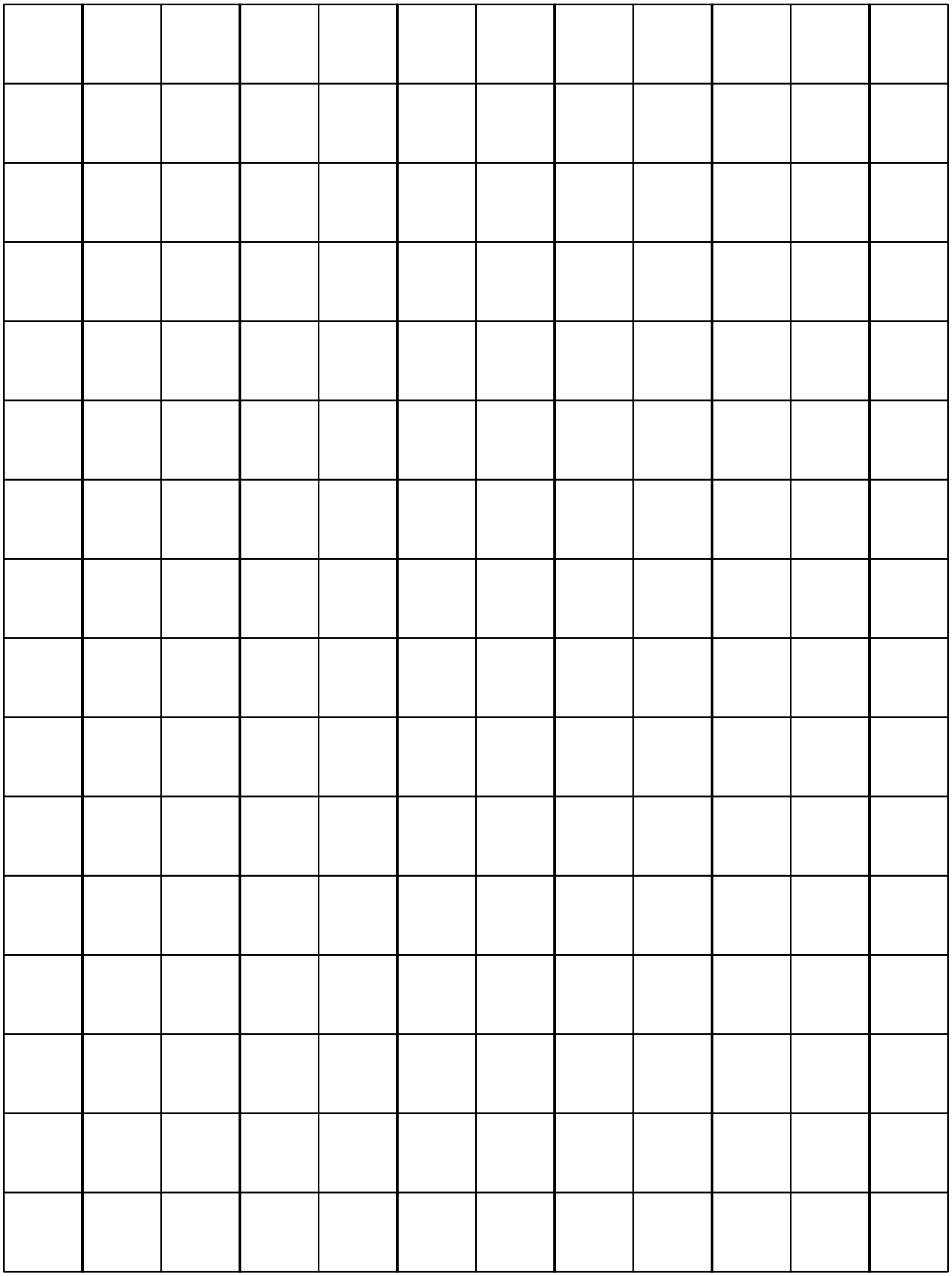


a. Label the missing measurements.

b. Area of the big rectangle: ______ × ______ = ______ sq cm

c. Area of the small rectangle: ______ × ______ = ______ sq cm

d. Find the area of the shaded region.

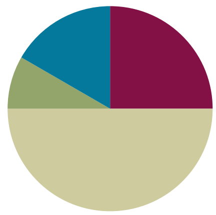


Lesson 14

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

Suggested Lesson Structure

Fluency Practice	(15 minutes)
Application Problem	(5 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (15 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Multiply by 8 **3.OA.7** (7 minutes)
- Find the Area **3.MD.7** (5 minutes)

Group Counting (3 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Fours to 40
- Sixes to 60
- Sevens to 70
- Nines to 90

Multiply by 8 (7 minutes)

Materials: (S) Multiply By 8 Pattern Sheet (6–10)

Note: This activity builds fluency with multiplication facts using units of 8. It works toward students knowing from memory all products of two one-digit numbers. See G3–M4–Lesson 2 for the directions for administration of a *Multiply By* pattern sheet.

T: (Write 6 × 8 = ___.) Let's skip-count up by eights to solve. (Count with fingers to 6 as students count.)

S: 8, 16, 24, 32, 40, 48.

T: Let's skip-count down to find the answer, too. Start at 80. (Count down with fingers as students count.)

S: 80, 72, 64, 56, 48.

T: Let's skip-count up again to find the answer, but this time start at 40. (Count up with fingers as students count.)

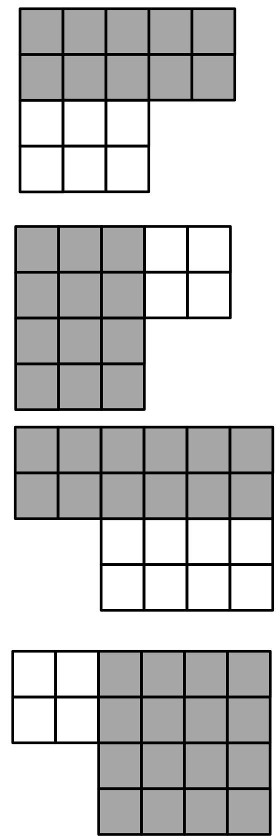
S: 40, 48.

Continue with the following possible sequence: 8 × 8, 7 × 8, and 9 × 8.

T: (Distribute Multiply by 8 pattern sheet.) Let's practice multiplying by 8. Be sure to work left to right across the page.

Find the Area (5 minutes)

Figures for *Find the Area*



Materials: (S) Personal white boards

Note: This fluency reviews the relationship between side lengths and area and supports the perception of the composite shapes by moving from part to whole using a grid.

T: (Project the first figure on the right.) On your boards, write a number sentence to show the area of the shaded rectangle.

S: (Write 5 × 2 = 10 square units or 2 × 5 = 10 square units.)

T: Write a number sentence to show the area of the unshaded rectangle.

S: (Write 3 × 2 = 6 square units or 2 × 3 = 6 square units.)

T: (Write __ sq units + __ sq units = __ sq units.) Using the areas of the shaded and unshaded rectangle, write an addition sentence to show the area of the entire figure.

S: (Write 10 sq units + 6 sq units = 16 sq units or 6 sq units + 10 sq units = 16 sq units.)

Continue with the other figures.

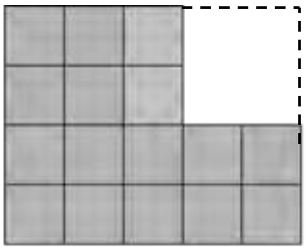
Application Problem (5 minutes)

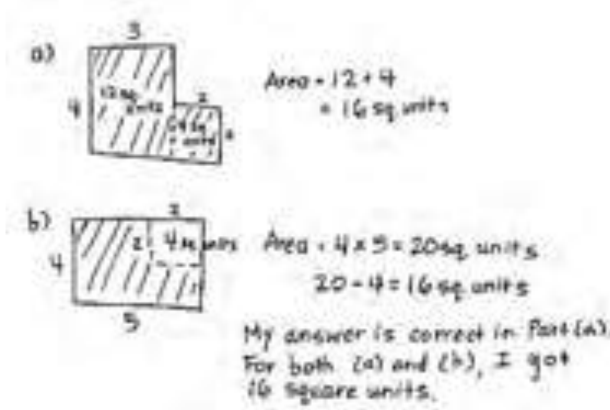
MP.7

a. Break apart the shaded figure into 2 rectangles. Then add to find the area of the shaded figure below.

b. Subtract the area of the unshaded rectangle from the area of the large rectangle to check your answer in Part (a).

MP.7

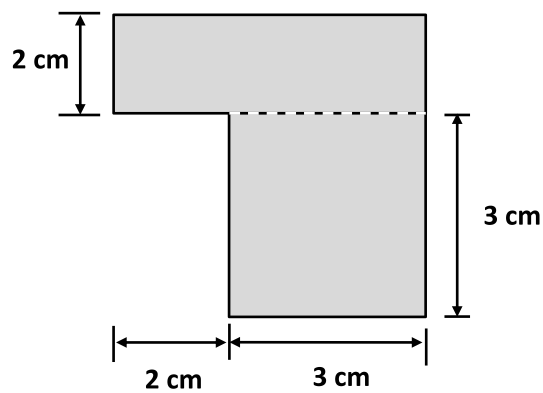




Note: This problem reviews G3–M4–Lesson 13's concept of finding area of composite shapes. Students may choose to break apart their rectangles in different ways for Part (a).

Concept Development (30 minutes)

Materials: (S) Personal white boards, Problem Set



Problem 1: Choose an appropriate method for finding the area of a composite shape.

Distribute one Problem Set to each student. Project the shape to the right.

T: What two strategies did we learn yesterday to find the area of a non-rectangular shape?

S: We can break the shape apart into smaller rectangles and then add the areas of the smaller rectangles together. → Or, find the area of the larger rectangle and subtract the area of the "missing" part.

T: Look at the figure in Problem 1(a).

T: What is the unknown width?

S: 5 centimeters! → 2 centimeters plus 3 centimeters is 5 centimeters.

T: Label that on your figure. Then write the equation used to find the area of each of the smaller rectangles.

S: (Record on Problem Set.)

T: What is the area of the top rectangle?

S: 10 square centimeters!

T: What is the area of the bottom rectangle?

S: 9 square centimeters!

T: On your Problem Set, write the number sentence used to find the area of the whole figure. Be sure to answer

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Students working below grade level may benefit from sentence frames to assist their writing the equations to find the area in Problem 1. You may provide the following:

____ ×____=____square centimeters

____ ×____=____square centimeters

____ sq cm + ____ sq cm =____square centimeters

The area is ____square centimeters.

in a complete sentence!

T: What is the total area of the figure?

S: 19 square centimeters!

Continue with Problem 1(b) from the Problem Set.

Problem 2: Solve a word problem involving area of non-rectangular shapes.

Write or project the following problem: Fanny has a piece of fabric 8 feet long and 5 feet wide. She cuts out a rectangular piece that measures 3 feet by 2 feet. How many square feet of fabric does Fanny have left?

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Adjust the numbers in Problem 2 of the Concept Development to challenge students working above grade level. Or, offer an alternative challenge, such as scripting and recording the steps to find the area of a non-rectangular shape that they can refer back to when needed.

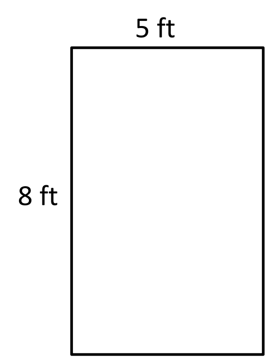
T: Draw and label Fanny's fabric.

T: How big is the piece that Fanny cuts out?

S: 3 ft by 2 ft.

T: Work with your partner to draw the piece of fabric that Fanny cuts out. Label the measurements of the piece being cut out.

S: (Draw as shown at right. Note: The 3 ft by 2 ft piece can be taken out of any part of the original rectangle, including at an angle.)



T: What's the best way for us to find the area of the remaining fabric?

S: Find the area of the original piece, then subtract the area of what was cut out.

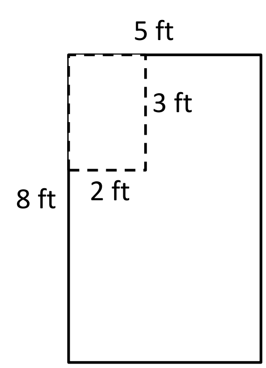
T: Write an equation to find the area of the original piece of fabric.

S: (Write 8 × 5 = 40 sq ft.)

T: Beneath what you just wrote, write a number sentence to find the area of the piece of fabric Fanny cuts out.

T: What is the area of the piece that is cut out?

S: 6 square feet!



T: What expression tells us the area of the remaining fabric?

S: 40 – 6.

T: 40 – 6 equals?

S: 34!

T: How much fabric does Fanny have left?

S: 34 square feet!

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

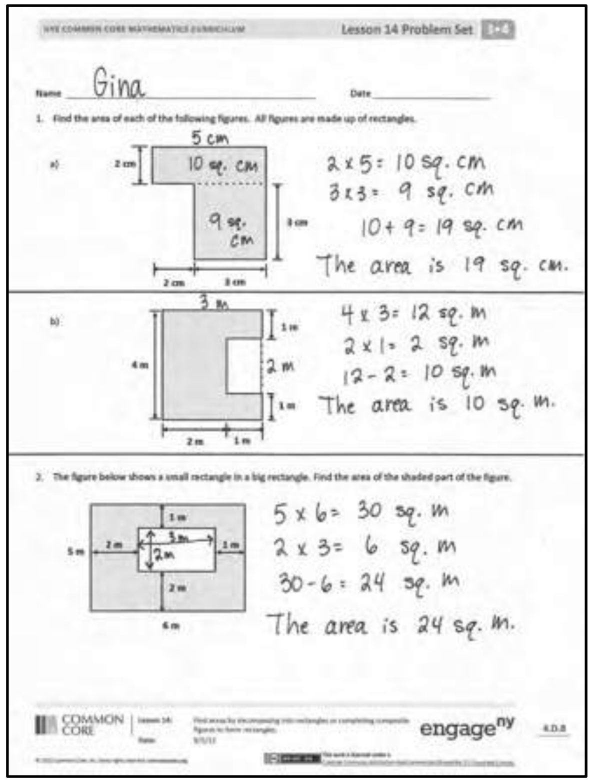
Lesson Objective: Find areas by decomposing into rectangles or completing composite figures to form rectangles.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- Lead a discussion about the strategy choice for Problems 1(a) and 1(b). Could the strategies have been reversed for these two problems?
- What steps did you need to follow to solve Problem 2? How were you able to find the area of the smaller rectangle?
- Invite students to share their drawings for Problem 3. In what ways are they similar? In what ways are they different?
- Why did Tila and Evan wind up with the same amount of paper in Problem 4? If they both cut their rectangles from the corners of their papers, would they both be able to cut out a 4 cm by 8 cm rectangle with their remaining paper? (Guide students to reason that even though they both have 42 sq cm left and the 4 × 8 rectangle only measures 32 sq cm, only Evan can cut out such a rectangle from his remaining paper.)



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 14 Problem Set 3•4

Name Gina Date

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

a)

2 x 5 = 10 sq. cm
3 x 3 = 9 sq. cm
10 + 9 = 19 sq. cm
The area is 19 sq. cm.

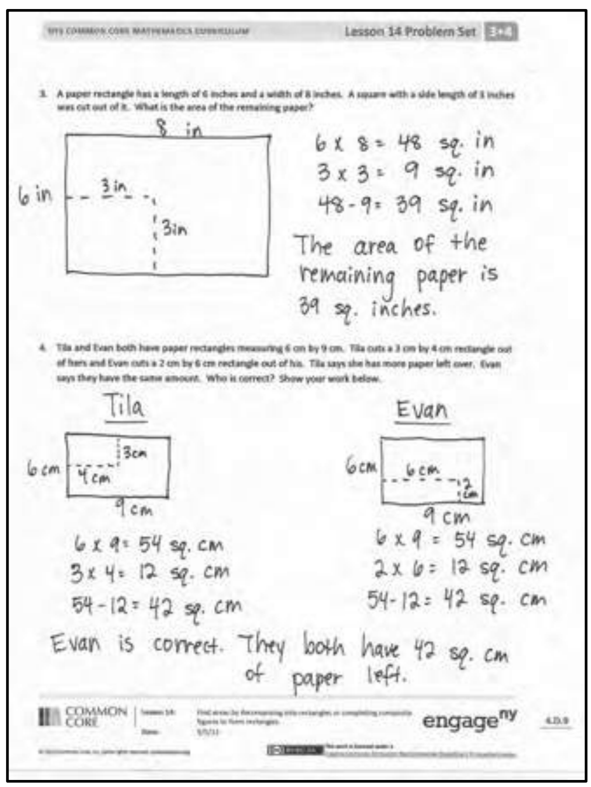
b)

4 x 3 = 12 sq. m
2 x 1 = 2 sq. m
12 - 2 = 10 sq. m
The area is 10 sq. m.

2. The figure below shows a small rectangle in a big rectangle. Find the area of the shaded part of the figure.

5 x 6 = 30 sq. m
2 x 3 = 6 sq. m
30 - 6 = 24 sq. m
The area is 24 sq. m.

COMMON CORE engage[ny] 4.D.8



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 14 Problem Set 3•4

3. A paper rectangle has a length of 6 inches and a width of 8 inches. A square with a side length of 3 inches was cut out of it. What is the area of the remaining paper?

6 x 8 = 48 sq. in
3 x 3 = 9 sq. in
48 - 9 = 39 sq. in
The area of the remaining paper is 39 sq. inches.

4. Tila and Evan both have paper rectangles measuring 6 cm by 9 cm. Tila cuts a 3 cm by 4 cm rectangle out of hers and Evan cuts a 2 cm by 6 cm rectangle out of his. Tila says she has more paper left over. Evan says they have the same amount. Who is correct? Show your work below.

6 x 9 = 54 sq. cm
3 x 4 = 12 sq. cm
54 - 12 = 42 sq. cm

6 x 9 = 54 sq. cm
2 x 6 = 12 sq. cm
54 - 12 = 42 sq. cm

Evan is correct. They both have 42 sq. cm of paper left.

COMMON CORE engage[ny] 4.D.9

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

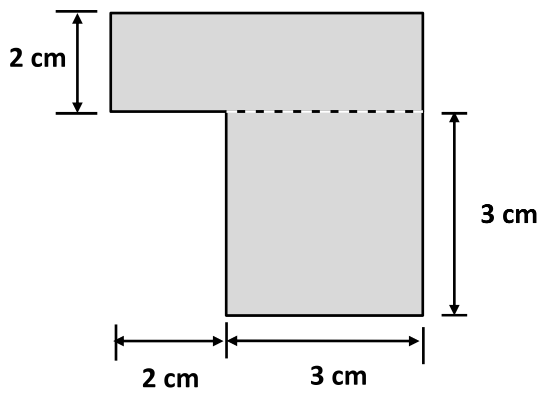
Multiply.

8 x 1 = ______	8 x 2 = ______	8 x 3 = ______	8 x 4 = ______
8 x 5 = ______	8 x 6 = ______	8 x 7 = ______	8 x 8 = ______
8 x 9 = ______	8 x 10 = ______	8 x 5 = ______	8 x 6 = ______
8 x 5 = ______	8 x 7 = ______	8 x 5 = ______	8 x 8 = ______
8 x 5 = ______	8 x 9 = ______	8 x 5 = ______	8 x 10 = ______
8 x 6 = ______	8 x 5 = ______	8 x 6 = ______	8 x 7 = ______
8 x 6 = ______	8 x 8 = ______	8 x 6 = ______	8 x 9 = ______
8 x 6 = ______	8 x 7 = ______	8 x 6 = ______	8 x 7 = ______
8 x 8 = ______	8 x 7 = ______	8 x 9 = ______	8 x 7 = ______
8 x 8 = ______	8 x 6 = ______	8 x 8 = ______	8 x 7 = ______
8 x 8 = ______	8 x 9 = ______	8 x 9 = ______	8 x 6 = ______
8 x 9 = ______	8 x 7 = ______	8 x 9 = ______	8 x 8 = ______
8 x 9 = ______	8 x 8 = ______	8 x 6 = ______	8 x 9 = ______
8 x 7 = ______	8 x 9 = ______	8 x 6 = ______	8 x 8 = ______
8 x 9 = ______	8 x 7 = ______	8 x 6 = ______	8 x 8 = ______

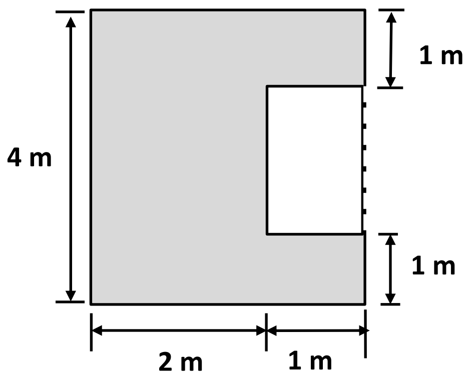
Name ____ Date ______________________

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

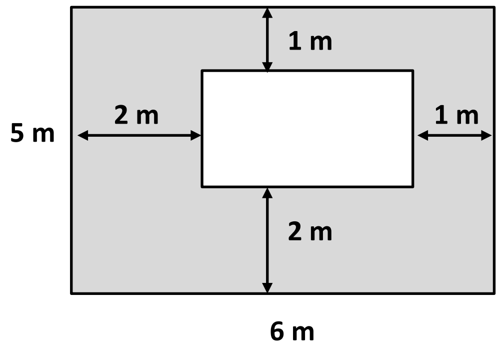
a.



b.



2. The figure below shows a small rectangle in a big rectangle. Find the area of the shaded part of the figure.



3. A paper rectangle has a length of 6 inches and a width of 8 inches. A square with a side length of 3 inches was cut out of it. What is the area of the remaining paper?

4. Tila and Evan both have paper rectangles measuring 6 cm by 9 cm. Tila cuts a 3 cm by 4 cm rectangle out of hers and Evan cuts a 2 cm by 6 cm rectangle out of his. Tila says she has more paper left over. Evan says they have the same amount. Who is correct? Show your work below.

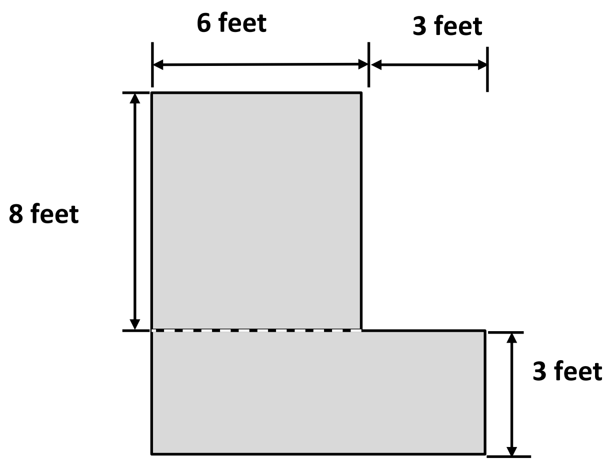
Name ____ Date ________________________

Mary draws an 8 cm by 6 cm rectangle on her grid paper. She shades a square with a side length of 4 cm inside her rectangle. What area of the rectangle is left unshaded?

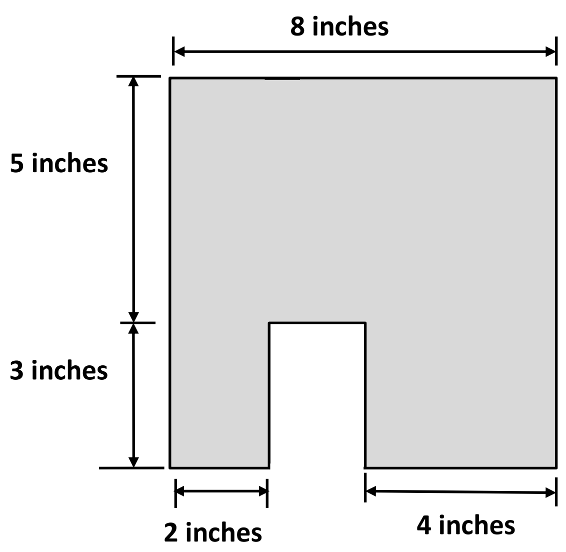
Name ___________________________________ Date ____________________

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

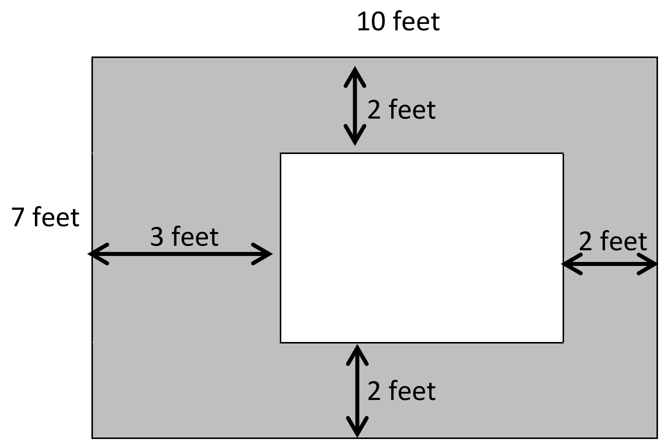
a.



b.



2. The figure below shows a small rectangle cut out of a big rectangle.



a. Label the side lengths of the unshaded region.

b. Find the area of the shaded region.

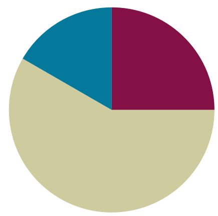
Lesson 15

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

Suggested Lesson Structure

- Fluency Practice (15 minutes)
- Concept Development (35 minutes)
- Student Debrief (10 minutes)

Total Time (60 minutes)



Fluency Practice (15 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Multiply by 9 **3.OA.7** (7 minutes)
- Find the Area **3.MD.7** (5 minutes)

Group Counting (3 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Threes to 43
- Sixes to 60
- Sevens to 70
- Eights to 80

Multiply by 9 (7 minutes)

Materials: (S) Multiply by 9 Pattern Sheet (1–5)

Note: This activity builds fluency with multiplication facts using units of 9. It works toward students knowing from memory all products of two one-digit numbers. See G3–M4–Lesson 2 for the directions for administration of a *Multiply By* pattern sheet.

T: (Write 5 × 9 = ____.) Let's skip-count by nines to find the answer. (Count with fingers to 5 as students count.)

S: 9, 18, 27, 36, 45. (Record on the board as students count.)

T: (Circle 45 and write 5 × 9 = 45 above it. Write 3 × 9 = ____.) Let's skip-count up by nines again. (Count with fingers to 3 as students count.)

S: 9, 18, 27.

T: Let's see how we can skip-count down to find the answer, too. Start at 45 with 5 fingers, 1 for each nine. (Count down with your fingers as students say numbers.)

S: 45 (5 fingers), 36 (4 fingers), 27 (3 fingers).

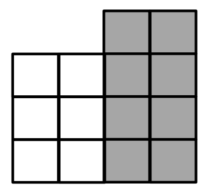
Repeat the process for 4 × 9.

T: (Distribute Multiply by 9 Pattern Sheet.) Let's practice multiplying by 9. Be sure to work left to right across the page.

Find the Area (5 minutes)

Materials: (S) Personal white boards

Note: This fluency reviews the relationship between side lengths and area and supports the perception of the composite shapes by moving from part to whole using a grid.



T: (Project the figure on the right.) On your boards, write a number sentence to show the area of the shaded rectangle.

S: (Write 4 × 2 = 8 square units or 2 × 4 = 8 square units.)

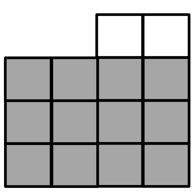
T: Write a number sentence to show the area of the unshaded rectangle.

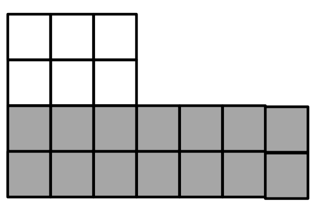
S: (Write 3 × 2 = 6 square units or 2 × 3 = 6 square units.)

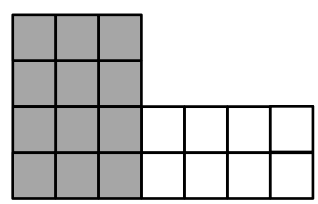
T: (Write __ sq units + __ sq units = __ sq units.) Using the areas of the shaded and unshaded rectangles, write an addition sentence to show the area of the entire figure.

S: (Write 8 sq units + 6 sq units = 14 sq units or 6 sq units + 8 sq units = 14 sq units.)

Continue with the figures below:







Concept Development (35 minutes)

Materials: (S) Problem Set, ruler

T: For the next two days, you are going to be architects. Today you are going to use a floor plan that your clients designed to find the area in square centimeters of each room in the house. Look at the floor plan. What will you need to do before you can find the areas?

A NOTE TO THE TEACHER:

This lesson is designed to be completed in two days. For early finishers, please refer to the optional activities suggested in G3–M4–Lesson 16.

S: We need to find the side lengths of each room. → We need to know the lengths and widths of the rooms.

T: Use your ruler to measure the side lengths of Bedroom 1 in centimeters. What is the length?

S: 5 cm.

T: What is the width?

S: 12 cm.

T: Write an expression to show how to find the area of Bedroom 1.

S: (Write 5 × 12.)

T: (Write *Multiply Side Lengths* on a chart labeled *Strategies We Can Use to Find Area.*) What strategy can you use to find the area since this fact is so large?

S: The break apart and distribute strategy!

T: (Add the strategy to the chart.) What about the rooms that aren't rectangles, how will you find their areas?

S: We can find the areas of smaller rectangles and add them together to get the area of a room that isn't rectangular. → Yeah, that's the break apart and add strategy we just learned. → Or, we might be able to find the area of a large rectangle and then subtract the area of a smaller rectangle.

T: (Add the strategies to the chart.) Look at the floor plan and use what we've learned about area to help you answer Problem 1. (Allow students time to answer Problem 1.) Work with a partner to find the areas of the rooms and the hallway in the floor plan. Record the areas and the strategy you use to find each area in the chart in Problem 2.

Problem Set (20 minutes)

Students should do their personal best to complete the Problem Set within the allotted 20 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Some students may benefit from a review of how to use a ruler to measure. Have them try the following:

- Place the zero end of the ruler against the line to be measured.
- Make sure the zero tick mark is lined up against the beginning of the side length.
- Read the last number on the ruler that is by the end of the side length.

To make measuring easier, try the tips below:

- Darken the lines to be measured.
- Outline the lines with glue to make a tactile model.
- Provide large print rulers.
- Give the option of using centimeter blocks to measure.

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

To ease the task of constructing a response for Problems 3–5 of the Problem Set, allow English language learners and others to discuss their reasoning prior to writing. Discussions can be in first languages, if beneficial. Also provide English language learners with sentence frames, such as those given below.

The _____ has the biggest area. My prediction was right/wrong because_____.

There are/aren't enough tiles because _____.

Student Debrief (10 minutes)

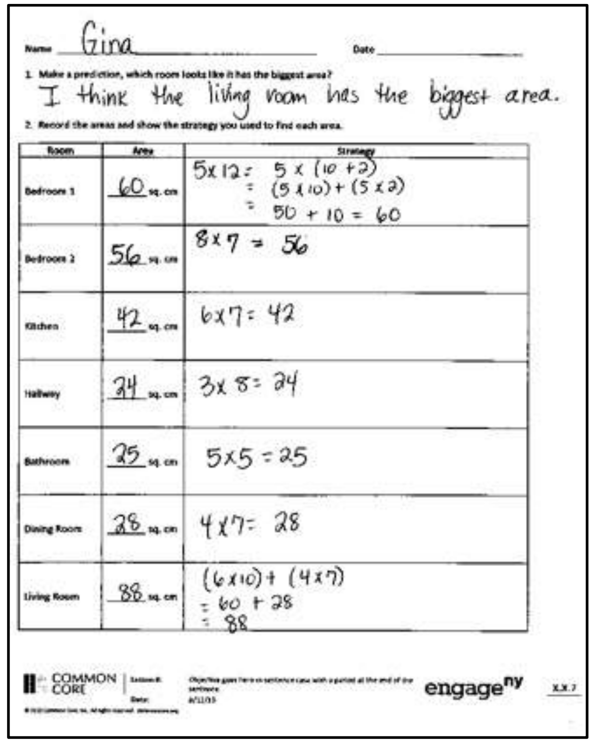
Lesson Objective: Apply knowledge of area to determine areas of rooms in a given floor plan.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- Explain to a partner your choice for the prediction you made in Problem 1. What have you learned about area that helped you make your prediction?
- What strategy did you use to find the area of the living room? Is there more than one way to break apart the living room into smaller rectangles? Explain two different ways to a partner.
- How many more tiles do your clients need to have enough tiles for the bathroom floor? If they buy another box of tiles, how many will be left over?



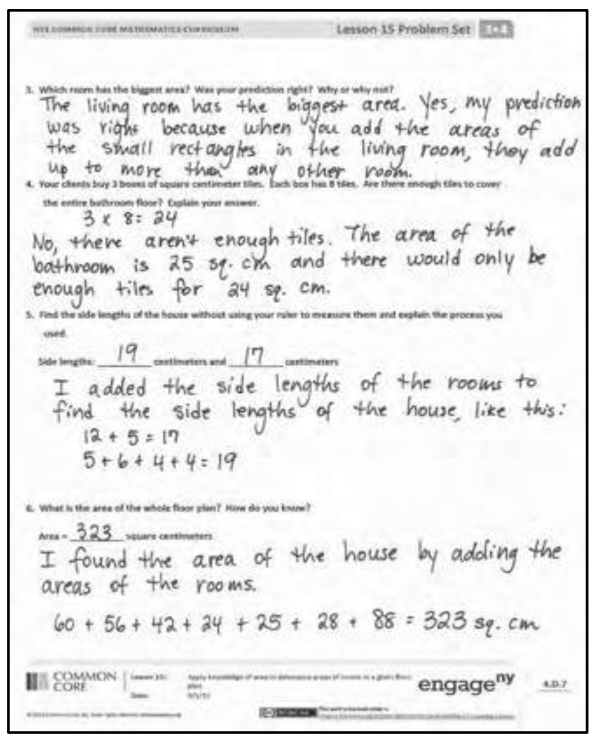
Name Gina Date

1. Make a prediction, which room looks like it has the biggest area?

I think the living room has the biggest area.

2. Record the areas and show the strategy you used to find each area.

Room	Area	Strategy
Bedroom 1	60 sq. cm	5 x 12 = 5 x (10 + 2) = (5 x 10) + (5 x 2) = 50 + 10 = 60
Bedroom 2	56 sq. cm	8 x 7 = 56
Kitchen	42 sq. cm	6 x 7 = 42
Hallway	24 sq. cm	3 x 8 = 24
Bathroom	25 sq. cm	5 x 5 = 25
Dining Room	28 sq. cm	4 x 7 = 28
Living Room	88 sq. cm	(6 x 10) + (4 x 7) = 60 + 28 = 88



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 15 Problem Set 3•4

3. Which room has the biggest area? Was your prediction right? Why or why not?

The living room has the biggest area. Yes, my prediction was right because when you add the areas of the small rectangles in the living room, they add up to more than any other room.

4. Your clients buy 3 boxes of square centimeter tiles. Each box has 8 tiles. Are there enough tiles to cover the entire bathroom floor? Explain your answer.

3 x 8 = 24

No, there aren't enough tiles. The area of the bathroom is 25 sq. cm and there would only be enough tiles for 24 sq. cm.

5. Find the side lengths of the house without using your ruler to measure them and explain the process you used.

Side lengths: 19 centimeters and 17 centimeters

I added the side lengths of the rooms to find the side lengths of the house, like this:

12 + 5 = 17

5 + 6 + 4 + 4 = 19

6. What is the area of the whole floor plan? How do you know?

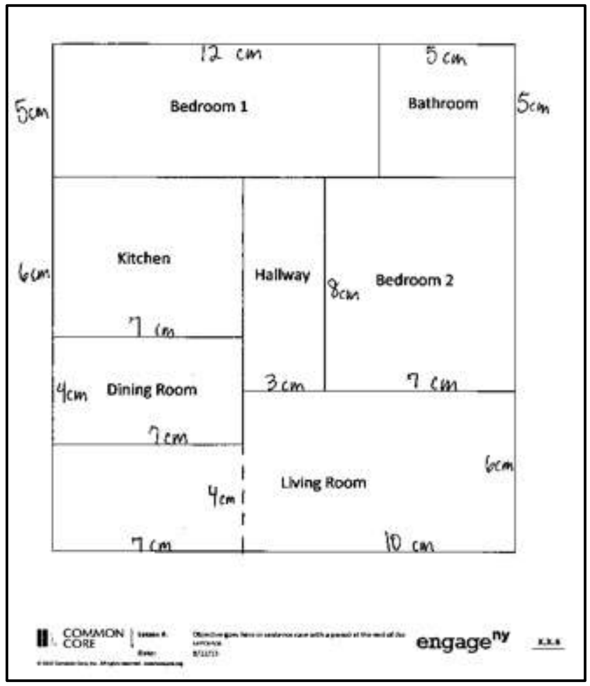
Area = 323 square centimeters

I found the area of the house by adding the areas of the rooms.

60 + 56 + 42 + 24 + 25 + 28 + 88 = 323 sq. cm

Exit Ticket (5 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.



Multiply.

9 x 1 = ______	9 x 2 = ______	9 x 3 = ______	9 x 4 = ______
9 x 5 = ______	9 x 1 = ______	9 x 2 = ______	9 x 1 = ______
9 x 3 = ______	9 x 1 = ______	9 x 4 = ______	9 x 1 = ______
9 x 5 = ______	9 x 1 = ______	9 x 2 = ______	9 x 3 = ______
9 x 2 = ______	9 x 4 = ______	9 x 2 = ______	9 x 5 = ______
9 x 2 = ______	9 x 1 = ______	9 x 2 = ______	9 x 3 = ______
9 x 1 = ______	9 x 3 = ______	9 x 2 = ______	9 x 3 = ______
9 x 4 = ______	9 x 3 = ______	9 x 5 = ______	9 x 3 = ______
9 x 4 = ______	9 x 1 = ______	9 x 4 = ______	9 x 2 = ______
9 x 4 = ______	9 x 3 = ______	9 x 4 = ______	9 x 5 = ______
9 x 4 = ______	9 x 5 = ______	9 x 1 = ______	9 x 5 = ______
9 x 2 = ______	9 x 5 = ______	9 x 3 = ______	9 x 5 = ______
9 x 4 = ______	9 x 2 = ______	9 x 4 = ______	9 x 3 = ______
9 x 5 = ______	9 x 3 = ______	9 x 2 = ______	9 x 4 = ______
9 x 3 = ______	9 x 5 = ______	9 x 2 = ______	9 x 4 = ______

Name ______________________________________ Date ____________________

1. Make a prediction: Which room looks like it has the biggest area?

2. Record the areas and show the strategy you used to find each area.

Room	Area	Strategy
Bedroom 1	_______ sq cm	
Bedroom 2	_______ sq cm	
Kitchen	_______ sq cm	
Hallway	_______ sq cm	
Bathroom	_______ sq cm	
Dining Room	_______ sq cm	
Living Room	_______ sq cm	

3. Which room has the biggest area? Was your prediction right? Why or why not?

4. Your clients buy 3 boxes of square centimeter tiles. Each box has 8 tiles. Are there enough tiles to cover the entire bathroom floor? Explain your answer.

5. Find the side lengths of the house without using your ruler to measure them and explain the process you used.

   Side lengths: __________ centimeters and __________ centimeters

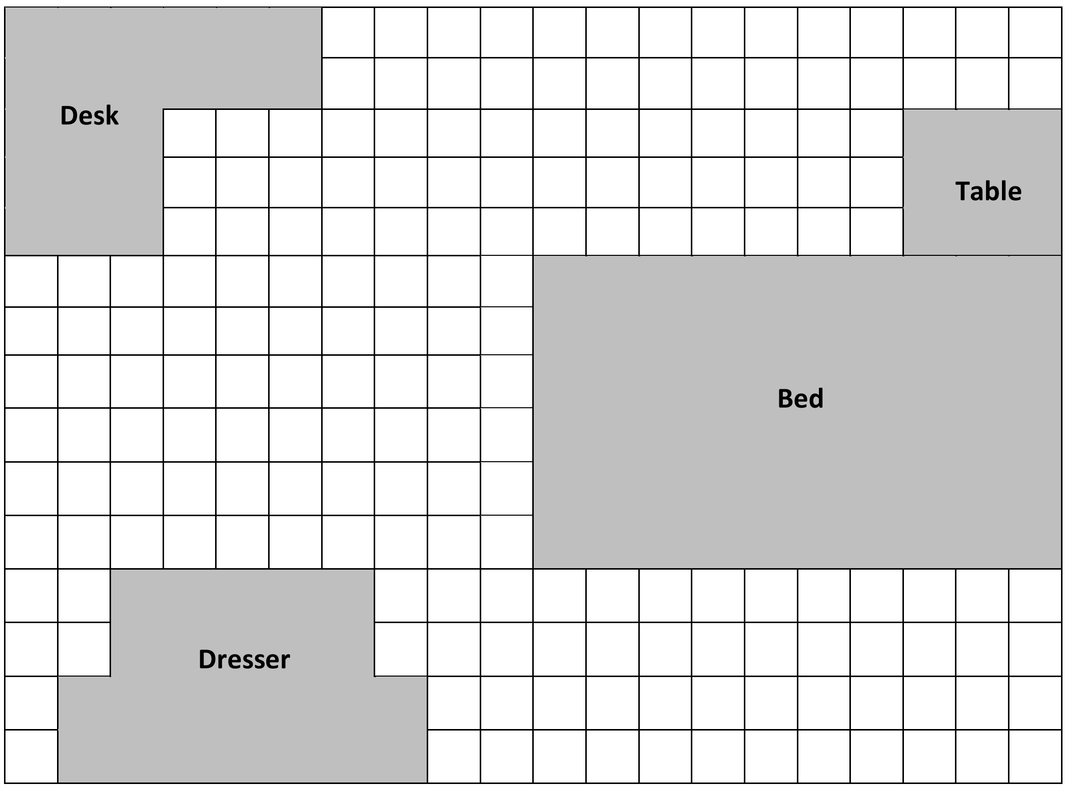
6. What is the area of the whole floor plan? How do you know?

   Area = __________ square centimeters

The rooms in the floor plan below are rectangles or made up of rectangles.

Name ____ Date _____________________

Jack uses grid paper to create a floor plan of his room. Label the missing measurements and find the area of the items listed below.



Name	Equations	Total Area
a. Jack's Room		________ square units
b. Bed		________ square units
c. Table		________ square units
d. Dresser		________ square units
e. Desk		________ square units

Name ____ Date ____________________

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

Kitchen - 28 square centimeters

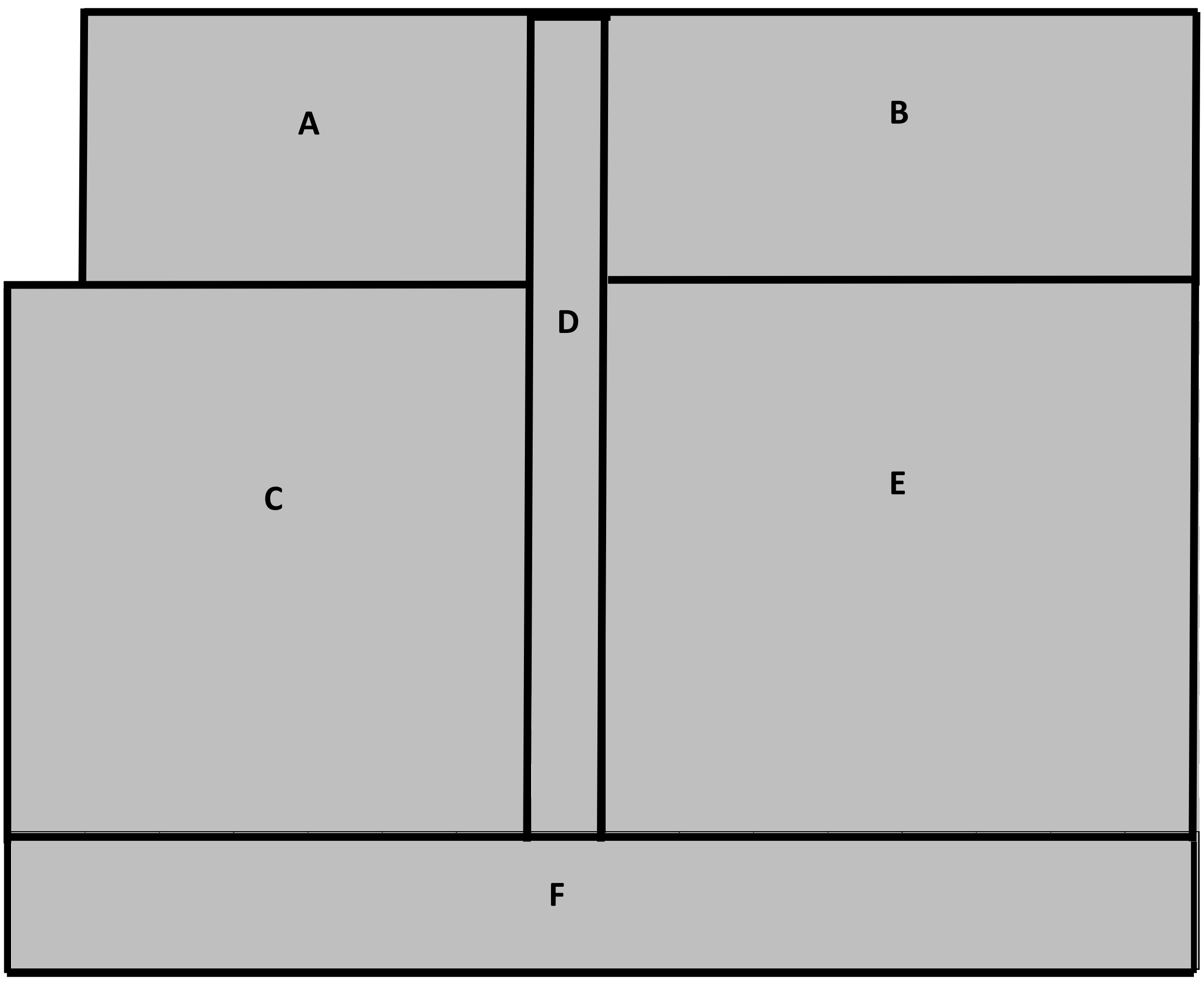
Porch – 32 square centimeters

Bathroom – 24 square centimeters

Garage – 72 square centimeters

Bedroom – 56 square centimeters

Hallway – 12 square centimeters

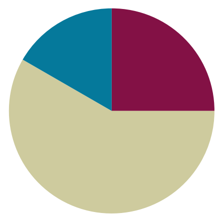


Lesson 16

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

Suggested Lesson Structure

Fluency Practice	(15 minutes)
Concept Development	(35 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (15 minutes)

- Group Counting **3.OA.1** (3 minutes)
- Multiply by 9 **3.OA.7** (7 minutes)
- Find the Area **3.MD.7** (5 minutes)

Group Counting (3 minutes)

Note: Group counting reviews interpreting multiplication as repeated addition.

Direct students to count forward and backward, occasionally changing the direction of the count.

- Sixes to 60
- Sevens to 70
- Eights to 80

Multiply By 9 (7 minutes)

Materials: (S) Multiply By 9 Pattern Sheet (6–10)

Note: This activity builds fluency with multiplication facts using units of nine. It works toward students knowing from memory all products of two one-digit numbers. See G3–M4–Lesson 2 for the directions for administration of a *Multiply By* pattern sheet.

T: (Write 6 × 9 = ____.) Let's skip-count up by nine to solve. (Count with fingers to 6 as students count.)

S: 9, 18, 27, 36, 45, 54.

T: Let's skip-count down to find the answer, too. Start at 90. (Count down with fingers as students count.)

S: 90, 81, 72, 63, 54.

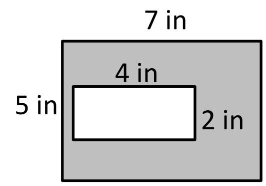
T: Let's skip-count up again to find the answer, but this time start at 45. (Count up with fingers as students count.)

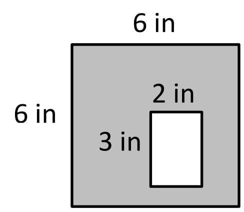
S: 45, 54.

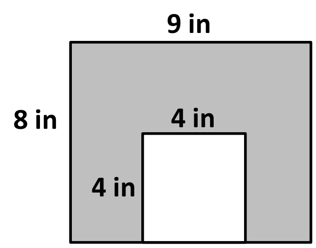
Continue with the following possible sequence: 8 × 9, 7 × 9, and 9 × 9.

T: (Distribute Multiply By 9 pattern sheet.) Let's practice multiplying by 9. Be sure to work left to right across the page.

Find the Area (5 minutes)







Materials: (S) Personal white boards

Note: This fluency reviews G3–M4–Lesson 14.

T: (Project the first figure on the right.) Find the areas of the large rectangle and the unshaded rectangle. Then subtract to find the area of the shaded region. (Write *Area* = ____ *square inches*.)

S: (Students work and write *Area = 27 square inches*.)

Continue with other figures.

Concept Development (35 minutes)

Materials: (S) G3–M4–Lesson 15 Problem Set, ruler

T: Today you will continue to find the area in square centimeters of each room in the house.

Materials: (S) Optional Problem Set, centimeter grid paper, construction paper, glue

Optional: Create a floor plan with different side lengths for given areas.

If students finish early on the second day, they may work with a partner to create a floor plan with the areas of the rooms that they found. The task is for students to find new side lengths for each room. Students should use their answers from the Problem Set to ensure that they find different side lengths with the same area. After they find new side lengths, they mark each room on centimeter grid paper and then cut the rooms out. They will use these centimeter grids to fit the rooms together to make their floor plan. They will glue their final arrangement of rooms onto a piece of construction paper. Allow students a few minutes to do a gallery walk of the completed floor plans.

Optional: Review strategies to find new side lengths of given areas.

T: Yesterday you found the areas of the rooms in a floor plan that your clients designed. They like the area of each room, but they want to change the way the rooms look. Your job today is to create rooms with the same areas, but with different side lengths. Are you up for the challenge architects?

S: Yes!

T: Look at the Problem Set. What is the area of the hallway?

S: 24 square centimeters.

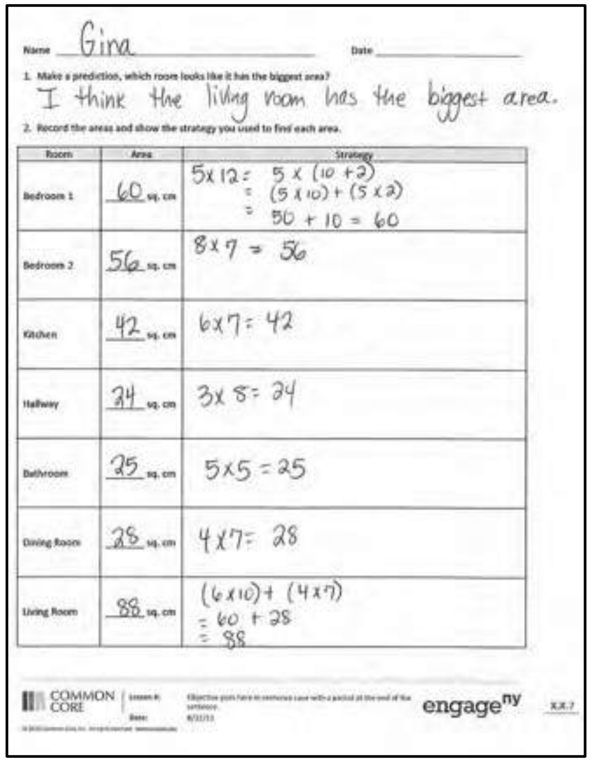
T: What are possible side lengths you can have for the hallway and still have the same area?

S: 3 and 8. → 1 and 24. → 2 and 12. → 6 and 4.

T: Talk to a partner: Which of these choices was used in the floor plan?

S: 8 and 3. → The numbers are just switched.

T: So when you redesign the floor plan today, be sure you don't use that combination!



Name Gina Date

1. Make a prediction, which room looks like it has the biggest area?

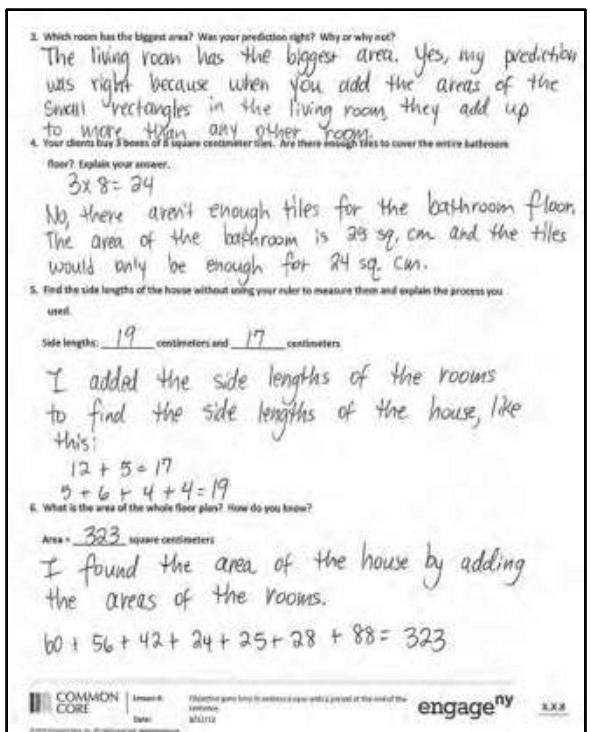
I think the living room has the biggest area.

2. Record the areas and show the strategy you used to find each area.

Room	Area	Strategy
Bedroom 1	60 sq. cm	5 x 12 = 5 x (10 + 2) = (5 x 10) + (5 x 2) = 50 + 10 = 60
Bedroom 2	56 sq. cm	8 x 7 = 56
Kitchen	42 sq. cm	6 x 7 = 42
Hallway	24 sq. cm	3 x 8 = 24
Bathroom	25 sq. cm	5 x 5 = 25
Dining Room	28 sq. cm	4 x 7 = 28
Living Room	88 sq. cm	(6 x 10) + (4 x 7) = 60 + 28 = 88

Problem Set (25 minutes)

Students should do their personal best to complete the Problem Set within the allotted 25 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students solve these problems using the RDW approach used for Application Problems.



3. Which room has the biggest area? Was your prediction right? Why or why not?

The living room has the biggest area. Yes, my prediction was right because when you add the areas of the small rectangles in the living room, they add up to more than any other room.

4. Your clients buy 3 boxes of 8 square centimeter tiles. Are there enough tiles to cover the entire bathroom floor? Explain your answer.

3 x 8 = 24

No, there aren't enough tiles for the bathroom floor. The area of the bathroom is 25 sq. cm and the tiles would only be enough for 24 sq. cm.

5. Find the side lengths of the house without using your ruler to measure them and explain the process you used.

Side lengths: 19 centimeters and 17 centimeters

I added the side lengths of the rooms to find the side lengths of the house, like this:

12 + 5 = 17

5 + 6 + 4 + 4 = 19

6. What is the area of the whole floor plan? How do you know?

Area = 323 square centimeters

I found the area of the house by adding the areas of the rooms.

60 + 56 + 42 + 24 + 25 + 28 + 88 = 323

Student Debrief (10 minutes)

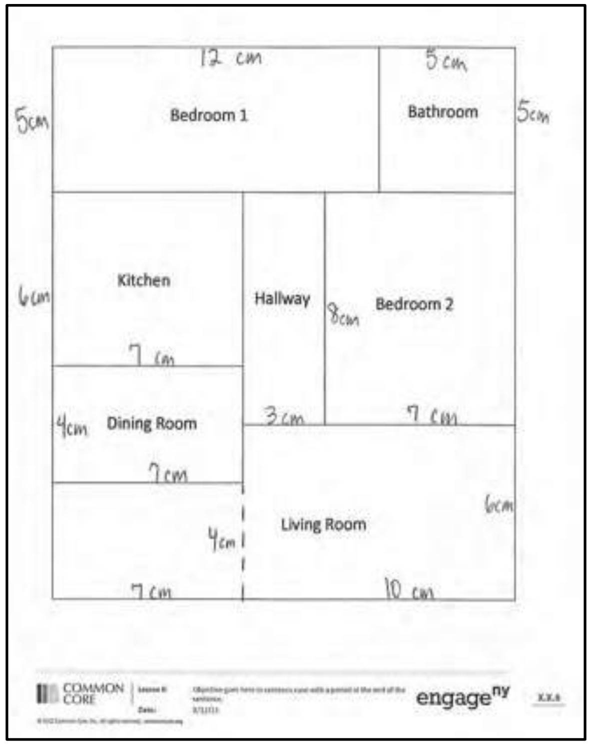
Lesson Objective: Apply knowledge of area to determine areas of rooms in a given floor plan.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

You may choose to use any combination of the questions below to lead the discussion.

- Explain to a partner how you found the side lengths of the whole house without using your ruler to measure.
- Can you multiply the side lengths of the house to find the area of the house? Why or why not? How did you find the area of the whole house?
- Do we usually measure rooms in centimeters? What unit might each centimeter in this picture represent on a real house? (Yards, feet, or meters.)



Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Multiply.

9 x 1 = ______	9 x 2 = ______	9 x 3 = ______	9 x 4 = ______
9 x 5 = ______	9 x 6 = ______	9 x 7 = ______	9 x 8 = ______
9 x 9 = ______	9 x 10 = ______	9 x 5 = ______	9 x 6 = ______
9 x 5 = ______	9 x 7 = ______	9 x 5 = ______	9 x 8 = ______
9 x 5 = ______	9 x 9 = ______	9 x 5 = ______	9 x 10 = ______
9 x 6 = ______	9 x 5 = ______	9 x 6 = ______	9 x 7 = ______
9 x 6 = ______	9 x 8 = ______	9 x 6 = ______	9 x 9 = ______
9 x 6 = ______	9 x 7 = ______	9 x 6 = ______	9 x 7 = ______
9 x 8 = ______	9 x 7 = ______	9 x 9 = ______	9 x 7 = ______
9 x 8 = ______	9 x 6 = ______	9 x 8 = ______	9 x 7 = ______
9 x 8 = ______	9 x 9 = ______	9 x 9 = ______	9 x 6 = ______
9 x 9 = ______	9 x 7 = ______	9 x 9 = ______	9 x 8 = ______
9 x 9 = ______	9 x 8 = ______	9 x 6 = ______	9 x 9 = ______
9 x 7 = ______	9 x 9 = ______	9 x 6 = ______	9 x 8 = ______
9 x 9 = ______	9 x 7 = ______	9 x 6 = ______	9 x 8 = ______

Name ______________________________________ Date ____________________

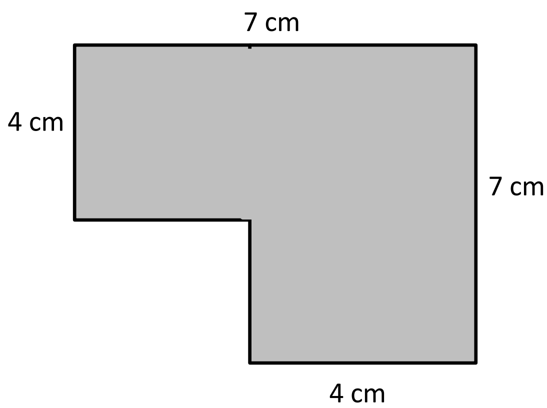
Optional: Record the new side lengths you have chosen for each of the rooms and show that these side lengths equal the required area. For non-rectangular rooms, record the side lengths and areas of the small rectangles. Then show how the areas of the small rectangles equal the required area.

Room	New Side Lengths
Bedroom 1: 60 sq cm	
Bedroom 2: 56 sq cm	
Kitchen: 42 sq cm	

Room	New Side Lengths
Hallway: 24 sq cm	
Bathroom: 25 sq cm	
Dining Room: 28 sq cm	
Living Room: 88 sq cm	

Name ______________________________ Date ______________

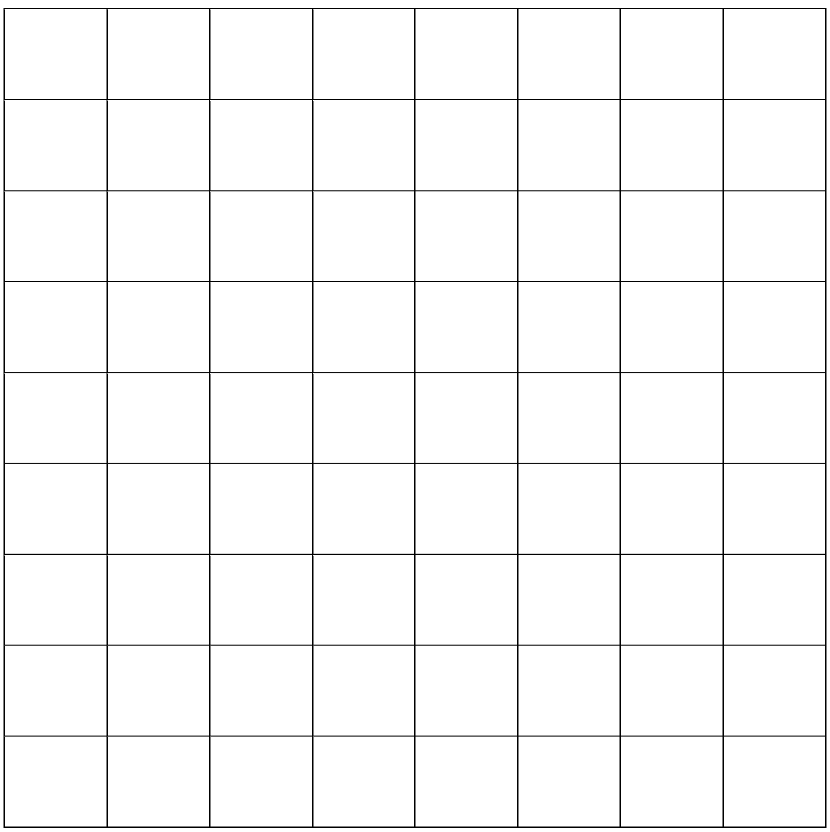
Find the area of the shaded region. Then draw and label a rectangle with the same area.



Name ______________________________ Date ____________________

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.

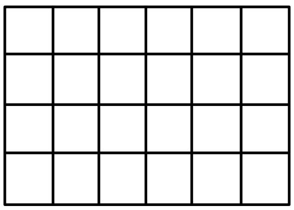
Basketball Court	10 square units
Jungle Gym	9 square units
Slide	6 square units
Soccer Area	24 square units



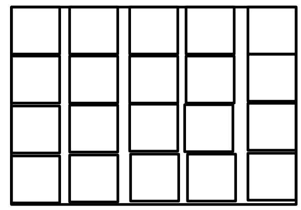
Name ____ Date ______________________

1. Jasmine and Roland each use unit squares to tile a piece of paper. Their work is shown below.

Jasmine's Array



Roland's Array



a. Can one of the arrays be used to correctly measure the area of the piece of paper? If so, whose array would you use? Explain why.

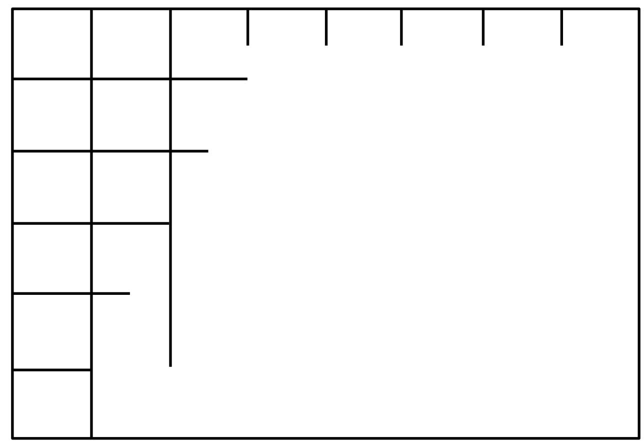
b. What is the area of the piece of paper? Explain your strategy for finding the area.

c. Jasmine thinks she can skip-count by sixes to find the area of her rectangle. Is she correct? Explain why or why not.

2. Jaheim says you can create three rectangles with different side lengths using 12 unit squares. Use numbers, equations, and words to show what Jaheim is saying.

3. The area of a rectangle is 72 square units. One side has a length of 9 units. What is the other side length? Explain how you know using pictures, equations, and words.

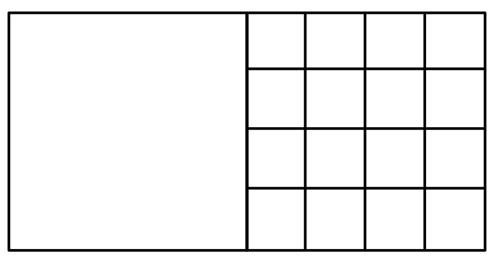
4. Jax started to draw a grid inside the rectangle to find its area.



   a. Use a straight edge to complete the drawing of the grid.

   b. Write both an addition and a multiplication equation that you could use to find the area, then solve.

5. Half of the rectangle below has been tiled with unit squares.



   a. How many more unit squares are needed to fill in the rest of the rectangle?

   b. What is the total area of the large rectangle? Explain how you found the area.

Mid-Module Assessment Task Standards Addressed	Topics A–B

Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

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.

Evaluating Student Learning Outcomes

A Progression Toward Mastery is provided to describe steps that illuminate the gradually increasing understandings that students develop *on their way to proficiency*. In this chart, this progress is presented from left (Step 1) to right (Step 4). The learning goal for each student is to achieve Step 4 mastery. These steps are meant to help teachers and students identify and celebrate what the student CAN do now and what they need to work on next.

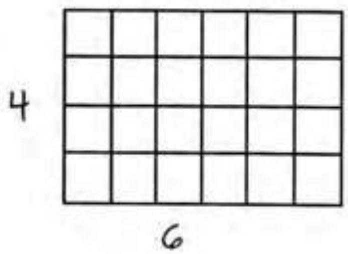
A Progression Toward Mastery				
Assessment Task Item and Standards Assessed	**STEP 1 Little evidence of reasoning without a correct answer. (1 Point)**	**STEP 2 Evidence of some reasoning without a correct answer. (2 Points)**	**STEP 3 Evidence of some reasoning with a correct answer or evidence of solid reasoning with an incorrect answer. (3 Points)**	**STEP 4 Evidence of solid reasoning with a correct answer. (4 Points)**
1 **3.MD.5** **3.MD.6**	Response demonstrates little evidence of reasoning without a correct answer.	Response shows limited reasoning with at least one correct answer.	Response includes evidence of some reasoning with three correct answers, or evidence of solid reasoning with an incorrect answer.	Student correctly answers: a. Jasmine's array, giving strong evidence of understanding that tiling must have no gaps or overlaps. b. The area is 24 tiles. Provides appropriate explanation of the calculation including counting or skip-counting strategies. c. Yes, there are 4 rows of 6 squares so it is possible to skip-count by six.
2 **3.MD.7b**	Response demonstrates little evidence of reasoning without a correct answer.	Response shows limited reasoning with at least one correct answer.	Student identifies at least two of three rectangles correctly. Response includes evidence of accurate reasoning with pictures, numbers, or words.	Student correctly identifies three rectangles: ▪ 1 × 12 or 12 × 1 ▪ 2 × 6 or 6 × 2 ▪ 3 × 4 or 4 × 3 Response shows evidence of solid reasoning using pictures, numbers, and words.

A Progression Toward Mastery				
3 **3.MD.7b**	Response demonstrates little evidence of reasoning without a correct answer.	Response shows limited reasoning without a correct answer.	Student finds the missing side length of 8 units but may not show enough work to clearly justify the answer.	Student correctly finds the missing side length of 8 units. Response shows evidence of solid reasoning using pictures, numbers, and words.
4 **3.MD.5** **3.MD.6** **3.MD.7a**	Response demonstrates little evidence of reasoning without a correct answer.	Response shows evidence of some reasoning in attempt to write equations and complete the array, but work may not include a correct answer.	Student accurately completes the array and finds the area of 48 sq cm, but may not accurately provide both addition and multiplication equations.	Student correctly: a. Completes the array with 8 columns and 6 rows. b. Writes an addition equation (repeated addition of 8 sixes or 6 eights); writes a multiplication equation (6 × 8 or 8 × 6); and gives an area of 48 sq cm.
5 **3.MD.5a** **3.MD.5b** **3.MD.7a** **3.MD.7d**	Response demonstrates little evidence of reasoning without a correct answer to either part.	Response shows limited reasoning with a correct answer in one part.	Student slightly miscalculates the number of tiles needed to fill the remaining area, but the explanation shows evidence of solid reasoning. Part (b) is correct based on the student's slight miscalculation but not the correct answer of 32 units.	Student correctly: a. Identifies that 16 tiles are needed to fill the remaining area. b. Says the area of the large rectangle is 32 square units. Explanation gives evidence of solid reasoning to support answer.

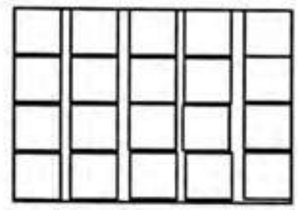
Name Gina Date ____________

1. Jasmine and Roland each use unit squares to tile a piece of paper. Their work is shown below.

Jasmine's Array



Roland's Array



a. Can one of the arrays be used to correctly measure the area of the piece of paper? If so, whose array would you use? Explain why.

Jasmine's array correctly measures the area of the piece of paper. You can't have gaps or overlaps when you tile or it won't be right.

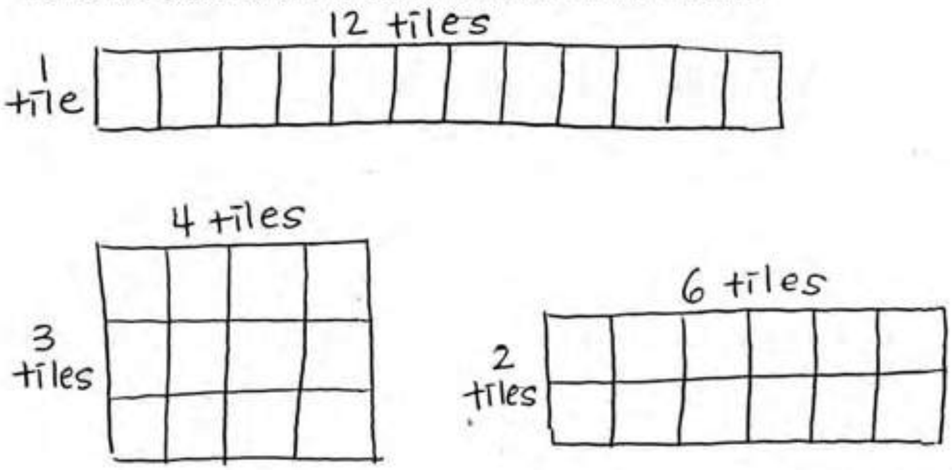
b. What is the area of the piece of paper? Explain your strategy for finding the area.

6 tiles across and 4 tiles down.
I can multiply $6 \times 4 = 24$ to find the area.
Roland's array is wrong so I have to use Jasmine's array.

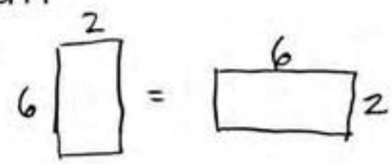
c. Jasmine thinks she can skip-count by sixes to find the area of her rectangle. Is she correct? Explain why or why not.

Yes, Jasmine is correct. There are 4 rows of six squares so she can skip-count: 6, 12, 18, 24. It's faster if she multiplies.

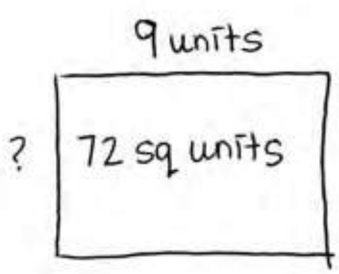
2. Jaheim says you can create three rectangles with different side lengths using 12 unit squares. Use numbers, equations, and words to show what Jaheim is saying.



Jaheim is correct. These are the only rectangles you can make with 12 tiles. You can turn them, but they will still be the same:



3. The area of a rectangle is 72 square units. One side has a length of 9 units. What is the other side length? Explain how you know using pictures, equations, and words.



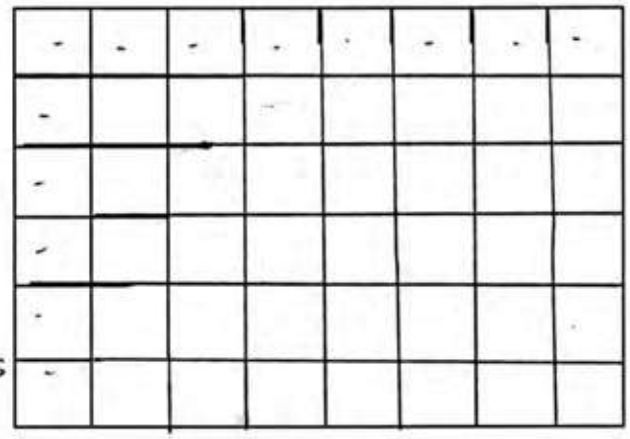
$? \times 9 = 72$
$72 \div 9 = 8$

If one side length is 9 units, the other side length is 8 units because $8 \times 9 = 72$.

4. Jax started to draw a grid inside the rectangle to find its area.

   a. Use a straight edge to complete the drawing of the grid.

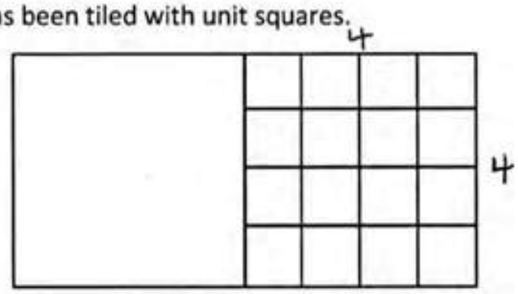
   b. Write both an addition and a multiplication equation that you could use to find the area, then solve.



$8 + 8 + 8 + 8 + 8 + 8 = 48$ sq units

$6 \times 8 = 48$ sq units

5. Half of the rectangle below has been tiled with unit squares.



$4 \times 4 = 16$ sq units

   a. How many more unit squares are needed to fill in the rest of the rectangle?

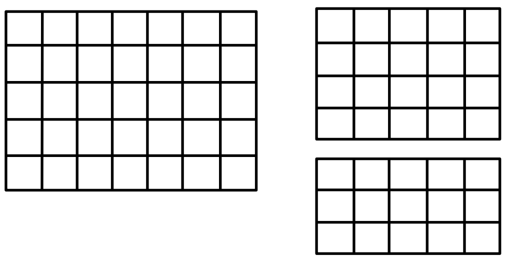
If there's 16 sq units in one half, there will be 16 sq units in the other half too. You need 16 more tiles to fill it in.

   b. What is the total area of the large rectangle? Explain how you found the area.

$16 + 16 = 32$ sq units.
I added the 2 halves together to find the total area of the rectangle.

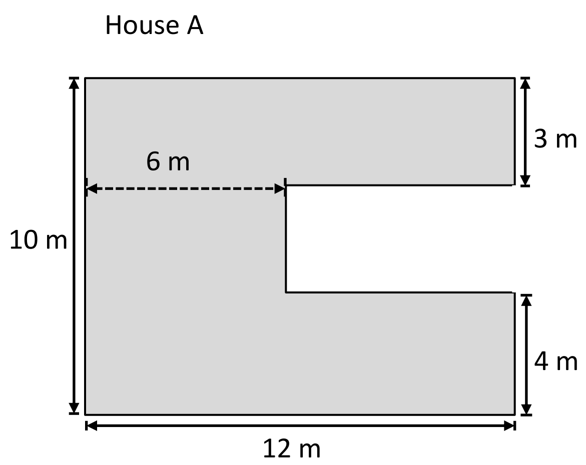
Name ____ Date ______________________

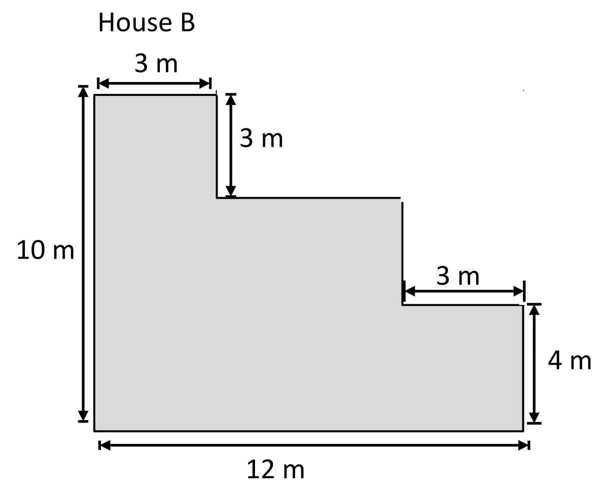
1. Sarah says the rectangle on the left has the same area as the sum of the two on the right. Pam says they do not have the same areas. Who is correct? Explain using numbers, pictures, or words.



2. Draw three different arrays that you could make with 36 square-inch tiles. Label the side lengths on each of your arrays. Write multiplication sentences for each array to prove that the area of each array is 36 square inches.

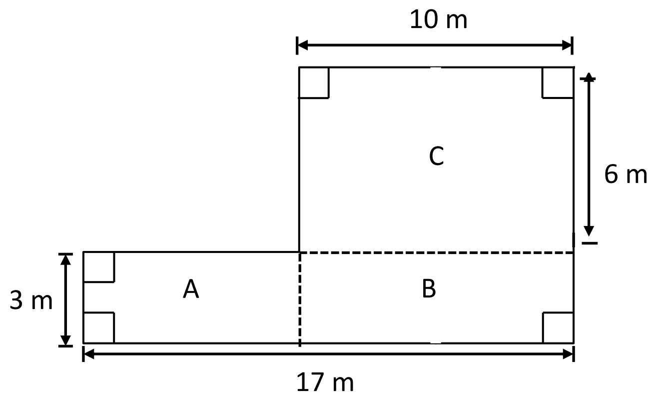
3. Mr. and Mrs. Jackson are buying a new house. They are deciding between the two floor plans below.





Which floor plan has the greater area? Show how you found your answer on the drawings above. Show your calculations below.

4. Superior Elementary School uses the design below for their swimming pool.



a. Label the side lengths of Rectangles A and B on the drawing.

b. Find the area of each rectangle.

c. Find the area of the entire pool. Explain how you found the area of the pool.

End-of-Module Assessment Task Standards Addressed	Topics A–D

Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

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.

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.

Evaluating Student Learning Outcomes

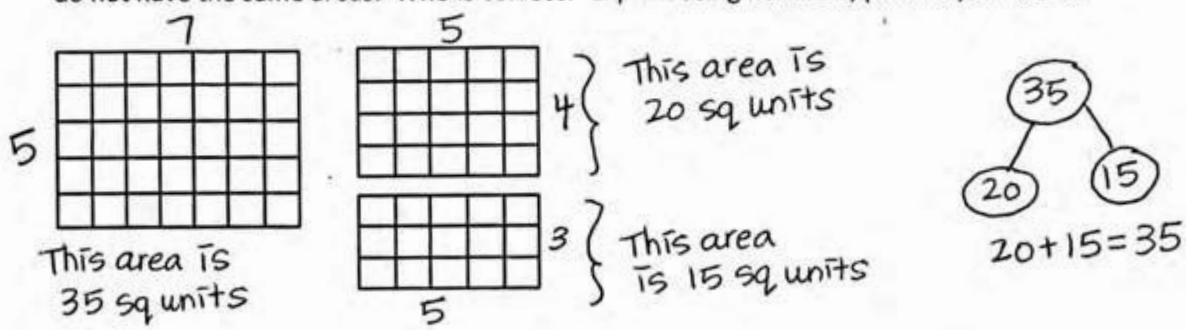
A Progression Toward Mastery is provided to describe steps that illuminate the gradually increasing understandings that students develop *on their way to proficiency*. In this chart, this progress is presented from left (Step 1) to right (Step 4). The learning goal for each student is to achieve Step 4 mastery. These steps are meant to help teachers and students identify and celebrate what the student CAN do now and what they need to work on next.

A Progression Toward Mastery				
Assessment Task Item and Standards Assessed	**STEP 1 Little evidence of reasoning without a correct answer. (1 Point)**	**STEP 2 Evidence of some reasoning without a correct answer or with a partially correct answer in a multi-step question. (2 Points)**	**STEP 3 Evidence of some reasoning with a correct answer or evidence of solid reasoning with an incorrect answer. (3 Points)**	**STEP 4 Evidence of solid reasoning with a correct answer. (4 Points)**
1 **3.MD.7c 3.MD.7d**	Response demonstrates little or no evidence of reasoning without a correct answer.	Student identifies that Sarah is correct, demonstrating evidence of limited reasoning to support the answer.	Student identifies that Sarah is correct. Response shows evidence of accurate reasoning to support the answer using at least one representation.	Student identifies that Sarah is correct. Explanation shows evidence of solid reasoning using multiple representations.
2 **3.MD.5b 3.MD.6 3.MD.7a 3.MD.7b**	Student attempts, but is unable to draw any correct arrays with labels. Multiplication sentences are not shown.	Student correctly draws and labels one array. Side lengths are labeled without units. A multiplication sentence is shown.	Student correctly draws and labels two different arrays. Side lengths are labeled in inches. Multiplication sentences are shown for those two arrays.	Student correctly draws and labels three different arrays. Side lengths are labeled in inches. Possible arrays: ▪ 1 × 36 ▪ 2 × 18 ▪ 3 × 12 ▪ 4 × 9 ▪ 6 × 6 Correct multiplication sentences are shown for each array drawn.
3 **3.MD.7d 3.MD.7b**	Response demonstrates little or no evidence of reasoning without a correct answer.	Student miscalculates one area. Student may identify that House A has the greater area with limited reasoning.	Response demonstrates correct calculations and area. Student identifies that House A has the greater area.	Student demonstrates correct area calculations with answers: ▪ House A = 102 sq meters ▪ House B = 84 sq meters Explanation identifies that House A has the greater area. Response provides evidence of solid reasoning.

A Progression Toward Mastery				
4 **3.MD.5** **3.MD.7b** **3.MD.7d**	Attempts, but is unable to answer any part of the question correctly.	Student: a. Labels length and width correctly, but without units. b. Calculates at least two areas correctly. c. May miscalculate the total area.	Student answers Parts (a) and (b) correctly, but may miscalculate the total area.	Student correctly: a. Labels length and width of rectangles A and B, including units: ▪ A = 3 m × 7 m ▪ B = 3 m × 10 m b. Calculates the area of each rectangle as: ▪ A = 21 sq meters ▪ B = 30 sq meters ▪ C = 60 sq meters c. Calculates the total area as 111 sq meters.

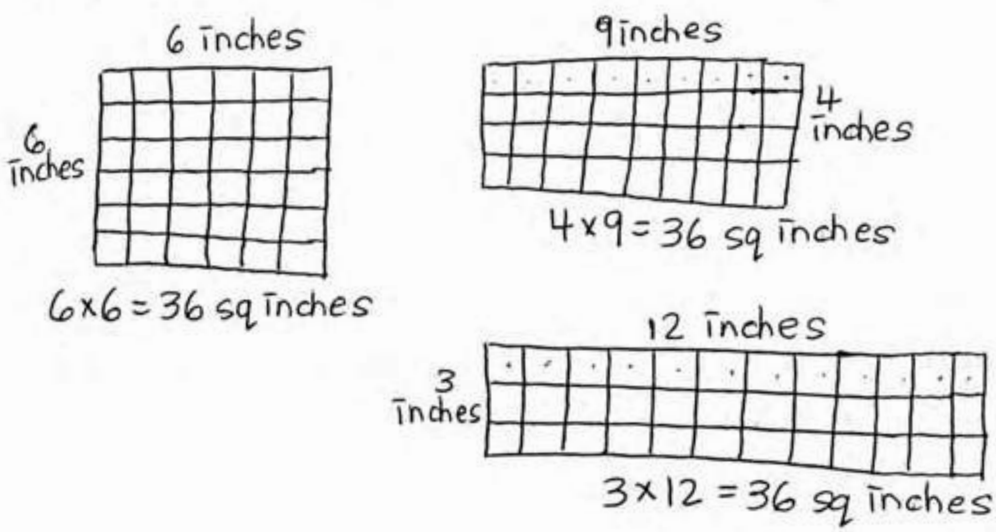
Name Gina Date ____________

1. Sarah says the rectangle on the left has the same area as the sum of the two on the right. Pam says they do not have the same areas. Who is correct? Explain using numbers, pictures, or words.



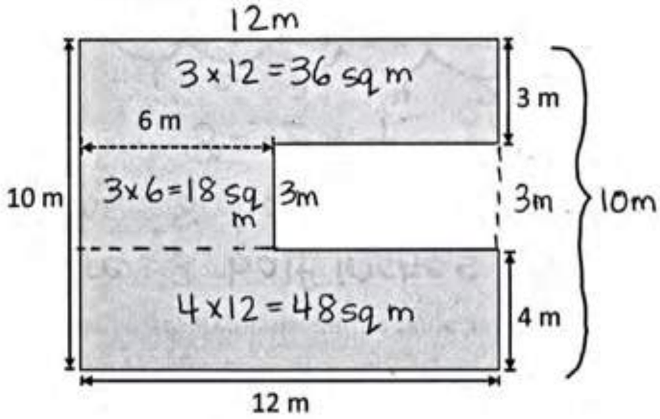
Sarah is right. The two on the right add up to 35 sq units, which is the area of the one on the left.

2. Draw three different arrays that you could make with 36 square-inch tiles. Label the side lengths on each of your arrays. Write multiplication sentences for each array to prove that the area of each array is 36 square inches.

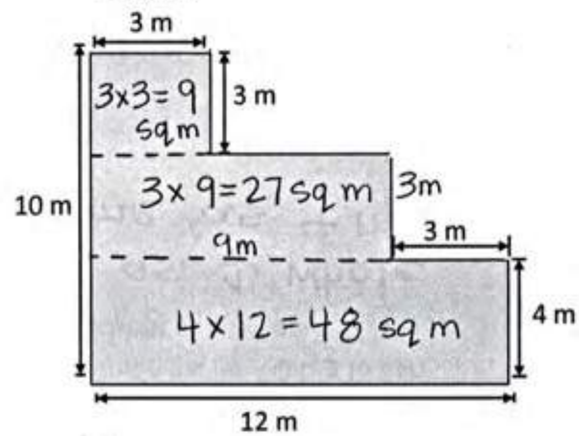


3. Mr. and Mrs. Jackson are buying a new house. They are deciding between the two floor plans below.

House A



House B



Which floor plan has the greater area? Show how you found your answer on the drawings above. Show your calculations below.

House A:

36 + 18 + 48

40 + 14

54 + 48

52 + 50

= 102 square meters

House B:

9 + 27 + 48

6 + 30

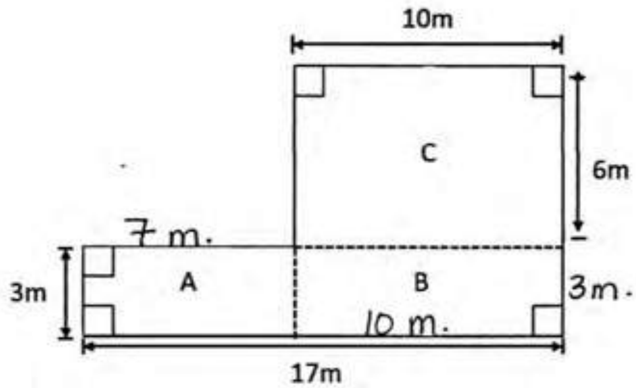
36 + 48

34 + 50

= 84 square meters

Mr. and Mrs. Jackson should buy House A, because it has a greater area than House B. House A is 102 square meters and House B is only 84 square meters.

4. Superior Elementary School uses the design below for their swimming pool.



a. Label the length and width of rectangles A and B on the drawing.

b. Find the area of each rectangle.

A → 7 x 3 = 21 square meters

B → 10 x 3 = 30 square meters

C → 10 x 6 = 60 square meters

c. Find the area of the entire pool. Explain how you found the area of the pool.

I can add the areas of all 3 parts to find the area of the whole pool.

21 + 30 + 60

21 + 90

111 square meters

Appendix, Section K
Parent and Student Satisfaction Surveys

The Children's Guild DC Public Charter School
SCHOOL PARENT SATISFACTION SURVEY

** To be completed by phone or in person*

☐ **Glen Burnie**

☐ **Baltimore**

☐ **Other**

	Strongly Agree 4	Agree 3	Disagree 2	Strongly Disagree 1	Do Not Know 0	Comments
My child's educational program meets his/her needs.						
In academics, I approve of the things my child is learning.						
In social and emotional areas, I approve of the things my child is learning.						
I am satisfied with the education my child is getting.						
I am satisfied with my child's teacher.						
I am satisfied with my child's counselor.						
I am pleased with my child's happiness in school.						
I am satisfied with my child's feeling of safety at school.						
My child is treated with fairness at school.						
I feel welcomed at my child's school.						
I am satisfied with the behavior of the students at my child's school.						
I am satisfied with my level of involvement in my child's school.						
I support the programs being offered at my child's school.						
I am satisfied with my child's school.						

The Children's Guild DC Public Charter School
STUDENT SATISFACTION SURVEY

- [ ] Glen Burnie
- [ ] Baltimore
- [ ] other

	Strongly Agree 4	Agree 3	Disagree 2	Strongly Disagree 1	Do Not Know 0	Comments
I like school.						
I am learning important things.						
People at my school care about me.						
I am treated fairly at school.						
My schoolwork is too hard.						
My schoolwork is too easy.						
My class has done new and fun things this year.						
I have a good teacher.						
I feel safe at school.						
The other students in my class follow the rules.						
I follow school rules.						
I am glad I go to this school.						

Appendix, Section L
Culture Card

The Children's Guild

Culture Card

Purpose

"To serve children not achieving their full capability in academic, emotional, social or life skills by establishing programs and discovering more effective methods to promote growth and change in the levels of achievement of those we serve."

Mission

"To teach children the values and life skills necessary for a successful life, one filled with caring, contribution and commitment, empowering each with:

The Vision to See

opportunity within adversity and the value of setting goals to reach;

The Courage to Try

and the value of accepting obstacles as challenges to meet;

The Will to Succeed

and the value of making the commitment to persevere."

Vision

"To create, implement and replicate an organizational culture that produces documented growth and change in the academic, emotional, social and life skills of the children we serve."

The Children's Guild, Inc.
6802 McClean Boulevard
Baltimore, Maryland 21234
www.childrensguild.org
March 2005

The Nine Wisdom Principles

The Personal Values

"What are the values needed to access personal growth?"

Caring

As an organization and as individuals, we need to be caring.

Contribution

Caring does not exist without action.

Commitment

Commitment is contribution over time.

The Life Skills

"What are the skills needed to achieve growth?"

Vision

The ability to see what you can become.

Courage

Pursuing one's vision despite adversity.

Will

Will is the application of courage over time.

The Growth Processes

"What is the process through which growth occurs?"

Struggle

Struggle is required for growth.

Transformation

Growth requires a change of thinking and behavior.

Enlightenment

A broader awareness of one's responsibilities and moral obligations.

Transformation Education

Transformation Education is an organizational philosophy that guides the creation of a culture for transmitting the value and life skills necessary for a successful life.

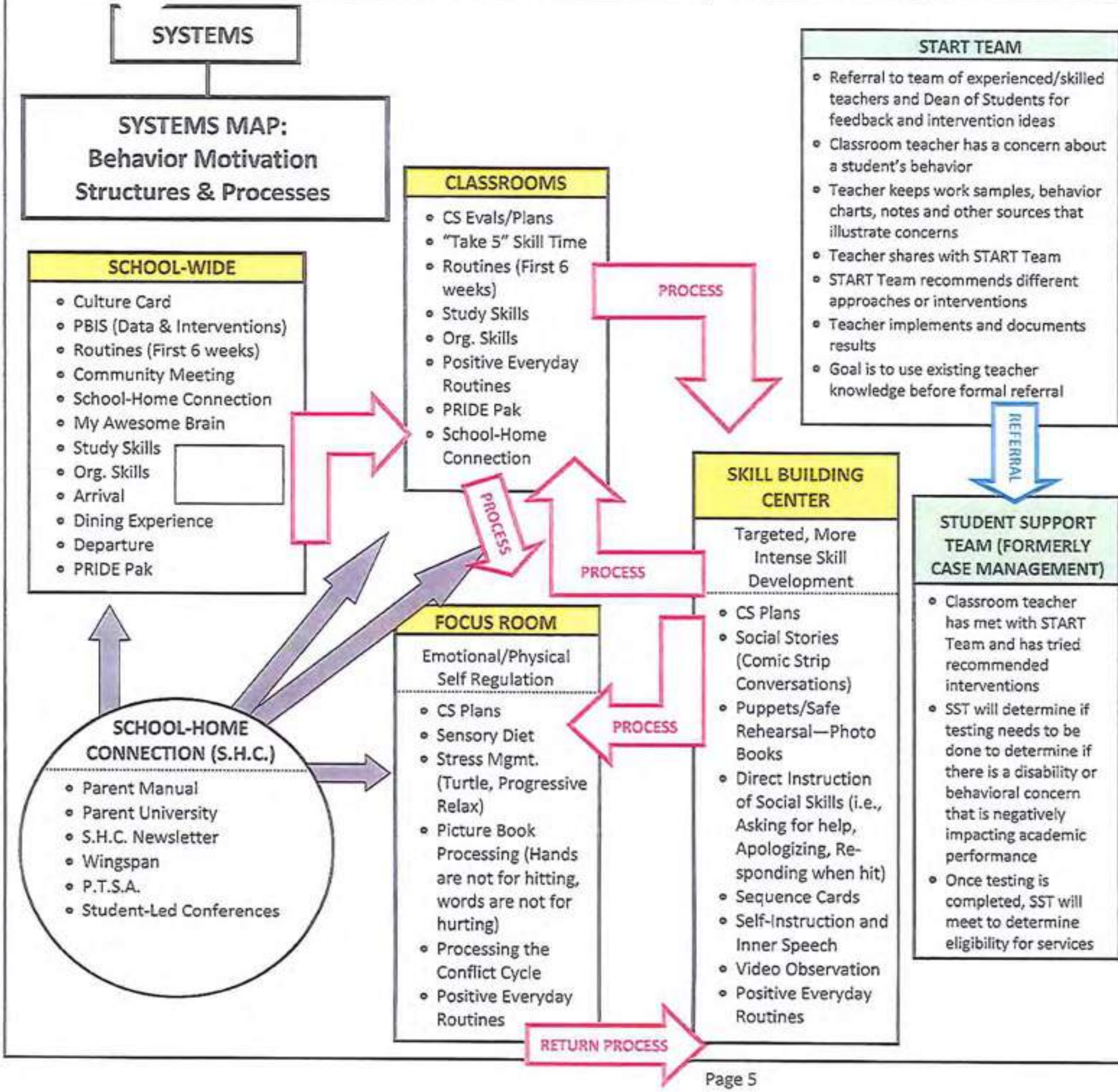
Foundational Beliefs

1. Life is a journey of personal growth ascending from a focus on self to a focus on family, community and world.
2. Culture is the most powerful force available to child-serving organizations for transmitting pro-social values and transforming one's mindset.
3. All life on this planet is connected in profound and countless subtle ways.
4. In virtually every choice is a moral dilemma and we must decide which choice is the most right. Each dilemma one faces provides the opportunity to grow in wisdom and experience.
5. Chaos is the norm, not the exception in a child-serving organization. The key to managing chaos is to embrace it, not fight it.
6. A child-serving organization is more than a host for the professions. The organization is the critical component for transmitting values and fostering emotional and intellectual growth.
7. The focus of management efforts is on transforming the disparate individual beliefs and values into alignment with the foundational beliefs and values of the organization.

Workplace Expectations

1. Norms Not Rules
   Understand the situation and act in context.
2. Spinning Plates
   Often we must manage a myriad of tasks with insufficient time and resources.
3. Be a Brinksman
   We come to know our true potential when we are pushed to the brink of the impossible.
4. Change is Constant
   Expect change because we live in a dynamic environment that calls for constant re-evaluation of decisions and assumptions.
5. Decide! Then Re-decide!
   Don't stick to the old decisions when you have new information.
6. Own It!
   When you're looking for the problem, start with yourself.
7. Be True to Your School (Talk the Talk & Walk the Walk)
   Model the values you espouse.
8. A Master Teacher and a Master Learner
   Teach by example and always be open to grow personally and professionally.
9. Count Using Mission Math
   Value mission, not recognition.
10. Don't Sign It Until the Quality is in It
    Do it over until it is right!
11. Work is Fun!
    Working where our talents lie brings joy and enriches life.
12. There is No Growth Without Pain!
    Accomplishments are attained through struggle and self-discipline.
13. 1 + 1 = 3
    In problem solving, the sum is greater than the parts.
14. Ready-Fire-Aim
    Assess the risk, begin to act and then make the adjustments along the way.
15. Say No With Compassion
    Develop the courage to deliver a difficult message with respect and compassion and then do it.
16. Make the Covert, Overt
    When there are unstated issues between individuals and groups, bring them to the surface of discussion.

Appendix, Section M
Behavior Motivation and Intervention System



MY AWESOME BRAIN

Curriculum taught by Guidance Counselor consolidating current social skills topics with brain-based material on how the brain works and how to take care of it.

STUDY SKILL/ORG. SKILLS

Common method for teaching students how to learn, study and organize. Applied consistently K-6. Organization method includes color coding and consistent, developmentally appropriate expectations by teachers.

PRIDE PAK—"RITUALS"

Instruction and activities to teach students personal, classroom, grade-level and school pride (song, colors, mascot, slogan) and inculcate school values (caring, contribution, commitment).

CRITICAL SKILLS (CS) EVALUATIONS AND PLANS

Tools to evaluate students on strengths on the Monarch Academy Critical Skills (Life Skills, Citizenship Skills and School Success Skills) and develop targeted plans to build skills in areas of need.

"TAKE 5" SKILL TIME

First 5 minutes of each class devoted to teaching one or more of the Monarch Academy Critical Skills.

POSITIVE EVERYDAY ROUTINES

Research-based method for students to plan alternatives to unsuccessful behavior, apply alternatives and assess results.

Appendix, Section N
Assessment Habits

THE CHILDREN'S GUILD DISTRICT OF COLUMBIA PUBLIC CHARTER SCHOOL
ASSESSMENT OF HABITS OF SCHOLARSHIP

Primary Grades

Values and Work Habits	All of The Time	Most of The Time	Occasionally	None of The Time
Compassion				
I can listen to others when being spoken to, while respecting their needs and feelings.				
I can treat others with kindness and respect				
I can say, "I'm Sorry" if I hurt or embarrass someone				
I can help and support others whenever I am able to help and support them.				
Respectful Open-Mindedness				
I can listen to other's perspectives about their personal history and/or other cultures				
I can respond positively about other's diversity and personal histories				
I can initiate appropriate information and/or questions about other's culture and personal histories				
Ownership of One's Behavior				
I can be honest and own my mistakes				
I can try my best at all times.				
I can follow the expectations and values the school has for me.				
I can be aware that my actions have consequences.				
I can be responsible for my self when working in a group				
Reflective				
I can name my strengths and challenges in my learning and personal development				
I can reflect on the quality of my actions and my work.				
I can reflect on how my thinking has changed over				

time.				
I can provide feedback to my peers				
Global Citizenship				
I can be proud of my own identity while also being proud of other's.				
I can recognize that people come from and live in different countries				
I can participate in being of service to others and to myself				
Risk Taking				
I am brave.				
I can persevere when I am challenged.				
I can expose my feelings and my truce self to others.				
I can weigh the pros and cons of taking an action.				
Curiosity				
I can be curious about the world around me and my learning.				
I can ask questions to get clarification about ideas, information and opinions.				
I can seek diversity throughout my learning and in the world.				

THE CHILDREN'S GUILD DISTRICT OF COLUMBIA PUBLIC CHARTER SCHOOL
ASSESSMENT OF HABITS OF SCHOLARSHIP

Intermediate and Middle Grades

Values and Work Habits	All of The Time	Most of The Time	Occasionally	None of The Time
Compassion				
I can listen attentively to others and value their word				
I can accept the differences in others and treat them with respect				
I can recognize my mistakes and apologize when I cause another person feel hurt or embarrassed.				
I can make connections with others by helping and contributing to the community.				
Respectful Open-Mindedness				
I can listen tentatively about others culture and personal histories				
I can initiate ideas or comments connected to my own culture and/or personal history.				
I can respond constructively to ideas and points of view				
I can justify and substantiate opinion, arguments and feedback respectfully.				
I can expand on other's perspectives and points of view.				
I can monitor my own understandings by paraphrasing or summarizing information.				
Ownership of One's Behavior				
I can adhere to the expectations that I, along with the school community has for me.				
I can be honest with myself and others.				
I can take responsibility for my actions and the consequences that accompany them.				
I can exhibit justice and respect for the dignity of individuals, groups and communities.				

I can take responsibility for my own learning.				
Reflective				
I can set goals to support my learning and personal development.				
I can identify the thinking and problem-solving strategies I use.				
I can reflect on how my thinking has changed overtime.				
I can provide specific feedback and support to my peers.				
I can reflect on the quality of my actions and my work.				
Global Citizenship				
I can understand and make connections to the idea of a world community.				
I can understand that change is constant.				
I can impact and improve the state of the world.				
I can discuss major world issues and cooperatively problem solve at the local, national and international level.				
I can investigate how people from different countries can work together for mutual benefit				
Risk Taking				
I am brave and articulate in defending my beliefs.				
I can face unfamiliar situations and uncertainty with courage and forethought.				
I can make a personal sacrifice as an investment to better my own circumstances and the circumstances of others.				
I can honestly appraise a situation in my life requiring me to act and the risk involved.				
I can open myself up to change.				
Curiosity				
I can seek new worlds, communities and possibilities which are normally not visible to me.				
I can engage in natural inquisitive exploration, investigation and learning.				

I can exhibit a desire to learn and know about anything.				
I can engage in discussions by asking questions, arguing or expressing different points of view.				

THE CHILDREN'S GUILD DISTRICT OF COLUMBIA PUBLIC CHARTER SCHOOL
ASSESSMENT OF HABITS OF SCHOLARSHIP

Faculty

Values and Work Habits	All of The Time	Most of The Time	Occasionally	None of The Time
Compassion				
I can listen attentively to others and value their words				
I can accept the differences in others and treat them with respect				
I can recognize my mistakes and apologize when I cause another person feel hurt or embarrassed.				
I can make connections with others by helping and contributing to the community.				
I can work to develop positive relationships with my colleagues throughout the school.				
Respectful Open-Mindedness				
I can elaborate on other's ideas, perspectives and points of view, while challenging opinions or asking for clarification when discussing others culture and/or personal histories				
I can initiate ideas or comments connected to my own culture and/or personal history.				
I can respond constructively to ideas and points of view				
I can justify and substantiate opinion, arguments and feedback respectfully.				
I can expand on other's perspectives and points of view.				
I can monitor my own understandings by paraphrasing or summarizing information.				
Ownership of One's Behavior				
I can act with integrity and honesty.				
I can exhibit justice and respect for the dignity of individuals, groups and communities.				

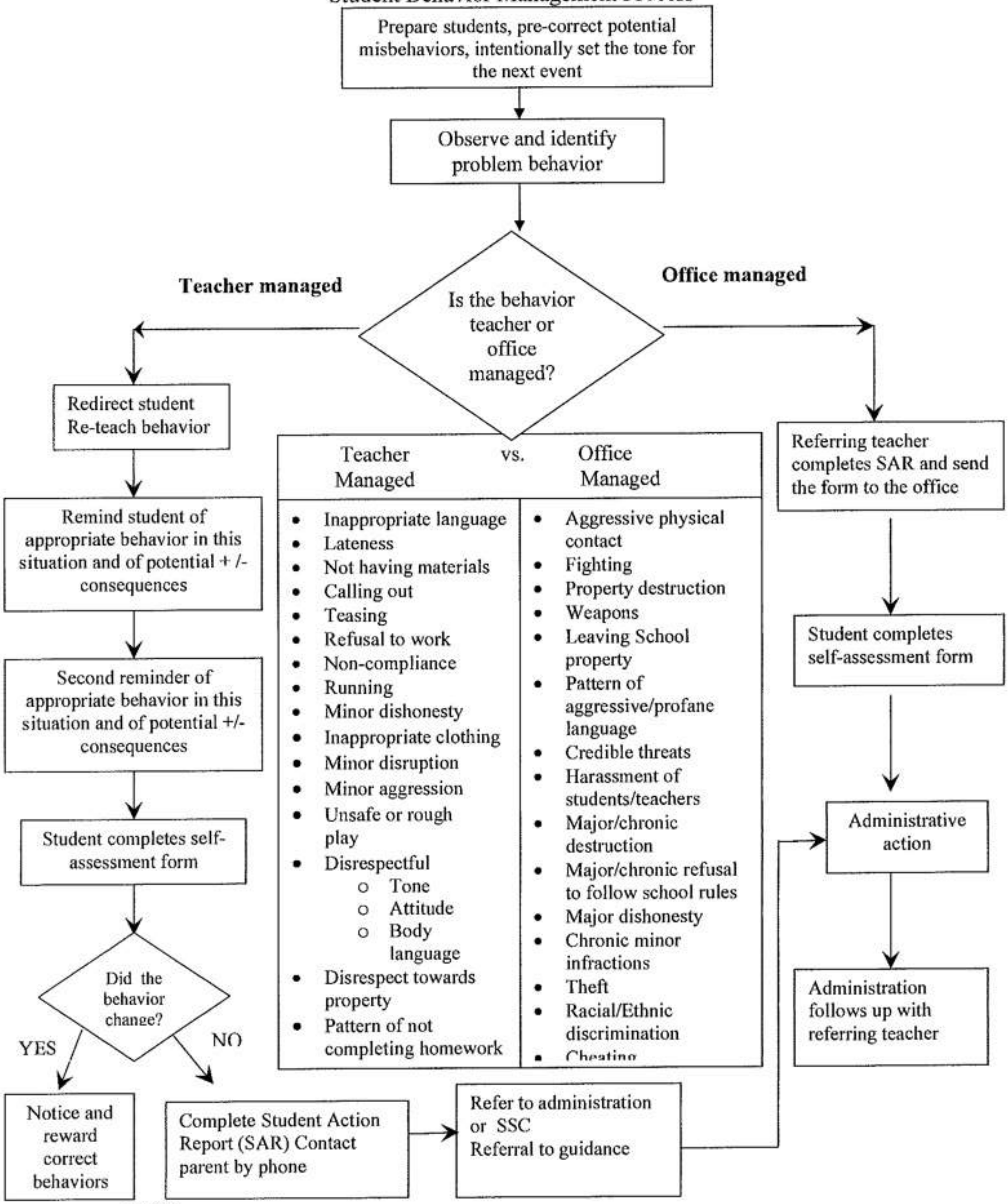
I can take responsibility for my own learning.				
Reflective				
I can set goals to support my learning and personal development.				
I can identify the thinking and problem solving strategies I use				
I can provide specific feedback and support to my peers.				
I can reflect on the quality of my actions and my work.				
I can reflect on how my thinking has changed overtime.				
Global Citizenship				
I can be adaptable and have the capacity to cope with rapid change.				
I can understand the need to balance interdependence with independence.				
I can investigate how people from different countries can work together for mutual benefit.				
I can understand and make connections to the importance of a world community.				
I can discuss major old issues and cooperatively problem solve at the local, national and international level.				
Risk Taking				
I am brave and articulate in defending my beliefs.				
I can face unfamiliar situations and uncertainty with courage and forethought.				
I cam make a personal sacrifice as an investment to better my own circumstances and the circumstances of others				
I can honestly appraise a situation in my life requiring me to act and understand the risk involved.				
I can open myself up to change.				
Curiosity				
I can seek new worlds and possibilities which are				

normally not visible.				
I can engage in natural inquisitive exploration, investigation and learning.				
I can exhibit a desire to learn and know about anything.				
I can engage in discussions by asking questions, arguing or expressing different points of view.				

Appendix, Section O
Student Behavior Management Process

THE CHILDREN'S GUILD DISTRICT OF COLUMBIA PUBLIC CHARTER SCHOOL

Student Behavior Management Process



Teacher Managed	vs. Office Managed

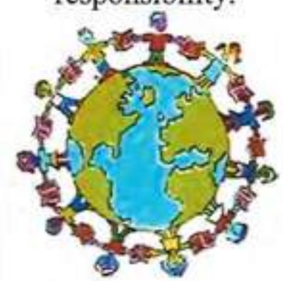
• Inappropriate language
• Lateness
• Not having materials
• Calling out
• Teasing
• Refusal to work
• Non-compliance
• Running
• Minor dishonesty
• Inappropriate clothing
• Minor disruption
• Minor aggression
• Unsafe or rough play
• Disrespectful
  o Tone
  o Attitude
  o Body language
• Disrespect towards property
• Pattern of not completing homework
	• Aggressive physical contact
	• Fighting
	• Property destruction
	• Weapons
	• Leaving School property
	• Pattern of aggressive/profane language
	• Credible threats
	• Harassment of students/teachers
	• Major/chronic destruction
	• Major/chronic refusal to follow school rules
	• Major dishonesty
	• Chronic minor infractions
	• Theft
	• Racial/Ethnic discrimination
	• Cheating

3/19/06

Appendix, Section P
PBIS Matrix

THE CHILDREN'S GUILD DISTRICT OF COLUMBIA PUBLIC CHARTER SCHOOL

PBIS TEACHING MATRIX

	CLASSROOM	CAFETERIA	BUS	PLAYGROUND	HALLWAY	BATHROOM
						
WORK HARD 	Strive to complete assignments and homework	Eat your own food	Keep your hands, feet, and objects to yourself. 	Play and have fun. Play safely.	WALK!! Stay in line	Wash your hands. Put trash in trash can.
BE RESPECTFUL 	Use appropriate language	Practice good table manners Pick up and clean around your table.	Use appropriate language Follow bus rules.	Follow adult's directions. Respect neighbors' property and pets.	Use inside voice. Respect art work on the walls.	Respect others' privacy. Ask permission and go with an adult.
BELIEVE IN YOURSELF 	Attempt challenging tasks. 259 ×917 Make good choices. Ask for help.	Try new foods. Eat healthy foods.	Be on time. Accept responsibility. 	Be careful and stay safe.  Display good sportsmanship. 	Accept responsibility. 	Practice good hygiene. 

Appendix, Section Q
Discipline Policy

The Children's Guild
Policy & Procedure Manual

Title: Discipline	Policy Number: 04-02-04
Page(s): 6	Initiated By: Kelly Spanoghe, Dir, Education Barbara Steinle, Dir, Clinical Svcs Approved By: Executive Management Effective Date: 8/26/99
Supersedes: 04-02-01, 04-02-02	Reviewed By: Kelly Spanoghe, V.P., Educational Services Review Dates: 10/99, 8/00, 11/01, 8/02, 9/02, 12/03, 7/06, 10/06, 8/07, 8/08, 11/09, 2/10, 8/11

Policy:

The teaching of discipline shall be directed toward helping students take responsibility for themselves, become capable decision-makers, become self-directed learners and promote the social and moral development of the child. Individualized approaches to the teaching of self-discipline will be tailored to the specific developmental level of the child.

Definitions:

Team--The team includes a special education teacher, classroom teaching assistant, tutor, school counselor, related services providers, nurse, fidelity and instructional coaches, and the youth life educators where appropriate.

Direct Care Personnel--Any staff member who provides a direct service to the student (i.e., teacher, teacher assistant, school counselor, related service provider, and tutor, youth life educator, etc.).

Rationales and Procedures:

1. Why Does The Children's Guild Teach Self-Discipline Rather Than Obedience, and Why Obedience Doesn't Work

Rationale:
Discipline comes from the Latin word meaning, "to teach". We are trying to teach children to reach the goal of self-discipline; that is, to take responsibility for the action they choose, not to act on impulse alone, and to assess probable consequences of several courses of action before making a decision. Obedience is defined as the ability to carry out or yield to command, authority, or instruction. Traditional models of education are based on curriculums of control. The educator establishes the rules and the student must obey the rules of the classroom, so that the teacher can move through the lesson plan in an orderly fashion. These models are designed more to instruct than to teach. This system takes the pleasure, ownership, and competency out of the learning process for students. In essence the rule