

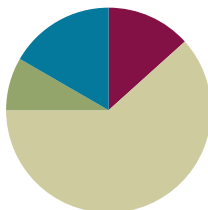
## Lesson 10

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

**Related Topics:** [More Lesson Plans for the Common Core Math](#)

### Suggested Lesson Structure

■ Fluency Practice	(8 minutes)
■ Application Problem	(5 minutes)
■ Concept Development	(37 minutes)
■ Student Debrief	(10 minutes)
<b>Total Time</b>	<b>(60 minutes)</b>



### 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  $4 \times \underline{\quad} = 12$ .) Fill in the unknown factor to make a true number sentence.

S:  $4 \times 3 = 12$ .

Continue with the following possible sequence:  $6 \times \underline{\quad} = 12$ ,  $2 \times \underline{\quad} = 12$ , and  $3 \times \underline{\quad} = 12$ .

T: (Write  $8 \times \underline{\quad} = 24$ .) Fill in the unknown factor to make a true number sentence.

S: (Write  $8 \times 3 = 24$ .)

Continue with the following possible sequence:

$6 \times \underline{\quad} = 24$ ,  $3 \times \underline{\quad} = 24$ ,  $6 \times \underline{\quad} = 36$ ,  $9 \times \underline{\quad} = 36$ ,  $4 \times \underline{\quad} = 24$ ,  
 $4 \times \underline{\quad} = 36$ ,  $8 \times \underline{\quad} = 72$ ,  $8 \times \underline{\quad} = 48$ ,  $9 \times \underline{\quad} = 72$ ,  $6 \times \underline{\quad} = 48$ ,  
 $2 \times \underline{\quad} = 24$ ,  $12 \times \underline{\quad} = 24$ ,  $12 \times \underline{\quad} = 36$ ,  $12 \times \underline{\quad} = 48$ ,  
 $12 \times \underline{\quad} = 72$ ,  $3 \times \underline{\quad} = 36$ ,  $4 \times \underline{\quad} = 48$ ,  $6 \times \underline{\quad} = 72$ , and  
 $3 \times \underline{\quad} = 72$ .

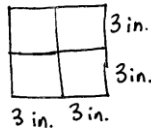
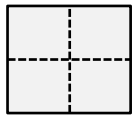


**A NOTE ON  
12 AS A FACTOR:**

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?



$3 \times 3 = 9$  sq. in.  
 The area of 1 part is 9 sq. inches. or

$6 \times 6 = 36$   
 The piece of paper has an area of 36 square inches

$36 \div 4 = 9$   
 The area of 1 folded part is 9 square inches.

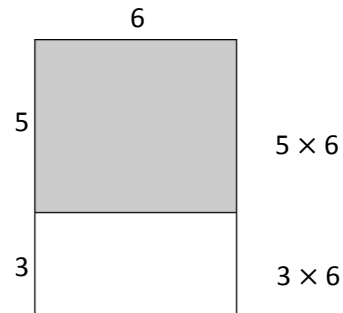
Note: This problem reviews the concept of finding area.

**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



$(5 \times 6) + (3 \times 6)$   
 $= 30 + 18$   
 $= 48$  square units

use to find the area of the shaded rectangle?

S:  $5 \times 6!$

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:  $3 \times 6!$

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!  $\rightarrow$  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:  $8 \times 6$ .

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?

S: They all show the area of the large rectangle.  $\rightarrow$  Oh

$8 \times 6$ $(5 + 3) \times 6$ $(5 \times 6) + (3 \times 6)$
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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  $(10 + 5) \times 8$ . 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  $9 \times 9$  or  $(10 + 8) \times 9$ .)

- 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

**Problem a:** A grid with 8 rows and 7 columns. The top 5 rows are shaded. The student labels the side lengths as 8 by 7 and breaks it into a 5 by 7 rectangle and a 3 by 7 rectangle. The calculation is:  $8 \times 7 = (5 + 3) \times 7 = (5 \times 7) + (3 \times 7) = 35 + 21 = 56$  square units.

**Problem b:** A grid with 12 rows and 4 columns. The top 10 rows are shaded. The student labels the side lengths as 12 by 4 and breaks it into a 10 by 4 rectangle and a 2 by 4 rectangle. The calculation is:  $12 \times 4 = (10 + 2) \times 4 = (10 \times 4) + (2 \times 4) = 40 + 8 = 48$  square units.

**Problem c:** A grid with 6 rows and 13 columns. The first 6 columns are shaded. The student labels the side lengths as 6 by 13 and breaks it into a 6 by 10 rectangle and a 6 by 3 rectangle. The calculation is:  $6 \times 13 = 6 \times (10 + 3) = (6 \times 10) + (6 \times 3) = 60 + 18 = 78$  square units.

**Problem d:** A grid with 8 rows and 12 columns. The first 8 columns are shaded. The student labels the side lengths as 8 by 12 and breaks it into an 8 by 10 rectangle and an 8 by 2 rectangle. The calculation is:  $8 \times 12 = 8 \times (10 + 2) = (8 \times 10) + (8 \times 2) = 80 + 16 = 96$  square units.

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 3•4

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

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

3. Shade to break the  $15 \times 5$  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.

$15 \times 5 = (10 + 5) \times 5$   
 $= (10 \times 5) + (5 \times 5)$   
 $= 50 + 25$   
 $= 75$  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.

COMMON CORE Lesson 10: Apply the distributive property as a strategy to find the total area of a large rectangle by adding two products. Date: 9/16/13

engage<sup>ny</sup> 4.C.7

### Exit Ticket (3 minutes)

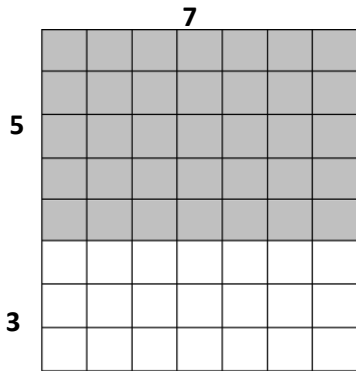
After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

Name \_\_\_\_\_

Date \_\_\_\_\_

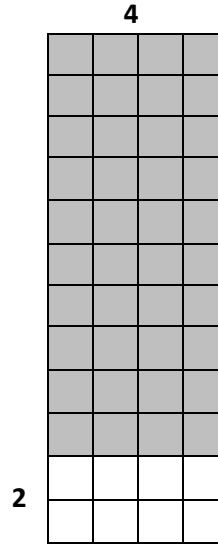
1. Label the side lengths of the shaded and unshaded rectangles. Then find the total area of the large rectangle by adding the areas of the two smaller rectangles.

a.



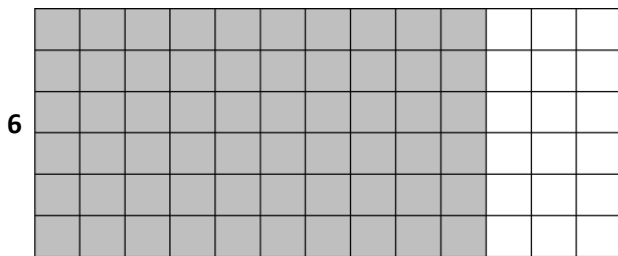
$$\begin{aligned}
 8 \times 7 &= (5 + 3) \times 7 \\
 &= (5 \times 7) + (3 \times 7) \\
 &= \underline{\quad} + \underline{\quad} \\
 &= \underline{\quad} \text{ square units}
 \end{aligned}$$

b.



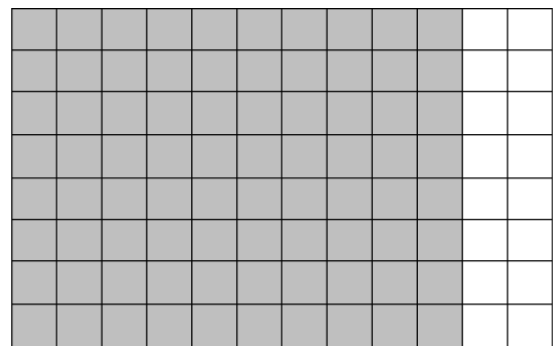
$$\begin{aligned}
 12 \times 4 &= (\underline{\quad} + 2) \times 4 \\
 &= (\underline{\quad} \times 4) + (2 \times 4) \\
 &= \underline{\quad} + 8 \\
 &= \underline{\quad} \text{ square units}
 \end{aligned}$$

c.



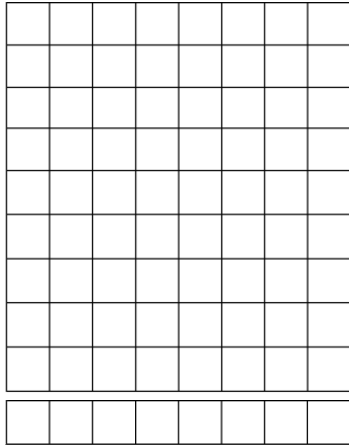
$$\begin{aligned}
 6 \times 13 &= 6 \times (\underline{\quad} + 3) \\
 &= (6 \times \underline{\quad}) + (6 \times 3) \\
 &= \underline{\quad} + \underline{\quad} \\
 &= \underline{\quad} \text{ square units}
 \end{aligned}$$

d.

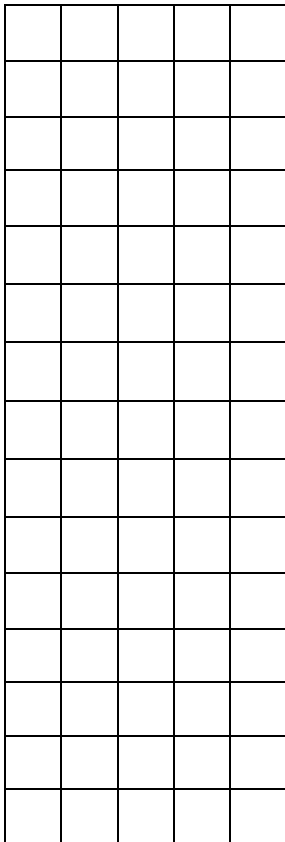


$$\begin{aligned}
 8 \times 12 &= 8 \times (\underline{\quad} + \underline{\quad}) \\
 &= (8 \times \underline{\quad}) + (8 \times \underline{\quad}) \\
 &= \underline{\quad} + \underline{\quad} \\
 &= \underline{\quad} \text{ square units}
 \end{aligned}$$

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



3. Shade to break the  $15 \times 5$  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.

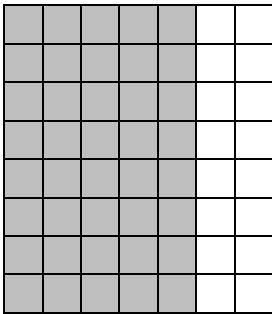


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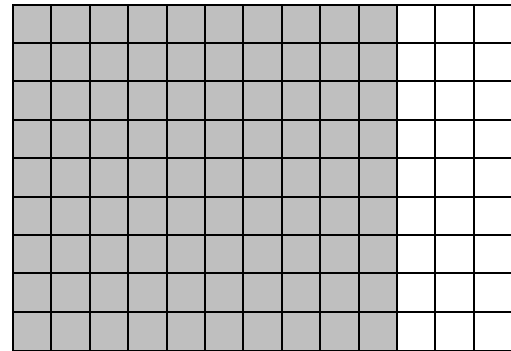
Label the side lengths of the shaded and unshaded rectangles. Then find the total area of the large rectangle by adding the areas of the 2 smaller rectangles.

a.



$$\begin{aligned}
 8 \times 10 &= 8 \times ( \quad + \quad ) \\
 &= (8 \times \quad) + (8 \times \quad) \\
 &= \quad + \quad \\
 &= \quad \text{square units}
 \end{aligned}$$

b.



$$\begin{aligned}
 9 \times 13 &= 9 \times ( \quad + \quad ) \\
 &= ( \quad \times \quad ) + ( \quad \times \quad ) \\
 &= \quad + \quad \\
 &= \quad \text{square units}
 \end{aligned}$$

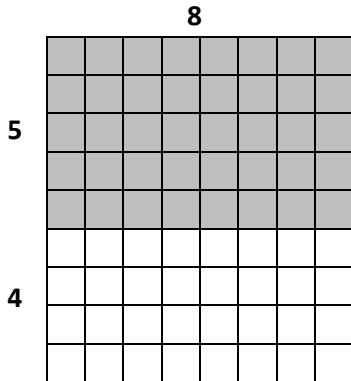


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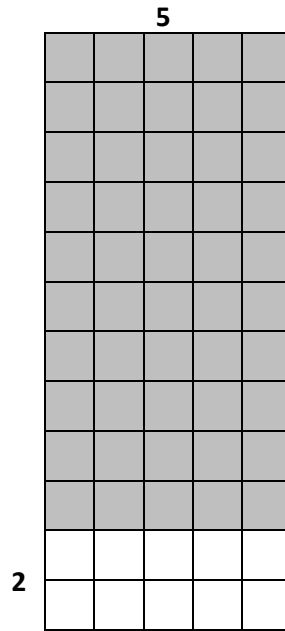
1. Label the side lengths of the shaded and unshaded rectangles. Then find the total area of the large rectangle by adding the areas of the 2 smaller rectangles.

a.



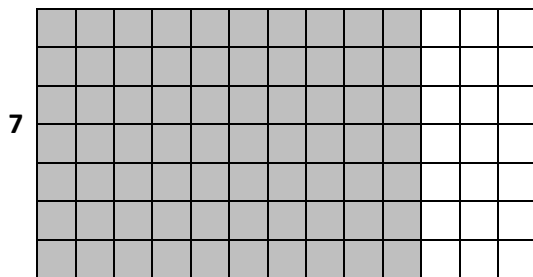
$$\begin{aligned}
 9 \times 8 &= (5 + 4) \times 8 \\
 &= (5 \times 8) + (4 \times 8) \\
 &= \underline{\quad} + \underline{\quad} \\
 &= \underline{\quad} \text{ square units}
 \end{aligned}$$

b.



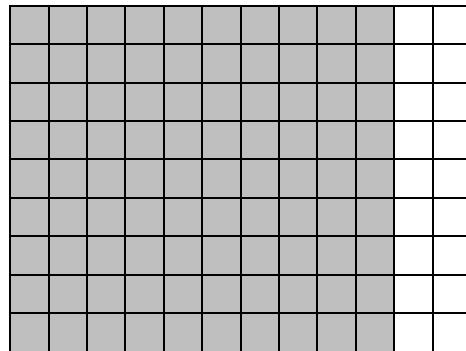
$$\begin{aligned}
 12 \times 5 &= (\underline{\quad} + 2) \times 5 \\
 &= (\underline{\quad} \times 5) + (2 \times 5) \\
 &= \underline{\quad} + 10 \\
 &= \underline{\quad} \text{ square units}
 \end{aligned}$$

c.



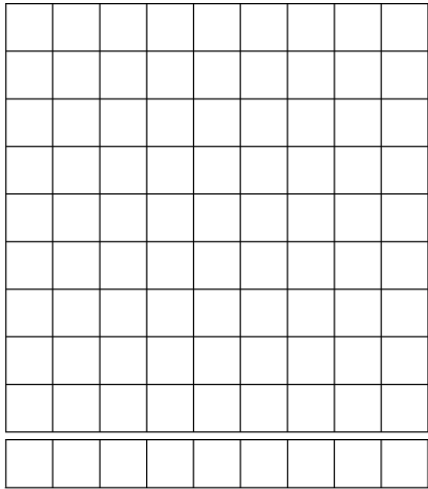
$$\begin{aligned}
 7 \times 13 &= 7 \times (\underline{\quad} + 3) \\
 &= (7 \times \underline{\quad}) + (7 \times 3) \\
 &= \underline{\quad} + \underline{\quad} \\
 &= \underline{\quad} \text{ square units}
 \end{aligned}$$

d.



$$\begin{aligned}
 9 \times 12 &= 9 \times (\underline{\quad} + \underline{\quad}) \\
 &= (9 \times \underline{\quad}) + (9 \times \underline{\quad}) \\
 &= \underline{\quad} + \underline{\quad} \\
 &= \underline{\quad} \text{ square units}
 \end{aligned}$$

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



3. Shade to break the  $16 \times 4$  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.

