**MINI Lab**

The rectangle at the right has an area of 20 square units. The distance around the rectangle is $5 + 4 + 5 + 4$, or 18 units.

1. Draw as many rectangles as you can on grid paper so that each one has an area of 20 square units. Find the distance around each one.

2. Which rectangle from Question 1 has the greatest distance around it? the least?

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The area of a figure is the number of square units needed to cover a surface. You can use a formula to find the area of a rectangle. A formula is an equation that shows a relationship among certain quantities.

**Area of a Rectangle**

**Words**
The area $A$ of a rectangle is the product of the length $\ell$ and width $w$.

**Formula**

\[ A = \ell w \]

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**EXAMPLE**

Find the area of a rectangle with a length of 8 inches and a width of 6 inches.

\[ A = \ell w \quad \text{Area of a rectangle} \]

\[ A = 8 \cdot 6 \quad \text{Replace } \ell \text{ with } 8 \text{ and } w \text{ with } 6. \]

\[ A = 48 \quad \text{Multiply.} \]

The area is 48 square inches.

**CHECK Your Progress**

Find the area of each rectangle.

a. A rectangle with a length of 10 meters and a width of 2 meters

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In Lesson 1-3, you wrote products as powers by using exponents. The formula for the area of a square is also written with an exponent.

**Area of a Square**

<table>
<thead>
<tr>
<th>Words</th>
<th>The area A of a square is the length of a side s squared.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formula</td>
<td>( A = s^2 )</td>
</tr>
</tbody>
</table>

**EXAMPLE** Find the Area of a Square

2. Find the area of a square with side length 9 inches.

\[
A = s^2 \quad \text{Area of a square} \\
A = 9^2 \quad \text{Replace } s \text{ with } 9. \\
A = 81 \quad \text{Multiply.}
\]

The area is 81 square inches.

**CHECK Your Progress**

Find the area of each square.

c. a square with side length 5 meters  
d. a square with side length 7 feet

**Real-World EXAMPLE**

5. **GYMNASTICS** Use the information at the left. What is the area of a gymnastics floor routine mat?

The length of one side is 40 feet.

\[
A = s^2 \quad \text{Area of a square} \\
A = 40^2 \quad \text{Replace } s \text{ with } 40. \\
A = 1,600 \quad \text{Multiply.}
\]

The area of a floor routine mat is 1,600 square feet.

**Real-World Link**

A tumbling mat for a gymnastics floor routine is a square that measures 40 feet on each side.

**CHECK Your Progress**

e. **SPORTS** A high school basketball court measures 84 feet long and 50 feet wide. What is the area of this court?
Check Your Understanding

Example 1 (p. 63)
Find the area of each rectangle.
1. 5 cm  3 cm
2. 8 ft  15 ft

Example 2 (p. 64)
Find the area of each square.
3. 4 ft
4. 1 yd

Example 3 (p. 64)
5. DISHES A glass baking dish measures 9 inches by 13 inches. What is the area of the baking dish?

Practice and Problem Solving

Find the area of each rectangle.
6. 8 yd  4 yd
7. 9 in.  10 in.
8. 6 ft  14 ft
9. 16 m  32 m
10. 25 cm  20 cm
11. 17 ft  48 ft

12. Find the area of a rectangle with a length of 26 inches and a width of 12 inches.
13. What is the area of a rectangle with a length of 40 centimeters and a width of 30 centimeters?

Find the area of each square.
14. 3 m
15. 10 in.
16. 12 cm

17. What is the area of a square with a side length of 22 feet?

Lesson 1-9 Algebra: Area Formulas 65
18. **TENTS** The floor of a domed camping tent measures 7 feet by 9 feet. What is the area of the floor of the tent?

19. **HOBBIES** Meagan and her friends are knitting small squares to join together to form a blanket. The side length of each square must be 7 inches. What is the area of each square?

Find the area of each shaded region.

20. [Diagram of a rectangle with dimensions 8 ft x 4 ft]  
21. [Diagram of a rectangle with dimensions 5 m x 5 m]  
22. [Diagram of a rectangle with dimensions 15 cm x 7 cm]

23. **FIND THE DATA** Refer to the Data File on pages 16–19. Choose some data and write a real-world problem in which you would find the area of a square or a rectangle.

24. **REMODELING** The Junkins are replacing the flooring in their kitchen with ceramic tiles. They are deciding between 12-inch square tiles and 6-inch square tiles. What is the difference in the area of the two tiles they are considering?

25. **ANIMALS** The floor spaces of two cages are shown. The square footage of Cage 1 is large enough for one guinea pig. For each additional guinea pig, the cage should be 1 square foot larger. How many guinea pigs should be kept in Cage 2?

**H.O.T. Problems**

26. **OPEN ENDED** Draw and label a rectangle that has an area of 48 square units.

27. **NUMBER SENSE** Give the dimensions of two different rectangles that have the same area.

28. **FIND THE ERROR** James and John are finding the area of the square with a side of 8 feet. Who is correct? Explain your reasoning.

\[
A = s^2 \\
A = 8^2 \\
A = 64 \text{ m}^2
\]

James

\[
A = s^2 \\
A = s^2 \\
A = 8 \cdot 8 \\
A = 64 \text{ m}^2
\]

John

66 Chapter 1 Algebra: Number Patterns and Functions
29. **CHALLENGE** Suppose opposite sides of a rectangle are increased by 5 units. Would the area of the rectangle increase by 10 square units? Use a model in your explanation.

30. **WRITING IN MATH** Explain how to use the formula for the area of a square. Include the formula for the area of a square in your explanation.

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**TEST PRACTICE**

31. Which rectangle has an area of 54 square units?

A

<table>
<thead>
<tr>
<th>6 units</th>
<th>8 units</th>
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</thead>
</table>

B

<table>
<thead>
<tr>
<th>4 units</th>
<th>9 units</th>
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</thead>
</table>

C

<table>
<thead>
<tr>
<th>8 units</th>
<th>8 units</th>
</tr>
</thead>
</table>

D

<table>
<thead>
<tr>
<th>6 units</th>
<th>9 units</th>
</tr>
</thead>
</table>

32. A family has a rectangular vegetable garden in their backyard and planted grass in the rest of the yard. The rectangular backyard is 110 feet by 70 feet, and the garden is 14 feet by 6 feet. What is the area of the backyard that is planted with grass?

- **F** 360 sq ft
- **G** 7,616 sq ft
- **H** 7,700 sq ft
- **J** 7,804 sq ft

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**SPIRAL REVIEW**

Solve each equation mentally. (Lesson 1-8)

33. \(x + 4 = 12\)

34. \(9 - m = 5\)

35. \(k - 8 = 20\)

Copy and complete each function table. (Lesson 1-6)

36. **Input (x)** | **Output \((5 + x)\)**
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

37. **Input (x)** | **Output \((x + 2)\)**
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

38. What is the value of \(n^3 + 5n\) if \(n = 2\)? (Lesson 1-5)

39. **SCIENCE** The Milky Way galaxy is about \(10^5\) light years wide. What is the value of \(10^3\)? (Lesson 1-3)

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**Lesson 1-9** Algebra: Area Formulas 67