

# Lesson 8

## Using Formulas in Geometry

Formula – A mathematical relationship expressed with symbols. Some formulas have already been encountered in algebra.

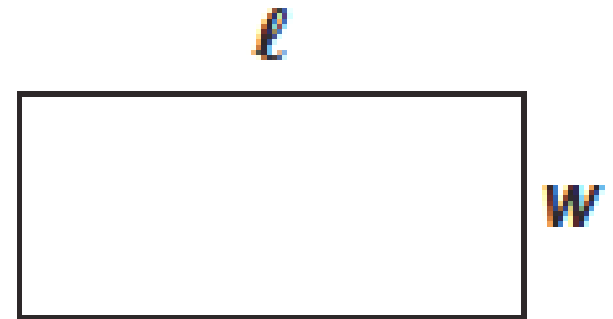
### Math Reasoning

**Write** List some other formulas used in other math classes, such as in algebra. How might these formulas be helpful in geometry?

Perimeter – The sum of the side lengths of a closed geometric figure. It is often thought of as the distance around a figure.

There is a special formula to find the perimeter of a rectangle, where  $P$  is the perimeter,  $l$  is the length of the

rectangular base, and  $w$  is the width, or height, of the rectangle.  $P = 2l + 2w$



# Example 1. Finding Perimeter of a Figure.

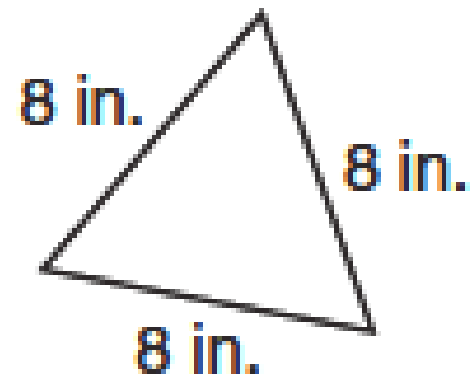
a. Find the perimeter of the triangle.

SOLUTION

Add the lengths of the sides together.

$$8 + 8 + 8 = 24$$

The perimeter of the triangle is 24 inches.



# Example 1. Finding Perimeter of a Figure.

b. Find the perimeter of the rectangle.

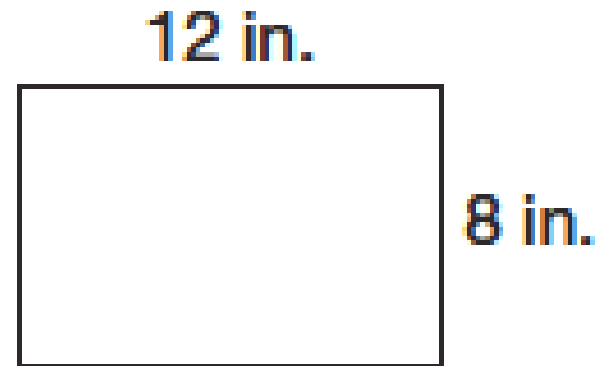
**SOLUTION**

Use the formula for the perimeter of a rectangle.

$$P = 2l + 2w \quad \text{Perimeter formula}$$

$$P = 2(12) + 2(8) \quad \text{Substitute.}$$

$$P = 40 \text{ in.} \quad \text{Simplify.}$$



# Example 1. Finding Perimeter of a Figure.

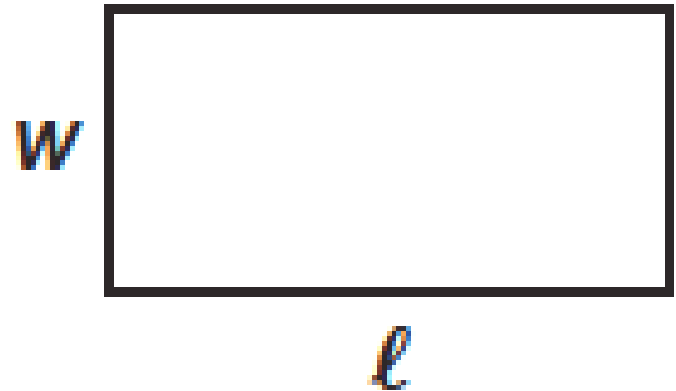
c. If a regular pentagon has a side length of 8 inches, what is its perimeter?

**SOLUTION**

There are five sides in a pentagon and each side of a regular pentagon has the same measure. Therefore, the perimeter is  $5 \times 8 = 40$  inches.

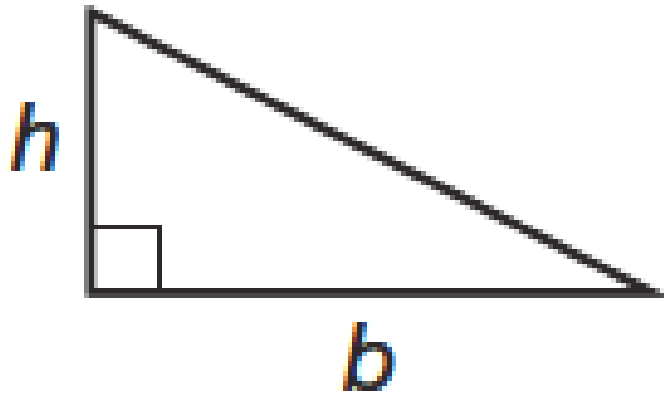
Area – The size of the region bounded by the figure.

The area of a rectangle is found by the following formula, where  $l$  is the length of the figure's base and  $w$  is the length of the figure's height:  $A = lw$



The area of a triangle is found by the following formula:  $A = \frac{1}{2}bh$

The area of a figure is always expressed in square units.



### Math Reasoning

**Formulate** Draw a diagonal from one corner of a rectangle to the other. What shapes does the diagonal create? Explain how this relates to the formula for area of a triangle.



# Example 2 Using the Area Formula for a Rectangle

a. Find the area of the rectangle.

SOLUTION

$$A = lw$$

$$A = (14)(3)$$

$$A = 42 \text{ cm}^2$$

Area formula

Substitute.

Simplify.



# Example 2 Using the Area Formula for a Rectangle

b. Find the length of the rectangle.

SOLUTION

$$A = lw$$

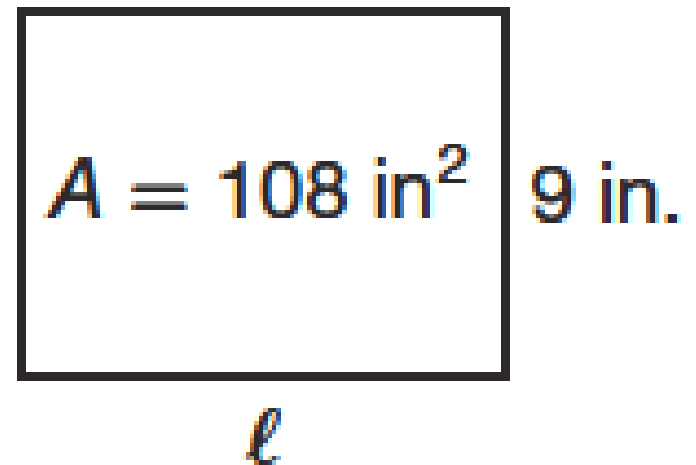
Area formula

$$108 = l(9)$$

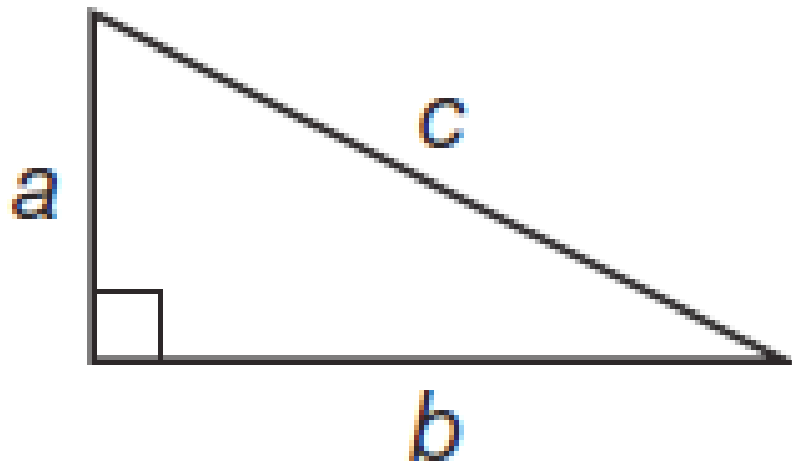
Substitute.

$$12 \text{ in.} = l$$

Divide both sides by 9.



**Theorem 8-1: Pythagorean Theorem – The sum of the square of the lengths of the legs,  $a$  and  $b$ , of a right triangle is equal to the square of the length of the hypotenuse  $c$  and is written  $a^2 + b^2 = c^2$ .**



# Example 3. Using the Pythagorean Theorem.

a. Find the length of the hypotenuse.

SOLUTION

$$a^2 + b^2 = c^2$$

$$12^2 + 5^2 = c^2$$

$$144 + 25 = c^2$$

$$\sqrt{169} = \sqrt{c^2}$$

$$13 \text{ cm} = c$$

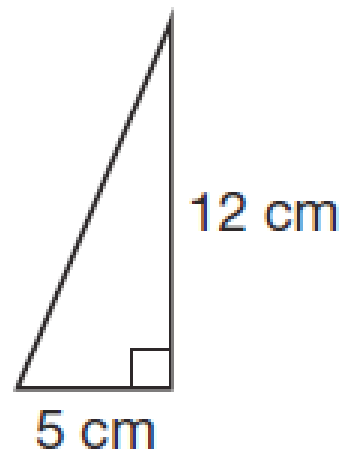
Pythagorean Theorem

Substitute.

Simplify.

Square root of both sides

Simplify.



# Example 3. Using the Pythagorean Theorem.

b. Find the area of the triangle.

SOLUTION

Use the Pythagorean Theorem to find the length of  $b$ .

$$a^2 + b^2 = c^2$$

Pythagorean Theorem

$$3^2 + b^2 = 5^2$$

Substitute.

$$9 + b^2 = 25$$

Simplify.

$$9 + b^2 - 9 = 25 - 9$$

Subtract 9 from both sides. **3 ft**

$$b^2 = 16$$

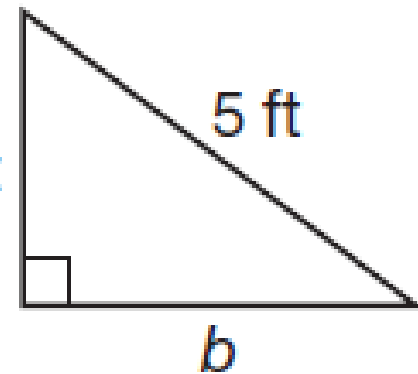
Simplify.

$$\sqrt{b^2} = \sqrt{16}$$

Square root of both sides

$$b = 4 \text{ ft.}$$

Simplify.



Then calculate the area of the triangle.

$$A = \frac{1}{2}bh$$

Formula for area of a triangle

$$A = \frac{1}{2}(4)(3)$$

Substitute.

$$A = 6ft^2$$

Simplify.

# Example 4 Application: Measuring Temperature

Different countries use different units to measure the temperature. Much of the world uses degrees Celsius, but a few countries use degrees Fahrenheit. For scientists and travelers, converting between Celsius and Fahrenheit is an important skill.

To convert to Celsius from Fahrenheit, use the formula:

$$C = \frac{5}{9}(F - 32)$$

a. If it is  $77^{\circ}\text{F}$ , what is the temperature in degrees Celsius?

**SOLUTION**

$$C = \frac{5}{9}(F - 32)$$

$$C = \frac{5}{9}(77 - 32)$$

$$C = 25$$

Conversion formula

Substitute.

Simplify.

# Example 4 Application: Measuring Temperature

b. If it is  $10^{\circ}\text{C}$ , what is the temperature in degrees Fahrenheit?

SOLUTION

$$C = \frac{5}{9}(F - 32)$$

Conversion formula

$$10 = \frac{5}{9}(F - 32)$$

Substitute.

$$10 \cdot \frac{9}{5} = \frac{5}{9}(F - 32) \cdot \frac{9}{5}$$

Multiply by the reciprocal

$$18 = F - 32$$

Simplify.

$$18 + 32 = F - 32 + 32$$

Add 32 to both sides

$$50 = F$$

Simplify.

# You Try!!!!

g. Use the Pythagorean Theorem to find the area of a triangle with a hypotenuse of 17 millimeters and a side length of 15 millimeters.

$$60\text{mm}^2$$

i. If it is  $100^\circ$  Celsius, what is the temperature in degrees Fahrenheit?

$$112^\circ F$$



# Assignment

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Lesson Practice a–l (Ask Mr. Heintz)

Page 44

Practice 1–30 (Do the starred ones first)