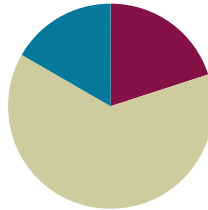


## Lesson 3

**Objective:** Demonstrate understanding of area and perimeter formulas by solving multi-step real world problems.

### Suggested Lesson Structure

■ Fluency Practice	(12 minutes)
■ Concept Development	(38 minutes)
■ Student Debrief	(10 minutes)
<b>Total Time</b>	<b>(60 minutes)</b>



### Fluency Practice (12 minutes)

- Sprint: Missing Products and Factors **4.OA.4** (8 minutes)
- Find the Area and Perimeter **4.MD.3** (4 minutes)

### Sprint: Missing Products and Factors (8 minutes)

Materials: (S) Squares and Missing Factors Sprint

Note: This Sprint will review skills that students need to master to access area problems.

### Find the Area and Perimeter (4 minutes)

Materials: (S) Personal white boards

Note: This will review content from G4–M3–Lessons 1 and 2.

Repeat the process from G4–M3–Lesson 2 for the following possible suggestions:

- Rectangles with dimensions of 5 cm  $\times$  2 cm, 7 cm  $\times$  2 cm, and 4 cm  $\times$  7 cm.
- Squares with lengths of 4 cm and 6 m.
- Rectangles with a given area of 8 square cm, length 2 cm, and width  $x$ ; area of 15 square cm, length 5 cm, and  $x$  for the length; and area of 42 square cm, width 6 cm, and  $x$  for the length.



#### NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

To maximize productivity, you may choose to make team goals for sustained effort, perseverance, and cooperation. Motivate improvement by providing specific feedback after each problem. Resist feedback that is comparative or competitive. Showcase students who incorporated your feedback into their subsequent work.

**Concept Development (38 minutes)**

Materials: (S) Problem Set

Note: For this lesson, the Problem Set will be comprised of word problems from the Concept Development and is, therefore, to be used during the lesson itself.

For Problems 1–4 below, students may work in pairs to solve each of the problems using the RDW approach to problem solving.

**1. Model the problem.**

Have two pairs of students who you think can be successful with modeling the problem work at the board while the others work independently or in pairs at their seats. Review the following questions before beginning the first problem.

- Can you draw something?
- What can you draw?
- What conclusions can you make from your drawing?

As students work, circulate. Reiterate the questions above.

After two minutes, have the two pairs of students share *only* their labeled diagrams.

For about one minute, have the demonstrating students receive and respond to feedback and questions from their peers. Depending on the problem and the student work you see as you circulate while they model, supplement this component of the process as necessary with direct instruction or clarification.

**2. Calculate to solve and write a statement.**

Give everyone two minutes to finish work on that question, sharing their work and thinking with a peer. All should then write their equations and statements of the answer.

**3. Assess the solution.**

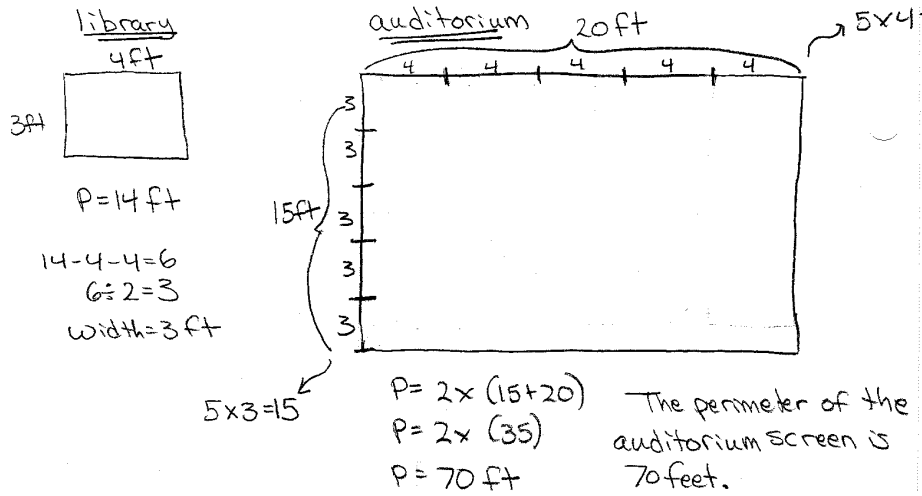
Give students one or two minutes to assess the solutions presented by their peers on the board, comparing the solutions to their own work. Highlight alternative methods to reach the correct solution.

**NOTES ON  
MULTIPLE MEANS  
OF ENGAGEMENT:**

After the discussion of relationships of perimeter in Lesson 2, challenge students to quickly predict the perimeter of the screen in the auditorium. Have students offer several examples of the multiplicative pattern.

**Problem 1**

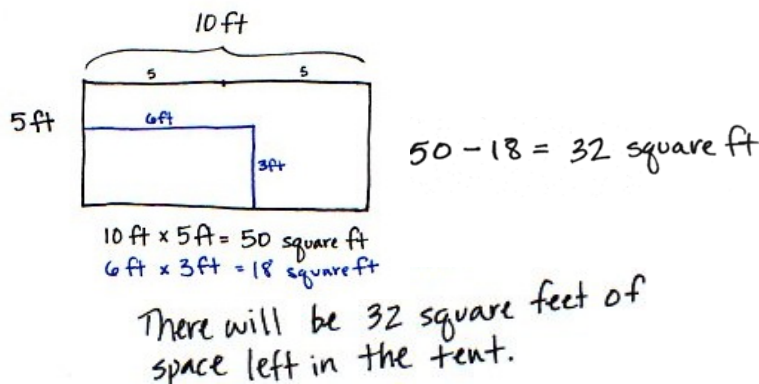
The projection screen in the school auditorium is 5 times as long and 5 times as wide as the screen in the library. The screen in the library is 4 feet long with a perimeter of 14 feet. What is the perimeter of the screen in the auditorium?



The structure of this problem and what it demands of the students is similar to that found within the first and second lessons of this module. Elicit from students why both the length and the width were multiplied by 5 to find the dimensions of the larger screen. Students will use the dimensions to find the perimeter of the larger screen. Look for students to use formulas for perimeter other than  $2 \times (l + w)$  for this problem, such as the formula  $2l + 2w$ .

**Problem 2**

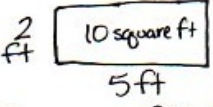
The width of David's tent is 5 feet. The length is twice the width. David's rectangular air mattress measures 3 feet by 6 feet. If David puts the air mattress in the tent, how many square feet of floor space will be available for the rest of his things?



The new complexity here is that students are finding an area within an area and determining the difference between the two. Have students draw and label the larger area first, and then draw and label the area of the air mattress inside as shown above. Elicit from students how the remaining area can be found using subtraction.

**Problem 3**

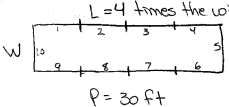
Jackson’s bedroom has an area of 90 square feet. The area of his bedroom is 9 times that of his closet. If the closet is 2 feet wide, what is its length?

$90 \text{ square ft} \div 9 = 10 \text{ square ft}$   
  
 $10 \text{ square ft} \div 2 \text{ ft} = 5 \text{ ft}$   
 The length of the closet is 5 feet.

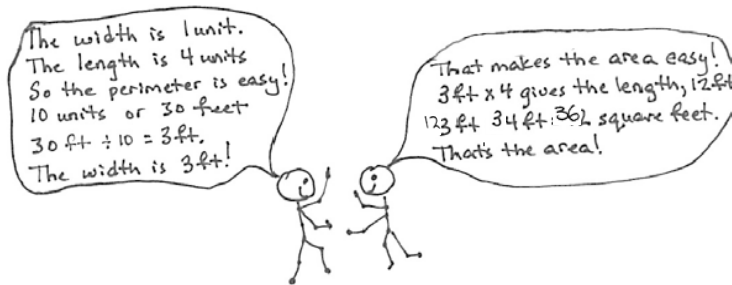
This multi-step problem requires students to work backwards, taking the area of Jackson’s room and dividing by 9 to find the area of his closet. Students will use their learning from the first and second lessons of this module to help solve this problem.

**Problem 4**

The length of a rectangular deck is 4 times its width. If the deck’s perimeter is 30 feet, what is the deck’s area?

① 
 $P = 2 \times (l + w)$   
 Width = 1 unit > 5 units  
 length = 4 units  $P = 2 \times 5$   
 $P = 10 \text{ units}$   
 $10 \times a = 30 \text{ feet}$   
 $a = 3 \text{ feet per unit}$   
 $w = 3 \text{ ft}$

②  $w = 3 \text{ ft}$   
 $L = 12 \text{ ft}$   
 $A = 12 \text{ ft} \times 3 \text{ ft}$   
 $A = 36 \text{ square feet}$



Students will need to use what they know about multiplicative comparison and perimeter to find the dimensions of the deck. Students find this rectangle has 10 equal size lengths around its perimeter. Teachers can support students who are struggling by using square tiles to model the rectangular deck. Emphasize finding the number of units around the perimeter of the rectangle. Once the width is determined, students will be able to solve for the area of the deck. If students have solved using square tiles, encourage students to follow up by drawing a picture of the square tile representation. This will allow students to bridge a gap between the concrete and pictorial stage.

**Problem Set**

Please note that the Problem Set for Lesson 3 is comprised of this lesson’s problems, as stated in the introduction of the lesson.

**Student Debrief (10 minutes)**

**Lesson Objective:** Demonstrate understanding of area and perimeter formulas by solving multi-step real world problems.

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 simplifying strategies did you use to multiply to find the perimeter in Problem 1?
- Can David fit another air mattress of the same size in his tent? (Guide students to see that while there is sufficient area remaining, the dimensions of the air mattress and remaining area of the tent would prevent it from fitting.)

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

Name Jack Date \_\_\_\_\_

Solve the following problems. Use pictures, words, or diagrams to help you solve.

1. The projection screen in the school auditorium is 5 times as long and 5 times as wide as the screen in the library. The screen in the library is 4 feet long with a perimeter of 14 feet. What is the perimeter of the screen in the auditorium?

4 ft  
3 ft  
14 ft  
P = 14 ft  
14 - 4 - 4 = 6  
6 ÷ 2 = 3  
w = 3

Auditorium's Screen  
20 ft  
4 4 4 4 4  
3 3 3 3 3

$P = 2 \times (l + w)$   
 $= 2 \times (20 + 15)$   
 $= 2 \times 35$   
 $= 70$   
 $P = 70 \text{ ft}$   
The perimeter of the screen in the auditorium is 70 ft.

2. The width of David's tent is 5 feet. The length is twice the width. David's rectangular air mattress measures 3 feet by 6 feet. If David puts the air mattress in the tent, how many square feet of floor space will be available for the rest of his things?

5 ft 5 ft  
3 ft  
3 ft

Tent  
 $A = l \times w$   
 $= 10 \times 5$   
 $= 50$   
 $A = 50 \text{ square ft.}$

Air mattress  
 $A = l \times w$   
 $= 6 \times 3$   
 $= 18$   
 $A = 18 \text{ square ft.}$

$\frac{40}{50}$   
 $- 18$   
 $\hline 32$   
32 square feet of floor space will be available.

COMMON CORE Lesson 3: Demonstrate understanding of area and perimeter formulas by solving multi-step real world problems. 8/12/13 engage<sup>ny</sup> 3.A.39

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

3. Jackson's bedroom has an area of 90 square feet. The area of his bedroom is 9 times that of his closet. If the closet is 2 feet wide, what is its length?

90 square ft

Area of closet  $\times 9 =$  Area of bedroom  
Area of closet  $\times 9 = 90$   
 $90 \div 9 = 10$   
Area of closet = 10 square ft

2 ft  
10 square ft  
 $A = l \times w$   
 $10 = l \times 2$   
 $l = 5$   
The length of the closet is 5 feet.

4. The length of a rectangular deck is 4 times its width. If the deck's perimeter is 30 feet, what is the deck's area?

4 units  
1 unit

$P = 2 \times (l + w)$   
 $= 2 \times (4 + 1)$   
 $= 2 \times 5$   
 $= 10 \text{ units}$

The deck's area is 36 square feet. 10 units = 30 ft  
1 unit = 3 ft  
 $w = 3 \text{ ft}$   
 $l = 12 \text{ ft}$   
 $A = 12 \text{ ft} \times 3 \text{ ft}$   
 $= 36 \text{ square feet}$

COMMON CORE Lesson 3: Demonstrate understanding of area and perimeter formulas by solving multi-step real world problems. 8/12/13 engage<sup>ny</sup> 3.A.40

- How was solving for Problem 3 different from other problems we have solved using multiplicative comparison?
- Explain how you used the figure you drew for Problem 4 to find a solution.
- When do we use *twice as much*, *2 times as many*, or *3 times as many*? When have you heard that language being used?

### 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.

**A**

# Correct \_\_\_\_\_

Solve.

1	$2 \times 2 =$		23	$3 \times \underline{\quad} = 21$	
2	$2 \times \underline{\quad} = 4$		24	$3 \times 3 =$	
3	$3 \times 3 =$		25	$4 \times \underline{\quad} = 20$	
4	$3 \times \underline{\quad} = 9$		26	$4 \times \underline{\quad} = 32$	
5	$5 \times 5 =$		27	$4 \times 4 =$	
6	$5 \times \underline{\quad} = 25$		28	$5 \times \underline{\quad} = 20$	
7	$1 \times \underline{\quad} = 1$		29	$5 \times \underline{\quad} = 40$	
8	$1 \times 1 =$		30	$5 \times 5 =$	
9	$4 \times \underline{\quad} = 16$		31	$6 \times \underline{\quad} = 18$	
10	$4 \times 4 =$		32	$6 \times \underline{\quad} = 54$	
11	$7 \times \underline{\quad} = 49$		33	$6 \times 6 =$	
12	$7 \times 7 =$		34	$7 \times \underline{\quad} = 28$	
13	$8 \times 8 =$		35	$7 \times \underline{\quad} = 56$	
14	$8 \times \underline{\quad} = 64$		36	$7 \times 7 =$	
15	$10 \times 10 =$		37	$8 \times \underline{\quad} = 24$	
16	$10 \times \underline{\quad} = 100$		38	$8 \times \underline{\quad} = 72$	
17	$9 \times \underline{\quad} = 81$		39	$8 \times 8 =$	
18	$9 \times 9 =$		40	$9 \times \underline{\quad} = 36$	
19	$2 \times \underline{\quad} = 10$		41	$9 \times \underline{\quad} = 63$	
20	$2 \times \underline{\quad} = 18$		42	$9 \times 9 =$	
21	$2 \times 2 =$		43	$9 \times \underline{\quad} = 54$	
22	$3 \times \underline{\quad} = 12$		44	$10 \times 10 =$	

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**B** Improvement \_\_\_\_\_ # Correct \_\_\_\_\_

Solve.

1	$5 \times 5 =$		23	$3 \times \underline{\quad} = 24$	
2	$5 \times \underline{\quad} = 25$		24	$3 \times 3 =$	
3	$2 \times 2 =$		25	$4 \times \underline{\quad} = 12$	
4	$2 \times \underline{\quad} = 4$		26	$4 \times \underline{\quad} = 28$	
5	$3 \times 3 =$		27	$4 \times 4 =$	
6	$3 \times \underline{\quad} = 9$		28	$5 \times \underline{\quad} = 10$	
7	$1 \times 1 =$		29	$5 \times \underline{\quad} = 35$	
8	$1 \times \underline{\quad} = 1$		30	$5 \times 5 =$	
9	$4 \times \underline{\quad} = 16$		31	$6 \times \underline{\quad} = 24$	
10	$4 \times 4 =$		32	$6 \times \underline{\quad} = 48$	
11	$6 \times \underline{\quad} = 36$		33	$6 \times 6 =$	
12	$6 \times 6 =$		34	$7 \times \underline{\quad} = 21$	
13	$9 \times 9 =$		35	$7 \times \underline{\quad} = 63$	
14	$9 \times \underline{\quad} = 81$		36	$7 \times 7 =$	
15	$10 \times 10 =$		37	$8 \times \underline{\quad} = 32$	
16	$10 \times \underline{\quad} = 100$		38	$8 \times \underline{\quad} = 56$	
17	$7 \times \underline{\quad} = 49$		39	$8 \times 8 =$	
18	$7 \times 7 =$		40	$9 \times \underline{\quad} = 27$	
19	$2 \times \underline{\quad} = 8$		41	$9 \times \underline{\quad} = 72$	
20	$2 \times \underline{\quad} = 16$		42	$9 \times 9 =$	
21	$2 \times 2 =$		43	$9 \times \underline{\quad} = 63$	
22	$3 \times \underline{\quad} = 15$		44	$10 \times 10 =$	

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Name \_\_\_\_\_

Date \_\_\_\_\_

Solve the following problem. Use pictures, words, or diagrams to help you solve.

1. A poster is 3 times as long as it is wide. A banner is 5 times as long as it is wide. Both the banner and the poster have perimeters of 24 inches. What are the length and width of the poster and the banner?

Name \_\_\_\_\_

Date \_\_\_\_\_

Solve the following problems. Use pictures, words, or diagrams to help you solve.

1. Katie cut out a piece of wrapping paper that was 2 times as long and 3 times as wide as the box that she was wrapping. The box was 5 inches long and 4 inches wide. What is the perimeter of the wrapping paper that Katie cut?
  
  
  
  
  
  
  
  
  
  
2. Alexis has a piece of red paper that is 4 centimeters wide. Its length is twice its width. She glues a piece of blue paper on top of the red piece measuring 3 centimeters by 7 centimeters. How many square centimeters of red paper will be visible on top?
  
  
  
  
  
  
  
  
  
  
3. Brinn's kitchen has an area of 81 square feet. The kitchen is 9 times as many square feet as Brinn's pantry. If the pantry is 3 feet wide, what is the length of the pantry?
  
  
  
  
  
  
  
  
  
  
4. The length of Marshall's poster is 2 times its width. If the perimeter is 72 inches, what is the area of the poster?