Chapter 13 Perimeter and Area

ESSENTIAL QUESTION
How are perimeter and area related and how are they different?

Let's Build Something!

Watch a video!
3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.

3.MD.5a 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.

3.MD.5b 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.

3.MD.7a 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.

3.MD.7b 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.

3.MD.7c 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.

3.MD.7d 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.

3.MD.8 Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

### Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

* = focused on in this chapter
Add.

1. \(3 + 4 + 3 + 4 = \)____  
2. \(5 + 6 + 5 + 6 = \)____

3. \(17 + 20 + 31 = \)____  
4. \(40 + 63 + 12 = \)____

5. From his house, Marcus walked three blocks north to the grocery store, six blocks east to the library, three blocks south to the park, and six blocks west back to his house. How many blocks did he walk in all?

Multiply.

6. \(3 \times 5 = \)____  
7. \(1 \times 7 = \)____  
8. \(4 \times 6 = \)____

9. \(5 \times 10 = \)____  
10. \(8 \times 9 = \)____  
11. \(6 \times 5 = \)____

12. Write a multiplication sentence that represents the array shown at the right.

Shade the boxes to show the problems you answered correctly.
Review Vocabulary

decompose
Distributive Property

Making Connections
Use the review vocabulary to help you complete each section of the chart. Then answer the question.

What multiplication problem is represented by the shaded array?

Show $8 \times 5$ in an array.

Decompose the above array.

Decompose the $8 \times 5$ array.

Explain how you used the Distributive Property to model $8 \times 5$. 
**Lesson 13-5**

**area**

12 square units

**Lesson 13-6**

**composite figure**

**Formula**

area (A) of a rectangle = length (ℓ) × width (w)

\[ A = \ell \times w \]

**Lesson 13-1**

**perimeter**

\[ P = 6 \text{ mm} + 6 \text{ mm} + 6 \text{ mm} + 10 \text{ mm} = 28 \text{ mm} \]

**Lesson 13-3**

**square unit**

6 square units

**Lesson 13-3**

**unit square**

1 unit
Ideas for Use

- Group 2 or 3 common words. Add a word that is unrelated to the group. Then work with a friend to name the unrelated word.

- Use the blank cards to draw or write examples that will help you with concepts like relating area to multiplication and addition.

A figure made up of two or more figures.
*Composite* comes from the root word *compose*, meaning “to put together.” Use *compose* to write a sentence that describes the figure on this card.

The number of square units needed to cover a figure without overlapping.
What is a real-life example of a situation when you would need to find area?

The distance around the outside of a figure.
The prefix *peri-* means “all around.” How does this help you remember the definition of *perimeter*?

An equation that shows the relationship between two or more quantities.
Explain why formulas are helpful to use when finding area.

A square with a side length of one unit.
A friend tells you he measured his bedroom’s perimeter in unit squares. Why is he incorrect?

A unit for measuring area.
Draw a rectangle that has a length of 6 square units and a width of 4 square units.
Follow the steps on the back to make your Foldable.

<table>
<thead>
<tr>
<th>1 square unit</th>
<th>1 square unit</th>
<th>1 square unit</th>
<th>1 square unit</th>
<th>1 square unit</th>
<th>1 square unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 square unit</td>
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<td>1 square unit</td>
<td>1 square unit</td>
</tr>
</tbody>
</table>
**Hands On**
**Find Perimeter**

**Perimeter** is the distance around the outside of a figure, or shape. You can estimate and measure perimeter.

**Measure It**

1. **Estimate the perimeter, in centimeters, of a piece of notebook paper.** Record the results in the table below.

2. **Use a centimeter ruler to find the perimeter to the nearest centimeter.** Find the length of each side. Then add the side lengths. Record the results in the table.

3. **Repeat Steps 1 and 2 for each object listed in the table.**

<table>
<thead>
<tr>
<th>Object</th>
<th>Estimate (cm)</th>
<th>Measure (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>piece of notebook paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>math book</td>
<td></td>
<td></td>
</tr>
<tr>
<td>desktop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chalkboard or whiteboard</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Online Content at [connectED.mcgraw-hill.com](https://connectED.mcgraw-hill.com)
An inch is larger than a centimeter. One inch is about halfway between 2 and 3 centimeters.

**Try It**

Using the same objects from the first activity, estimate and measure each perimeter to the nearest inch.

1. Estimate the perimeter, in inches, of a piece of notebook paper. Record the results in the table below.

2. Use an inch ruler to find the perimeter to the nearest inch. Record the results in the table.

3. Repeat Steps 1 and 2 for each object listed in the table.

<table>
<thead>
<tr>
<th>Object</th>
<th>Estimate (in.)</th>
<th>Measure (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>piece of notebook paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>math book</td>
<td></td>
<td></td>
</tr>
<tr>
<td>desktop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chalkboard or whiteboard</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Talk About It**

1. **Mathematical Practice** Explain to a Friend Why is it important to estimate the perimeter before finding its exact measurement?

2. Compare the perimeters of the objects in centimeters to the perimeters in inches. What do you notice?

3. After measuring the length of each side of an object, what operation did you use to find the perimeter? Explain.
Practice It

Estimate the perimeter of each figure in centimeters. Then measure the perimeter to the nearest centimeter.

4. Estimate: ____________  
   Actual: ______________

5. Estimate: ____________  
   Actual: ______________

Estimate the perimeter of each figure in inches. Then use an inch ruler to measure the perimeter to the nearest inch.

6. Estimate: ____________  
   Actual: ______________

7. Estimate: ____________  
   Actual: ______________

8. Circle whether the number of inches used to measure the perimeter of a figure would be larger or smaller than the number of centimeters.
   larger    smaller
9. **Use Number Sense** Rebecca used a centimeter ruler to measure the perimeter of the figure below. Which estimate is closest to the actual perimeter, 6 centimeters or 12 centimeters?

![Hexagon](image)

10. Antoine built a picture frame out of wood. He used an inch ruler to measure the perimeter of the frame. If the lengths of the sides of the frame are 8 inches, 6 inches, 8 inches, and 6 inches, what is the perimeter of the frame?

11. **Justify Conclusions** The perimeter of an object is 10 inches. Will the perimeter of the object to the nearest centimeter be less than, greater than, or equal to 10? Explain.

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**Write About It**

12. How is perimeter related to the operation of addition?
Homework Helper

Use a centimeter ruler to measure the perimeter of the figure at the right to the nearest centimeter.

Measure the length of each side.

To the nearest centimeter, the length of each side is 3 centimeters.

Add the side lengths.

\[3 + 3 + 3 + 3 = 12\]

So, the perimeter of the figure is 12 centimeters.

Practice

Estimate the perimeter of each figure in centimeters. Then measure the perimeter to the nearest centimeter.

1. Estimate:  
   Actual:  

2. Estimate:  
   Actual:  
Estimate the perimeter of each figure in inches. Then use an inch ruler to measure the perimeter to the nearest inch.

3. Estimate: ___________________  
Actural: ___________________

4. Estimate: ___________________  
Actural: ___________________

Problem Solving

5. **Make Sense of Problems**
Gina used a centimeter ruler to measure the perimeter of the figure at the right. Which estimate is closest to the actual perimeter, 8 centimeters or 16 centimeters?

6. **Be Precise**
Allison used an inch ruler to measure the perimeter of the figure above. Circle the measure that represents the best estimate of the perimeter to the nearest inch.

   2 inches  8 inches  12 inches  16 inches

Vocabulary Check

7. Complete the sentence below with the correct vocabulary word.
   perimeter      array

   ___________________ is the distance around a figure, or shape.
Perimeter

The distance around the outside of a figure or shape is its **perimeter**.

**Math in My World**

**Example 1**

Warren and his dad will fence in the backyard for his new puppy. Find the perimeter of the backyard.

To find the perimeter if you already know the side lengths, add the lengths of the sides.

\[ 9 + 12 + 9 + 12 = \]

So, the perimeter is **meters**.

**Example 2**

Find the perimeter of the shaded rectangle.

Count the distance around the figure, or add the lengths of the sides.

\[ 4 + 5 + 4 + 5 = \]

So, the perimeter is **units**.
**Key Concept**  
**Perimeter**

**Words**  
The perimeter of a figure is the distance around a figure, or the sum of its side lengths.

**Model**

```
4 cm
3 cm
3 cm
4 cm
```

**Numbers**  
Perimeter = 3 cm + 4 cm + 3 cm + 4 cm  
= 14 cm

---

**Example 3**

The perimeter of the figure is 33 feet. Find the unknown side length. Write an equation.

\[
8 + 6 + 6 + 9 + ? = 33
\]

\[
29 + ? = 33
\]

Add.

\[
29 + 4 = 33
\]

Think: 29 plus what number is 33?

The unknown side length is ______ feet, since 29 + ______ = 33.

---

**Guided Practice**

Find the perimeter of each figure.

1. 

```
2 cm
6 cm
```

```
3 cm
5 cm
```

The perimeter is ______ centimeters.

2. 

```
```

The perimeter is ______ units.

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760  Chapter 13  Perimeter and Area
Independent Practice

Find the perimeter of each figure.

3. The perimeter is ____ centimeters.

4. The perimeter is ____ units.

5. The perimeter is ____ centimeters.

6. The perimeter is ____ feet.

Algebra Find the unknown side length for each figure. The perimeter of each figure is 50 centimeters.

7. The unknown is ____ centimeters.

8. The unknown is ____ centimeters.

9. The unknown is ____ centimeters.

10. The unknown is ____ centimeters.
11. Maya’s family is building a deck. The deck has 6 sides. Each side of the deck is 12 feet long. What is the perimeter of the deck?

12. The figure below has a perimeter of 21 feet. Find the length of the missing side.

[Diagram of a pentagon with sides labeled 3 ft, 5 ft, 3 ft, 6 ft, and a missing side labeled as ? ft]

13. **Practice** Use Algebra A fountain has three sides. Its perimeter is 36 meters. One side is 12 meters and another is 15 meters. What is the length of the third side?

14. **Practice** Model Math In the space below, draw and label a figure that has a perimeter of 24 inches.

15. **Building on the Essential Question** What operation can you use to find an unknown side length, if you know the perimeter? Explain.
The perimeter of the figure is 88 centimeters. Find the unknown side length.

Write an equation.

\[ 10 + 15 + 15 + 15 + 10 + 10 + ? = 88 \]

\[ 75 + ? = 88 \] Add.

\[ 75 + 13 = 88 \] Think: 75 plus what number is 88?

The unknown side length is 13 centimeters, since \( 75 + 13 = 88 \).

**Check** Add the lengths of all the sides.

\[ 10 + 13 + 10 + 10 + 15 + 15 + 15 = 88 \]

**Practice**

Find the perimeter of each figure.

1. 
   ![Diagram of a rectangle with sides 4 cm, 10 cm, and 4 cm]  
   The perimeter is _______ centimeters.

2. 
   ![Diagram of a figure with grid]  
   The perimeter is _______ units.
Algebra  Find the unknown side length for each figure. The perimeter of each figure is 30 meters.

3.  \[
\begin{array}{c}
? \text{ m} \\
\end{array}
\]
\[
\begin{array}{c}
10 \text{ m} \\
5 \text{ m} \\
10 \text{ m} \\
\end{array}
\]
The unknown is ______ meters.

4.  \[
\begin{array}{c}
? \text{ m} \\
\end{array}
\]
\[
\begin{array}{c}
6 \text{ m} \\
6 \text{ m} \\
6 \text{ m} \\
\end{array}
\]
The unknown is ______ meters.

Problem Solving

5. **Use Algebra**  A garden has eight equal sides and has a perimeter of 56 meters. Circle the equation that gives the length, in meters, of each side.

\[
56 \div 8 = 7
\]
\[
56 - 8 = 48
\]
\[
56 + 8 = 64
\]

6. All professional baseball teams' playing fields are the same size. The three bases and home plate make a diamond that is 90 feet on each side. What is the perimeter of the diamond?

Vocabulary Check

7. Describe perimeter in your own words.

Test Practice

8. What is the perimeter of the shaded figure?

- O 18 units
- O 10 units
- O 20 units
- O 9 units
A square with a side length of one unit is called a **unit square**.

A unit square has one **square unit** of area and can be used to measure area. **Area** is the number of square units needed to cover a figure without overlapping.

### Draw It

Draw and shade two different rectangles that each have an area of 20 square units.

Use the 10-by-10 grid.

To shade a rectangle with 20 square units, you need to shade a rectangle made up of 20 unit squares.

1. Shade 20 unit squares so that they form a rectangle.
   
   What is the perimeter of your rectangle?

2. Shade another 20 unit squares so that they form a different rectangle.

   What is the perimeter of your rectangle?
You can also think of area as the amount of space enclosed by a figure.

**Try It**

Use a rubber band and a geoboard to make the rectangle shown. What is the area of the rectangle in square units?

How many unit squares are enclosed by the rubber band? _______

So, the area is _______ square units.

**Try It**

What is the area of the figure at the right?

The figure has no gaps or overlaps. So, count the shaded unit squares.

How many unit squares are enclosed, or covered, by the figure? _______

So, the area is _______ square units.

**Talk About It**

1. **Be Precise** Without drawing, tell how many different rectangles have an area of 5 square units. Explain.

2. How can the term *unit square* help you to remember that area is measured in square units?
Practice It

Count unit squares to find the area of each figure.

3. Area: _______

4. Area: _______

5. Draw and shade a rectangle with an area of 36 square units.

What is the perimeter of the figure you drew?

_______ units

6. Draw and shade a different rectangle with an area of 36 square units.

What is the perimeter of the figure you drew?

_______ units

7. A figure without gaps or overlaps can be covered by 14 unit squares. Circle the correct area of the figure.

4 square units  7 square units  14 square units
8. Jared used a rubber band and geoboard to create the rectangle at the right. What is the area of the rectangle?

9. **Make a Plan** Morgan will help her parents tile a new bathroom floor. She drew a sketch of the bathroom floor. Each square unit represents one tile. How many tiles are needed to tile the floor?

10. **Model Math** Draw and shade a figure (not a rectangle) with an area of 21 square units. The figure should not have any gaps or overlaps.

11. Find the perimeter of the figure you drew in Exercise 10.

**Write About It**

12. Describe one way that area can be measured.
What is the area of the figure at the right? The figure has no gaps or overlaps. So, count the shaded unit squares.

There are 26 unit squares covering, or enclosing, the figure.

So, the area is 26 square units.

Practice

Count unit squares to find the area of each figure.

1. 

Area: ______________________

2. 

Area: ______________________

3. A shape is covered by 40 unit squares. What is the area of the shape?
4. Draw and shade a rectangle with an area of 30 square units.

5. Draw and shade a different rectangle with an area of 30 square units.

**Problem Solving**

6. Caitlyn used a rubber band and geoboard to make the rectangle shown. What is the area of the rectangle?

**Mathematical Practice**

7. **Plan Your Solution** A figure can be covered by 28 unit squares, without any gaps or overlaps. What is the area of the figure?

**Vocabulary Check**

Choose the correct word(s) to complete each sentence.

- area
- square units
- unit square

8. ____________ is measured in ____________ and represents the number of those needed to cover a figure without overlapping.

9. A square with a side length of one unit is called a ____________.
Measure Area

**Area** is the number of square units needed to cover a figure without overlapping. Sometimes you need to count the number of half-square units covered by the figure.

![Squares](image1)

Each of these is a \( \frac{1}{2} \)-square unit.

**Math in My World**

**Example 1**

In art class, Hailey drew the figure at the right on grid paper. What is the area of the figure Hailey drew?

1. Count the number of whole squares.
   
   There are _____ whole squares.

2. Count the number of half-squares.
   
   There are 2 half-squares.
   Two halves equal one whole.

3. Add.
   
   14 whole squares + 2 half-squares
   14 whole squares + 1 whole square
   __________ whole squares

So, the area is _____ square units.
Sometimes, the units on drawings or figures represent another unit of measurement.

**Example 2**

Rafael created the geoboard figure at the right to represent a design he created. One square unit on the geoboard represents one square centimeter on the design. What is the area of the design?

1. Count the number of whole squares.
   
   There are ______ whole squares.

2. Count the number of half-squares.

   There are ______ half-squares. Eight halves equal four wholes.

3. Add.
   
   \[
   \text{8 whole squares} + \text{8 half-squares} = \text{12 whole squares}
   \]

So, the area is ______ square units.

The area of the design is ______ square centimeters.

**Guided Practice**

Find the area of each figure.

1. ______ square units

2. ______ square units
Independent Practice

Find the area of each figure.

3. [Image of a figure]
   The area is ______ square units.

4. [Image of a figure]
   The area is ______ square units.

5. [Image of a figure]
   The area is ______ square units.

6. [Image of a figure]
   The area is ______ square units.

Find the area of each shaded region if one square unit represents one square inch.

7. [Image of a figure]
   The area is ______ square inches.

8. [Image of a figure]
   The area is ______ square inches.

9. [Image of a figure]
   The area is ______ square inches.

10. [Image of a figure]
    The area is ______ square inches.
Problem Solving

11. Denitra's family is building a stone walkway around their backyard. One square unit on the drawing at the right represents one square foot of the stone walkway. What is the area of the stone walkway?

Mathematical Practice

12. Use Math Tools Luisa is helping to tile a hallway. How many square tiles will be needed to fill the area?

3 units

5 units

HOT Problems

13. Reason Use the grid to draw two different figures that have the same area.

14. Plan Your Solution A rectangular room is 10 units wide by 14 units long. Find the area and perimeter of the room.

15. Building on the Essential Question How is the operation of addition related to finding area?
Find the area of the figure at the right if each square unit represents one square centimeter.

1. Count the number of whole squares.
   There are 5 whole squares.

2. Count the number of half-squares.
   There are 4 half-squares. Four halves equal two wholes.

3. Add.
   
   \[ 5 \text{ whole squares} + 4 \text{ half-squares} \]
   
   \[ 5 \text{ whole squares} + 2 \text{ whole squares} \]
   
   \[ 7 \text{ whole squares} \]
   
   So, the area is 7 square units. If each square unit represents one square centimeter, then the area is 7 square centimeters.

Practice

Find the area of each figure.

1. The area is ________ square units.

2. The area is ________ square units.
Find the area of each shaded region if one square unit represents one square meter.

3. The area is ______ square meters.  
4. The area is ______ square meters.

Problem Solving

For Exercises 5 and 6, refer to the drawing at the right which represents the area of Elaine’s bedroom.

5. What is the area of Elaine’s bedroom in square units?

6. Look for a Pattern If each square unit represents 5 square feet, what is the area of Elaine’s bedroom in square feet? Use repeated addition.

Vocabulary Check

7. Describe area in your own words.

Test Practice

8. What is the area of the figure at the right?
   - A 12 square units  
   - B 13 square units  
   - C 14 square units  
   - D 16 square units
Check My Progress

Vocabulary Check

Fill in the correct word(s) that completes the sentence.

area  perimeter  square unit  unit square

1. The distance around a figure is its ____________.

2. A square with a side length of one unit is called a ____________.

3. ____________ is measured in square units and represents the number of those needed to cover a figure without overlapping.

Concept Check

Estimate the perimeter of each figure in centimeters. Then measure the perimeter to the nearest centimeter.

4. Estimate: ____________  Actual: ____________

5. Estimate: ____________  Actual: ____________
Find the perimeter and area of each figure.

6. The perimeter is _______ units. The area is _______ square units.
7. The perimeter is _______ units. The area is _______ square units.

8. **Algebra** Find the unknown side length if the perimeter is 89 inches.

   \[34\text{ in.} + 20\text{ in.} + 20\text{ in.} = ? \text{ in.}\]

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**Problem Solving**

Refer to the drawing at the right for Exercises 9 and 10.

9. Jeremy will help his father build a patio. The drawing represents the patio. What is the area of the patio in square units?

10. If each square unit represents 3 square feet, what is the area of the patio in square feet? Use repeated addition.

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**Test Practice**

11. Each square unit on the figure represents one square meter. What is the area, in square meters, of the figure?
   
   - A 3 square meters
   - B 6 square meters
   - C 12 square meters
   - D 24 square meters
You can find the area of a rectangle on a grid by counting the number of unit squares. If a rectangle is not on a grid, you can find its area by tiling it.

The dimensions of a rectangle are its length and width.

**Draw It**

Find the area of the rectangle at the right by tiling it.

1. Tile the rectangle by separating the rectangle into unit squares. Draw unit squares on the rectangle so that the length of the rectangle is 8 unit squares and the width is 3 unit squares.

2. Count the total number of unit squares.
   There are _______ unit squares.

So, the area of the rectangle is _______ square units.

Tiling the rectangle results in an array.

The array has _______ rows and _______ columns.

Find $3 \times 8$. $3 \times 8 = _______

What do you notice about the product of $3 \times 8$ and the total number of unit squares tiled in the rectangle?
Try It

Find the area of the rectangle at the right by tiling it.

1. Tile the rectangle by separating the rectangle into unit squares. Draw unit squares on the rectangle so that the length of the rectangle is 6 unit squares and the width is 5 unit squares.

2. Count the total number of unit squares.
   
   There are _______ unit squares.

   So, the area of the rectangle is _______ square units.

   Tiling the rectangle results in an array.

   The array has _______ rows and _______ columns.

   Find $5 \times 6$. $5 \times 6 = _____$

   What do you notice about the product of $5 \times 6$ and the total number of unit squares tiled in the rectangle?

Talk About It

1. How do arrays help you model the area of rectangles?

2. **Stop and Reflect** How could you use the dimensions of a rectangle to find its area without tiling it?

3. Use your answer from Exercise 2 to find the area of a rectangle with a length of 7 units and a width of 4 units.
Practice It

Tile each rectangle to find its area. Draw unit squares on each rectangle.

4. 6 units
   The area is _____ square units.

5. 5 units
   The area is _____ square units.

6. 4 units
   8 units
   The area is _____ square units.

7. 3 units
   4 units
   The area is _____ square units.

Algebra Find the area of each rectangle without tiling it. Write a multiplication equation.

8. 9 units
   4 units
   The area is _____ square units.

9. 7 units
   6 units
   The area is _____ square units.
Apply It

**Algebra** Write a multiplication equation to solve Exercises 10 and 11.

10. Lucas built a sandbox for his younger brother. The length of the sandbox was 7 feet and the width was 5 feet. He placed the sandbox in the backyard. How much area of the backyard was taken up by the sandbox?

11. Perry created a one-page greeting card for his mom. The greeting card had a length of 6 inches and a width of 3 inches. What is the area of the greeting card?

**Mathematical Practice**

12. Use Math Tools In the space at the right, draw and tile a rectangle to represent Exercise 11.

13. Make Sense of Problems A rectangle has a length of 8 meters and a width of 3 meters. Describe two different rectangles that have the same area as this rectangle.

**Write About It**

14. How is the area of a rectangle related to the operation of multiplication?
Homework Helper

Find the area of the rectangle at the right by tiling it.

1. Tile the rectangle by separating the rectangle into unit squares. Draw unit squares so the length of the rectangle is 7 unit squares and the width is 3 unit squares.

2. Count the total number of unit squares. There are 21 unit squares.

So, the area of the rectangle is 21 square units.

Tiling the rectangle results in an array. The array has 3 rows and 7 columns. Find $3 \times 7$. $3 \times 7 = 21$

The product of $3 \times 7$ and the total number of unit squares tiled in the rectangle are the same.

Practice

Tile each rectangle to find its area. Draw unit squares on each rectangle.

1. 6 units

   4 units

   The area is ________ square units.

2. 5 units

   3 units

   The area is ________ square units.
Algebra Find the area of each rectangle without tiling it. Write a multiplication equation.

3. 8 units
   7 units

4. 3 units
   9 units

---

Problem Solving

Algebra Write a multiplication equation to solve Exercises 5 and 6.

5. A piece of poster board is in the shape of a rectangle. The length of the poster board is 2 feet and the width is one foot. What is the area of the piece of poster board?

---

Mathematical PRACTICE Model Math A rectangular garden has a length of 8 meters and a width of 5 meters. What is the area of the garden?

---

7. Circle the number sentence that correctly represents the area of a rectangle, in square inches, with a length of 4 inches and a width of 10 inches.

   \[ 4 + 10 = 14 \quad 4 \times 10 = 40 \quad 4 + 10 + 4 + 10 = 28 \]
Example 1

A park manager is building a small rectangular playground. It will be 10 meters by 7 meters. Its area will be covered with shredded tires. What is the area of the playground that will be covered with shredded tires?

**One Way**  Tile a rectangle.

1. Tile a rectangle with unit squares. It is 10 unit squares long and 7 unit squares wide.
   
   Each unit square represents one square meter.

2. Count the unit squares.
   
   There are ________ unit squares.

**Another Way**  Multiply the side lengths.

Multiply the length by the width.

\[ 10 \times 7 = \]  

The length is 10 meters and the width is 7 meters.

Area is measured in square units. In this case, it is measured in square meters.

So, the area of the playground is ________ square meters.

**Check** You can check by using repeated addition to count the number of squares in each row.

\[ 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 + 10 = \]
A formula is an equation that shows the relationship between two or more quantities. A formula uses letters to represent the quantities. You can use a formula to find the area of a rectangle.

**Key Concept** *Area of a Rectangle*

- **Words** To find the area $A$ of a rectangle, multiply the length $l$ by the width $w$.

- **Formula** $A = l \times w$

**Example 2**

Find the area of the rectangle.

Replace each symbol with its value.

\[ A = l \times w \quad \text{Use the area formula.} \]
\[ A = 9 \times 5 \quad \text{The length is 9 feet and the width is 5 feet.} \]
\[ 45 = 9 \times 5 \quad \text{Multiply.} \]

Area is measured in square units. In this case, it is measured in square feet.

So, the area is _______ square feet.

**Guided Practice**

Find the area of each rectangle.

1. \[ \begin{array}{cc}
   & 6 \text{ in.} \\
\hline
2 \text{ in.} & \\
\end{array} \]

   The area is _______ square inches.

2. \[ \begin{array}{cc}
   & 3 \text{ m} \\
\hline
3 \text{ m} & \\
\end{array} \]

   The area is _______ square meters.
Independent Practice

Find the area of each rectangle.

3. 4 ft
   7 ft
   _______ square feet

4. 5 m
   4 m
   _______ square meters

5. 8 in.
   6 in.

6. 10 cm
   4 cm

7. A rectangle has an area of 42 square meters. Which could represent the length and width of this rectangle? Circle it.
   7 meters and 6 meters 6 meters and 8 meters

Algebra Find the unknown side. Use the area formula.

8. \( \ell \)
   1 yd

The area is 9 square yards.
\( A = \ell \times w \)
9 = _______ \times 1
The unknown is _______ yards.

9. 3 ft
   \( w \)

The area is 6 square feet.
\( A = \ell \times w \)
6 = 3 \times _______
The unknown is _______ feet.
10. **Use Math Tools** Andrea is making a quilt in the shape of a rectangle. The length of the quilt will be 6 feet and the width will be 5 feet. What is the area of the quilt she will make? Write an equation to solve.

11. A throw rug is 8 feet long and 4 feet wide. It is in a rectangular room with an area of 110 square feet. How much of the room is not covered by the rug?

**HOT Problems**

12. **Use Number Sense** A rectangle has side lengths of 5 centimeters and 3 centimeters. If the side lengths are doubled, will the area also double? Explain.

13. **Model Math** Draw and label two rectangles that each have an area of 24 square inches, but have different perimeters.

14. **Building on the Essential Question** How can multiplication and division be used to solve problems involving the area of rectangles?
Find the area of a rectangle with a length of 8 inches and a width of 7 inches.

**One Way** Tile a rectangle.

1. Tile a rectangle with unit squares. It is 8 unit squares long and 7 unit squares wide. Each unit square represents one square inch.

2. Count the unit squares. There are 56 unit squares.

**Another Way** Use \( A = l \times w \).

\[
A = l \times w \\
A = 8 \times 7 \quad \text{The length is 8 inches and the width is 7 inches.} \\
56 = 8 \times 7 \quad \text{Multiply.}
\]

Area is measured in square units. In this case, it is measured in square inches. So, the area is 56 square inches.

**Practice**

Find the area of each rectangle.

1. 4 ft \[ \text{square feet} \]

2. 7 m \[ \text{square meters} \]
Algebra  Find the unknown side. Use the area formula.

3. \[ \ell \times 6 \text{ in.} \]
\[ 36 = \ell \times w \]
\[ 36 = \underline{\text{?}} \times 6 \]
The unknown is \underline{\text{?}} inches.

4. \[ 8 \times w \]
\[ 24 = \ell \times w \]
\[ 24 = 8 \times \underline{\text{?}} \]
The unknown is \underline{\text{?}} meters.

Vocabulary Check

5. Explain how the equation \( A = \ell \times w \) is a formula.

Problem Solving

For Exercises 6 and 7, use the information below and the rectangle at the right.

Mrs. Morris plans to tile her front hallway shown at the right.

6. If each tile is 1 foot long and 1 foot wide, how many tiles will she need?

7. Keep Trying Squares of tile come in packages of 6 tiles. How many packages will Mrs. Morris need?

Test Practice

8. Which equation can be used to find the area of the rectangle?

- \( 5 + 10 = 15 \)
- \( 5 \times 10 = 50 \)
- \( 10 - 5 = 5 \)
- \( 10 \div 5 = 2 \)
The grid shows a rectangle with a length of 6 units and a width of 5 units. If the length of this rectangle increased by 2 units, what would be the new area?

The area of the rectangle is ________ square units.

Label this rectangle A.

1. Shade more unit squares so that the length of the rectangle is now increased by 2 units, but the width remains unchanged.

2. Label the additional rectangle formed by what you shaded as Rectangle B. What is the area of Rectangle B?

3. Add the areas of rectangles A and B.

\[ A = (6 \times 5) + (2 \times 5) \]

\[ A = \] _______ + _______

\[ A = \] _______

The area of the larger rectangle is ________ square units.

Check The length of the larger rectangle is 8 units. The width is 5 units. \( 8 \times 5 = 40 \)
The Distributive Property can be used to model the area of a rectangle. Recall that the Distributive Property allows you to decompose one factor.

**Try It**

**Use the Distributive Property to find the area of the rectangle.**

1. Decompose one factor.
   
   \[12 = 10 + 2\]

2. Find the area of each smaller rectangle. Then add.
   
   \[7 \times 12 = (7 \times 10) + (7 \times 2)\]
   
   \[= \quad + \quad = \]

   So, the area of the rectangle is ______ square units.

**Talk About It**

1. **Mathematical PRACTICE 3 Justify Conclusions** Refer to the second activity. If you decomposed 12 into 9 + 3 instead of 10 + 2, how would that have affected the result?

2. How can the Distributive Property help you find the area of rectangles with greater numbers?
Practice It

Use the Distributive Property to find the area of each rectangle.

3.  
\[ 6 \times 7 = (6 \times 5) + (6 \times 2) \]
\[ = \] 
\[ = \]

4.  
\[ 8 \times 9 = (8 \times 5) + (8 \times 4) \]
\[ = \] 
\[ = \]

The area is ___ square units.  The area is ___ square units.

Find the area of each rectangle. Use the Distributive Property to decompose the longer side into a sum. Show your steps.

5.  
\[ \text{The area is } ___ \text{ square centimeters.} \]

6.  
\[ \text{The area is } ___ \text{ square feet.} \]
7. Julia is planting vegetables in her rectangular garden. Her garden has a length of 8 feet and a width of 12 feet. Use the Distributive Property to decompose the factor 12 into a sum. Then find the area of the garden.

8. Matthew is carpeting the rectangular floor in his bedroom. The floor has a length of 15 feet and a width of 9 feet. Use the Distributive Property to decompose the factor 15 into a sum. Then find the area of the floor.

9. **Mathematical Reason** Describe three ways to find the area of a rectangle with a length of 9 meters and a width of 4 meters.

10. **Mathematical Find the Error** James needed to find the area of a rectangle with a length of 11 inches and a width of 9 inches. His steps are to the right. Find and correct his error.

   \[9 \times 11 = (9 \times 10) + (9 \times 2)\]
   \[= 90 + 18\]
   \[= 108\]

**Write About It**

11. How are the operations of addition and multiplication used when finding area using the Distributive Property?
Lesson 7
Hands On: Area and the Distributive Property

Homework Helper
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Use the Distributive Property to find the area of the rectangle.

1. Decompose one factor.
   \[ 11 = 10 + 1 \]

2. Find the area of each smaller rectangle. Then add.
   \[ 7 \times 11 = (7 \times 10) + (7 \times 1) \]
   \[ = 70 + 7 \]
   \[ = 77 \]

So, the area of the rectangle is 77 square units.

Practice

1. Use the Distributive Property to find the area of the rectangle.
   \[ 6 \times 9 = (6 \times 5) + (6 \times 4) \]
   \[ = + \]
   \[ = \]
2. Use the Distributive Property to find the area of the rectangle.

\[ 8 \times 12 = (8 \times 10) + (8 \times 2) \]

Find the area of each rectangle. Use the Distributive Property to decompose the longer side. Show your steps.

3. 9 in. 9 in.

The area is ___ square inches.

4. 8 m 11 m

The area is ___ square meters.

Problem Solving

5. **Mathematical PRACTICE 3** Identify Structure Erika is painting a rectangular painting. The painting has a length of 12 inches and a width of 10 inches. Use the Distributive Property to decompose the factor 12. Then find the area of the painting.

6. Hector will build a deck in his backyard. The deck has a length of 9 meters and a width of 8 meters. Use the Distributive Property to decompose the factor 9. Then find the area of the deck.
Area of Composite Figures

A **composite figure** is made up of two or more figures. To find the area of a composite figure, decompose the figure into smaller parts.

**Math in My World**

**Example 1**

Shrubs, trees, flowers, and plants can be bought at Mr. Corley's Nursery. What is the area of the nursery's garden at the right?

1. Break the composite figure into smaller parts. Look for rectangles.

2. Find the area of each part.

   **Rectangle 1**
   \[
   A = l \times w \\
   = 10 \times 8 \\
   = \phantom{00} 
   \]

   **Rectangle 2**
   \[
   A = l \times w \\
   = 12 \times 8 \\
   = (10 \times 8) + (2 \times 8) \\
   = \phantom{00} + \phantom{00} \\
   = \phantom{00} 
   \]

   Decompose 12 as 10 + 2.

   The area of Rectangle 1 is ______ square yards. The area of Rectangle 2 is ______ square yards.

3. Add the areas.

   \[
   80 + 96 = \phantom{00} 
   \]

   The area of the composite figure is ______ square yards.
Example 2

Find the area of the composite figure.

1. Break the composite figure into smaller parts. Look for rectangles.

   This composite figure can be broken into rectangles.

   \[
   \text{Rectangle 1} \quad \text{Rectangles 2 and 3}
   \]

   \[
   \begin{align*}
   12 \times 2 &= 12 \times (10 - 8) \\
   &= 12 \times 2 \\
   &= (10 \times 2) + (2 \times 2) \\
   &= 20 + 4 \\
   &= 24 \\
   \end{align*}
   \]

   So, the length of the side is 2.

2. Find the area of each part. Rectangles 2 and 3 are the same size.

   \[
   \text{Rectangle 1} \quad \text{Rectangles 2 and 3}
   \]

   \[
   \begin{align*}
   A &= \ell \times w \\
   &= 12 \times 2 \\
   &= (10 \times 2) + (2 \times 2) \\
   &= 20 + 4 \\
   &= 24 \\
   \end{align*}
   \]

   \[
   \begin{align*}
   A &= \ell \times w \\
   &= 8 \times 3 \\
   &= 24 \\
   \end{align*}
   \]

3. Add the areas. \[24 + 24 + 24 = 72\]

   The area of the composite figure is 72 square meters.

Guided Practice

1. Find the area of the composite figure. Show your work.

   \[
   \begin{array}{c}
   \text{7 cm} \\
   \hline
   5 \text{ cm} \\
   4 \text{ cm}
   \end{array}
   \]

   The area is \[\text{square centimeters}\].

Refer to Example 1. Find another way to decompose the composite figure.
Independent Practice

Find the area of each composite figure. Show your work.

2. The area is ______ square feet.

3. The area is ______ square meters.

4. The area is ______.

5. The area is ______.

6. Decompose the composite figure in Exercise 4 a different way. Show the steps you used.
7. What is the area of the top of the desk?

8. **Mathematical PRACTICE**
   **Make a Plan**
   Courtney is playing miniature golf. What is the area of the composite figure?

---

**HOT Problems**

9. **Mathematical PRACTICE**
   **Model Math** Draw and label two composite figures that have the same area but have different perimeters.

10. **Building on the Essential Question** How is the operation of addition related to finding the area of a composite figure?
Lesson 8
Area of Composite Figures

Find the area of the composite figure.

1. Break the composite figure into smaller parts. Look for rectangles.

   \[\text{Rectangle 1}\]
   \[\text{Length} = 12 \text{ ft}\]
   \[\text{Width} = 2 \text{ ft}\]
   \[\text{Area} = \ell \times w = 12 \times 2 = 24 \text{ square feet}\]

   \[\text{Rectangle 2}\]
   \[\text{Length} = 10 \text{ ft}\]
   \[\text{Width} = 2 \text{ ft}\]
   \[\text{Area} = \ell \times w = 10 \times 2 = 20 \text{ square feet}\]

2. Find the area of each part.

3. Add the areas.
   \[24 + 20 = 44\]
   The area of the composite figure is 44 square feet.
Practice

Find the area of each composite figure. Show your work.

1. \[\text{12 cm} \quad \text{3 cm} \]
\[\text{6 cm} \quad \text{4 cm}\]

The area is ______ square centimeters. The area is ______ square meters.

Vocabulary Check

3. Draw an example of a composite figure.

Problem Solving

The composite figure shows the floor plan of a bathroom.

4. What is the area of the bathroom floor?

5. Plan Your Solution The floor will be covered in square tiles. If one square tile covers one square foot, how many tiles are needed?

Test Practice

6. What is the area of the composite figure shown?

- A 8 square units
- B 12 square units
- C 16 square units
- D 20 square units
Check My Progress

Vocabulary Check

1. Circle the figure that represents a **composite figure**.
   Explain why the other figures are not composite figures.

   ![Figure Options]

2. Circle the **formula** that can be used to find the area of a rectangle.
   \[ A = l + w \quad A = l - w \quad A = l \times w \]

Concept Check

**For Exercises 3 and 4, refer to the rectangle shown.**

3. Tile the rectangle to find its area. Draw unit squares on the rectangle.

   The area is ________ square units.

![Rectangle with dimensions]

4. **Algebra** Write a multiplication equation that can be used to find the area of the rectangle without tiling it.

---

Check My Progress 803
5. **Algebra** Find the area of the rectangle. Write a multiplication equation.

6. Find the area of the rectangle. Use the Distributive Property to decompose the longer side. Show your steps.

   The area is ___ square meters.

---

**Problem Solving**

Refer to the drawing at the right for Exercises 7 and 8.

7. Seth painted the figure at the right on his wall. How many square inches of paint did he use?

8. Refer to Exercise 8. Decompose the composite figure in a different way to find its area. Show your steps.

---

**Test Practice**

9. Which equation can be used to find the area, in square feet, of a rectangle with a length of 8 feet and a width of 4 feet?

   A. $8 + 4 = 12$  
   B. $8 - 4 = 4$  
   C. $8 \times 4 = 32$  
   D. $8 \div 4 = 2$
Two rectangles can have the same area but different perimeters.

**Math in My World**

**Example 1**

Elizabeth will build two fences, one surrounding each garden shown below. How much area does each garden cover? How much fencing will she need for each garden?

1. **Find the area of each garden.**
   - **Garden 1**
     \[ A = \ell \times w \]
     \[ = 6 \times 2 \]
     \[ = 12 \text{ ft}^2 \]
   - **Garden 2**
     \[ A = \ell \times w \]
     \[ = 4 \times 3 \]
     \[ = 12 \text{ ft}^2 \]

   The gardens have the same area.

2. **Find the perimeter of each garden.**
   - **Garden 1**
     The perimeter is \( 6 + 2 + 6 + 2 \), or \( 16 \text{ feet} \).
   - **Garden 2**
     The perimeter is \( 3 + 4 + 3 + 4 \), or \( 14 \text{ feet} \).

   Garden 1 needs \( 16 \) feet of fencing.
   Garden 2 needs \( 14 \) feet of fencing.

The gardens have the same area, but different perimeters.
Two rectangles can have the same perimeter, but different areas.

**Example 2**

**Draw and label a rectangle that has the same perimeter as the rectangle shown, but a different area.**

1. Find the perimeter and area of the rectangle shown.
   - The perimeter is $6 + 4 + 6 + 4$, or __________ inches.
   - The area is $6 \times 4$, or __________ square inches.

2. Draw and label a rectangle that has a perimeter of 20 inches, but a different area.

   **My Drawing**

   What is the length of the rectangle you drew? __________

   What is the width of the rectangle you drew? __________

   What is the area of the rectangle you drew? __________

**Guided Practice**

1. Describe the length and width of a rectangle that has the same area as the one below, but a different perimeter.

   - 8 yd
   - 3 yd

   Refer to Example 2. Describe the length and width of a different rectangle you could have drawn.
Independent Practice

Draw and label a rectangle that has the same area, but a different perimeter, than each rectangle shown.

2. 5 cm
   6 cm

3. 4 yd
   4 yd

Draw and label a rectangle that has the same perimeter, but a different area, than each rectangle shown.

4. 10 ft
   3 ft

5. 4 m
   9 m

6. Circle the rectangles that have the same perimeter, but different areas.

   8 in
   4 in

   6 in
   6 in

   9 in
   5 in
Problem Solving

William's Windows makes the rectangular windows given in the table. Use this information to solve Exercises 7 and 8.

### Make Sense of Problems
Which windows will use the same number of square feet of glass?

<table>
<thead>
<tr>
<th>Window</th>
<th>Length (feet)</th>
<th>Width (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

8. Each window will have a wood border surrounding it. Which windows will use the same amount of wood border?

### HOT Problems

### Which One Doesn't Belong?
Circle the rectangle that does not belong with the other two. Explain.

- A: 10 cm x 4 cm
- B: 7 cm x 5 cm
- C: 9 cm x 3 cm

### Reason
What is true about the sum of the length and the width for any rectangles with the same perimeter, but different areas?

### Building on the Essential Question
How can two rectangles with the same area have different perimeters?
**Lesson 9**  
**Area and Perimeter**

**Homework Helper**

1. Find the perimeter and area of the rectangle shown.

   The perimeter is $5 + 3 + 5 + 3$, or 16 meters.
   
   The area is $5 \times 3$, or 15 square meters.

2. Draw and label a rectangle that has a perimeter of 16 meters, but a different area.

   The length of the rectangle is 6 meters. The width is 2 meters.
   
   The perimeter is $6 + 2 + 6 + 2$, or 16 meters.
   
   The area is $6 \times 2$, or 12 square meters.

**Practice**

1. In the space at the right, draw and label a different rectangle that also has a perimeter of 16 meters, but a different area than shown above.
Draw and label a rectangle that has the same area, but a different perimeter, than each rectangle shown.

Problem Solving

David's Dog Pens makes the rectangular dog pens shown in the table. Use this information to solve Exercises 4 and 5.

4. Which dog pens will take up the same area?

5. Which dog pens have the same perimeter?

6. **Keep Trying** Alexa drew a rectangle with an area of 36 square centimeters. The rectangle she drew has the smallest perimeter possible for this area. What is the length and width of the rectangle she drew?

Test Practice

7. Which rectangle has the same area as Rectangle E, but a different perimeter?

   - A. Rectangle A
   - B. Rectangle B
   - C. Rectangle C
   - D. Rectangle D
   - E. Rectangle E

<table>
<thead>
<tr>
<th>Dog Pens</th>
<th>Length (feet)</th>
<th>Width (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rectangle</th>
<th>Length (units)</th>
<th>Width (units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>E</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>
Problem-Solving Investigation

STRATEGY: Draw a Diagram

Learn the Strategy

Chloe’s father is building a rectangular sandbox. It has a width of 4 feet and a length of 6 feet. The wood that goes around the sandbox costs $2 for each foot. If they have $50, will that be enough to buy the wood?

1. Understand
   What facts do you know?
   - The sandbox is ______ feet by 6 feet.
   - The wood costs $_______ for each foot. They have $_______.

   What do you need to find?
   - if $50 is enough money to buy the wood

2. Plan
   I can draw a diagram to solve the problem.

3. Solve
   Draw a diagram to represent the sandbox.
   The perimeter is 6 + 4 + 6 + 4, or ______ feet.
   Multiply the perimeter by the cost per foot.
   ______ feet × $2 = $_______
   Since $_______ < $50, they will have enough money.

4. Check
   Is my answer reasonable? Explain.
Practice the Strategy

A picture frame is 2 inches longer and 2 inches wider than the photo shown. What is the perimeter of the frame?

1 Understand
What facts do you know?

What do you need to find?

2 Plan

3 Solve

4 Check
Is my answer reasonable?
Apply the Strategy

Solve each problem by drawing a diagram.

1. Phil cut a piece of yellow yarn that was 7 feet long. Kendra cut a piece of red yarn that was 2 feet shorter. William cut a piece of green yarn that was 3 feet longer than the piece Kendra cut. How long was the piece of yarn that William cut?

2. **Mathematical Practice** Use Math Tools Liseta is planting flowers around the outside edge of her rectangular garden. The garden is 12 feet long and 10 feet wide. She will place one flower at each corner and the remaining flowers will be placed 2 feet apart. How many flowers will she plant?

3. A community center is organizing a dance. There are four large columns arranged at the corners of a square. The decorating committee will hang one large streamer from each column to every other column. How many streamers are needed?

4. A cafeteria table has a length of 8 feet and a width of 3 feet. If three tables are pushed together, what is the combined area of the tables?
5. **Mathematical PRACTICE** Use Math Tools Madeline has a pink dress, a blue dress, and a yellow dress. She has a black pair of shoes and a white pair of shoes. How many dress and shoe outfits can she make?

6. Four friends are in line to see a concert. Greg is last in line. Melanie is before Greg and after Julie. Julie is after Dario. Who is first in line?

7. A restaurant has square dining tables. They will place table settings on each table so that there is a distance of 2 feet from each corner to a table setting. The 3 table settings on each side will be 3 feet apart. What is the perimeter of one table?

8. During one round of a game, Elio, Nida, and Geoffrey each scored 4 points. In round two, they each scored twice as many points. Find the total number of points scored.

9. **Mathematical PRACTICE** Make a Plan Lanetta will buy balloons for a party. She invited 6 friends from school, 3 friends from soccer practice, and 2 cousins. How many balloons will she need to buy if everyone gets two balloons?
Homework Helper

Gina's family built a deck in the shape of a hexagon. They placed posts on each outside corner. For a party, they will hang strings of decorative lights from each post to every other post. How many strings of lights are needed?

1 Understand
What facts do you know?
• The deck has six corners.
• One string of lights will be hung from each corner to every other corner.
What do you need to find?
• how many strings of lights are needed

2 Plan
Draw a diagram to solve the problem.

3 Solve
Draw a hexagon.
Draw lines from each corner to every other corner.
Each line represents a string of decorative lights.
Count the lines. There are 15 lines drawn.
So, Gina's family needs 15 strings of lights.

4 Check
Is my answer reasonable?
The diagram shows 9 lines inside the hexagon plus 6 lines connecting each side of the hexagon. Since $9 + 6 = 15$, the answer is reasonable.
Problem Solving

Solve each problem by drawing a diagram.

1. **Model Math** Martina and Charlotte are sharing a pizza. The pizza is cut into eight pieces. Martina ate a quarter of the pizza. Charlotte ate 3 pieces. How many pieces are left?

2. Five friends are having a tennis tournament. Each friend will play the other four friends once. How many matches will be played?

3. A rectangular bedroom floor has an area of 100 square feet and a length of 10 feet. What is the perimeter of the floor?

4. Alexander is riding his bicycle to school. After one mile, he is a third of the way there. How much farther does he have to ride?

5. Marjorie has 28 feet of trim to use as edging on a rectangular blanket she wants to make. What is the length and width of two blanket sizes she could make.
Vocabulary Check

Use the word bank to complete each sentence.

area composite figure formula
perimeter square unit unit square

1. The distance around the outside of a figure is its _____________.

2. A unit square has one ____________ of area and can be used to measure area.

3. A ____________ is an equation that shows the relationship between two or more quantities.

4. ____________ is the number of square units needed to cover a figure without overlapping.

5. A square with a side length of one unit is called a _____________.

6. A ____________ is made up of two or more figures.

Concept Check

Estimate the perimeter of each figure in centimeters. Then measure the perimeter to the nearest centimeter.

7. Estimate: ____________
   Actual: ____________

8. Estimate: ____________
   Actual: ____________
Find the perimeter of each figure.

9. 

\[ \text{cm} \]

10. 

\[ \text{ft} \]

Algebra Find the unknown side length for each figure. The perimeter of each figure is 30 meters.

11. 

\[ ? \text{ m} \]

12. 

\[ ? \text{ m} \]

The unknown is _______ meters.

The unknown is _______ meters.

Algebra Count unit squares to find the area of each figure. Then write a multiplication equation.

13. 

Area: 

Equation: 

14. 

Area: 

Equation: 

Find the area of each rectangle.

15. 

\[ \text{square inches} \]

16. 

\[ \text{square meters} \]
Problem Solving

Refer to the figure at the right for Exercises 17–18. The figure represents Kathleen’s backyard.

17. Use the Distributive Property to find the area of Kathleen’s backyard.

18. Tile the rectangle to find its area. What do you notice?

For Exercises 19 through 21, refer to the figure at the right. The figure shows the shape of a room. Each unit square represents 1 square foot.

19. What is the area of the room in square feet?

20. What is the perimeter of the room in feet?

21. Decompose the figure into two rectangles to find its area. What do you notice?

Test Practice

22. Find the unknown side length of the figure to the right. The perimeter is 26 inches.
   - A 5 inches
   - B 8 inches
   - C 9 inches
   - D 10 inches
Use what you learned about perimeter and area to complete the graphic organizer.

**Units of Measure**

**Vocabulary**

**ESSENTIAL QUESTION**
How are perimeter and area related and how are they different?

**Operations Used**

**Real-World Example**

Now reflect on the ESSENTIAL QUESTION
Write your answer below.