



# Perimeter and Area of Polygons

Based on power point presentations by Pearson Education, Inc.  
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# Learning Objectives

1. Memorize the units of perimeters and areas.
2. Memorize and use the perimeter and area formula of rectangles.
3. Memorize and use the perimeter and area formula of squares.
4. Memorize and use the perimeter and area formula of parallelograms.
5. Memorize and use the perimeter and area formula of trapezoids.
6. Memorize and use the perimeter and area formula of triangles.

# 1. Introduction to Perimeters and Areas of Polygons

The *perimeter* is the sum of the lengths of the sides of a figure.

**Perimeters are measured in linear units, such as *inches (in)*, *feet (ft)*, *yards (yd)*, *centimeters (cm)*, *meters (m)*, *kilometers (km)*, etc.**

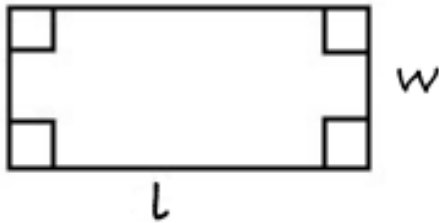
*Area* is the amount of space occupied by a two-dimensional figure.

**Areas are measured in square units, such as  $in^2$ ,  $ft^2$ ,  $yd^2$ ,  $cm^2$ ,  $m^2$ ,  $km^2$ , etc.**

## 2. Perimeter and Area Formulas of Rectangles

In a rectangle, both pairs of opposite sides are parallel, and each pair has the same measure. All interior angles are right angles.

Let  $l$  be the length of the rectangle and  $w$  its width.



Perimeter Formula:  $P = l + l + w + w$

$$\text{or } P = 2 \cdot l + 2 \cdot w = 2l + 2w$$

Area Formula:  $A = l \cdot w = lw$

## Example 1: Perimeter and Area of Rectangles

Find the perimeter and area of a rectangle whose length  $l$  is 14 ft and whose width  $w$  is 9 ft.

Required formulas:  $P = 2l + 2w$  and  $A = l \cdot w = l w$

$$P = 2(14) + 2(9) = 28 + 18 = 46$$

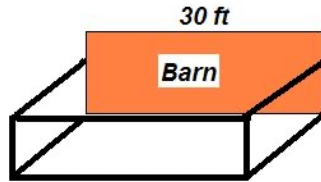
$$A = 9(14) = 126$$

The perimeter of the rectangle is 46 ft and the area is 126 ft<sup>2</sup>. **Please note that the area units are squared.**

## Example 2: Perimeter of Rectangles

A farmer wants to build a rectangular pen for his sheep using his barn as one side. The barn is 30 ft long. If only 110 ft of chain link fencing is available at the lumber yard, what is the length that each side adjacent to the barn can have?

Sometimes it is a good idea to draw a picture. How about the following?



We will use the formula  $P = l + 2w$  because one side of the pen is the barn! Given that we have *110 ft* of chain link fence, and the barn is *30 ft* long, we can write the formula as follows:

$$110 = 30 + 2w$$

$80 = 2w$  Now we will divide both sides by 2!

$$w = 40$$

Therefore, the length of each side adjacent to the barn must be 40 ft.

## Example 3: Perimeter of Rectangles

An amateur gardener would like to erect a rectangular fence around her flower garden. The enclosure is to be 12 yd long and 15 yd wide and the fence costs \$1.50 per foot. How much will she have to pay for the fence?

For this calculation, we will use the perimeter formula  $P = 2l + 2w$  to find out how much fence is needed. We know that  $l = 12$  and  $w = 15$ .

$$\text{Then } P = 2(12) + 2(15) = 54 \text{ yd}$$

We know that the fence costs \$1.50 per foot, therefore, we will first have to change the yards to feet because the price for the fence is quoted per foot.

We know that 1 yd = 3 ft. Therefore, 54 yd equals  $54(3) = 162$  ft

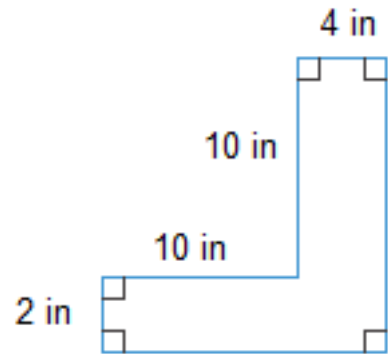
Now, we can calculate the cost  $C$  for the fence as follows:

$$C = 162(1.50) = 243$$

The gardener must pay \$243 for the new fence around her flower garden.

## Example 4: Area of Rectangles (1 of 2)

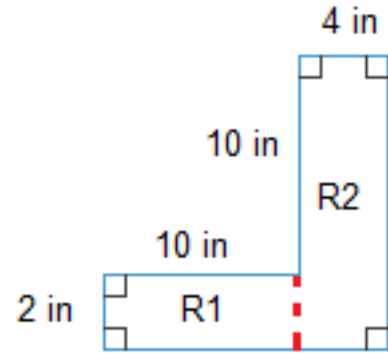
Find the area of the following figure.



We will use the formula  $A = l \cdot w$ ! Here, we must divide this figure into 2 rectangles and find the area of each. **You can divide the figure in two different ways.**



## Example 4: Area of Rectangles (2 of 2)

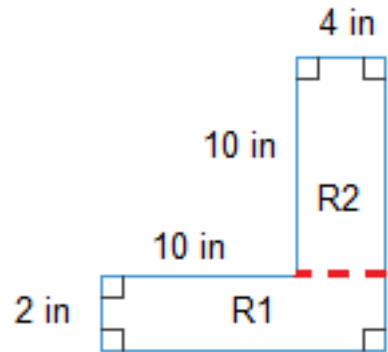


The dashed red line is 2 in long.

$$\text{Area } R1 = 2(10) = 20$$

$$\text{Area } R2 = 4(10 + 2) = 48$$

$$\text{Total Area} = 20 + 48 = 68$$



The dashed red line is 4 in long!

$$\text{Area } R1 = 2(10 + 4) = 28$$

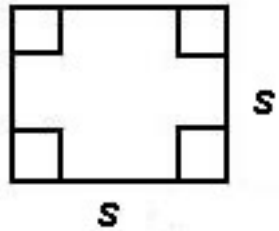
$$\text{Area } R2 = 4(10) = 40$$

$$\text{Total Area} = 28 + 40 = 68$$

In either case, the total area of the given figure is  $68 \text{ in}^2$ . **Please note that the area units are squared.**

### 3. Perimeter and Area Formulas of Squares

The square is a special rectangle in which all sides are of equal length. Therefore, we usually don't call the sides length  $l$  and width  $w$ , but all sides get the name  $s$ .



Perimeter Formula:  $P = s + s + s + s$

$$\text{or } P = 4 \cdot s = 4s$$

Area Formula:  $A = s \cdot s = s^2$

## Example 5: Perimeter and Area of Squares

Find the perimeter and area of a square that measures 5 cm on a side.

Required formulas:  $P = 4s$  and  $A = s^2$ .

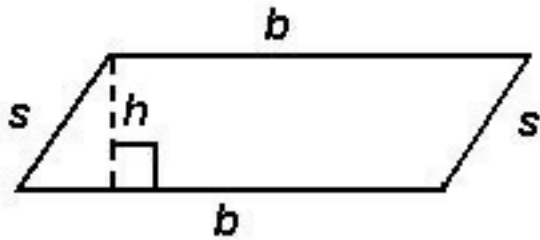
$$P = 4(5) = 20$$

$$A = 5^2 = 25$$

The perimeter of the square is 20 cm and the area is 25 cm<sup>2</sup>. **Please note that the area units are squared.**

## 4. Perimeter and Area Formulas of Parallelograms

The parallelogram is a special rectangle in which the right and left side  $s$  are parallel and of equal length and the top and bottom  $b$  are also parallel and of equal length. However, no interior angle is a right angle.



The height  $h$  makes a  $90^\circ$  angle with the base  $b$ . It is not the length of a side!

Perimeter Formula:  $P = s + s + b + b$

$$\text{or } P = 2 \cdot s + 2 \cdot b = 2s + 2b$$

Area Formula:  $A = b \cdot h = bh$

## Example 6: Area of Parallelograms

Find the area of a parallelogram with base  $b = 30$  ft and height is  $h = 18$  ft.

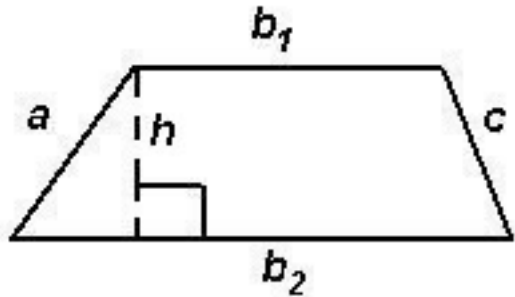
Required formula:  $A = bh$ , where  $h$  is the height and  $b$  is the base

$$A = 30(18) = 540$$

The area of the parallelogram is  $540 \text{ ft}^2$ . **Please note that the area units are squared.**

## 5. Perimeter and Area Formulas of Trapezoids

The trapezoid is a quadrilateral in which exactly two lines are parallel. The sides  $a$  and  $c$  can be of equal length, but it is not mandatory. The top and bottom  $b_1$  and  $b_2$  are parallel.



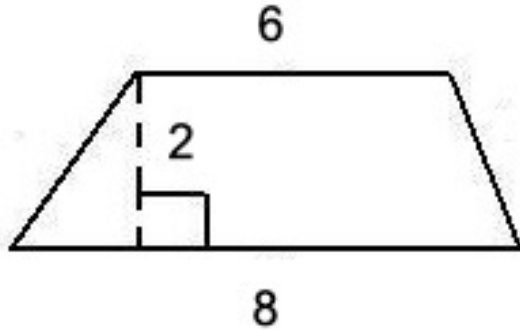
The height  $h$  makes a  $90^\circ$  angle with base  $b_1$  and  $b_2$ . It is not the length of a side!

Perimeter Formula:  $P = a + c + b_1 + b_2$

Area Formula:  $A = \frac{1}{2} \cdot h \cdot (b_1 + b_2) = \frac{1}{2}h (b_1 + b_2)$

## Example 7: Area of Trapezoids

Find the area of the given trapezoid. The unit of measure is yards.



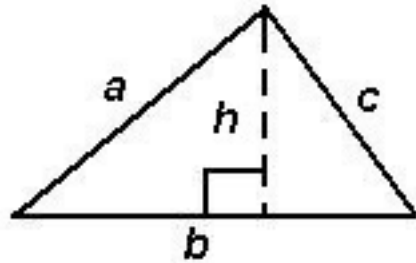
Required formula:  $A = \frac{1}{2} h (b_1 + b_2)$

$$A = \frac{1}{2} (2)(6 + 8) = 14$$

The area of the trapezoid is 14 yd<sup>2</sup>. **Please note that the area units are squared.**

## 6. Perimeter and Area Formulas of Triangles

The triangle is a 3-sided polygon and the sum of the measures of its three interior angles is  $180^\circ$ . We name the sides ***a***, ***b***, and ***c***.



The line drawn from ANY vertex to the opposite side is called the altitude or height ***h*** of the triangle. It makes a  $90^\circ$  angle with this side which we call base ***b***.

Perimeter Formula:  $P = a + b + c$

Area Formula:  $A = \frac{1}{2} \cdot b \cdot h = \frac{1}{2}bh$



## Example 8: Area of Triangles

A parking lot is in the shape of a triangle with base 6.2 m and height 10 m. What is the area of the parking lot?

Required formula:  $A = \frac{1}{2} bh$

$$A = \frac{1}{2}(6.2)(10) = 31$$

The area of the triangular parking lot is 31 m<sup>2</sup>. **Please note that the area units are squared.**