

Area



Getting the Idea

The **area** of a figure is the number of square units inside the figure.

Below are some formulas that can be used to find the areas of common polygons.

Formula	Diagram
<p>Triangle</p> <p>$A = \frac{1}{2}bh$, where b represents the base length and h represents the height.</p>	
<p>Parallelogram</p> <p>$A = bh$, where b represents the base length and h represents the height.</p>	
<p>Rectangle</p> <p>$A = lw$, where l represents the length and w represents the width.</p>	
<p>Square</p> <p>$A = s^2$, where s represents the length of a side.</p>	
<p>Trapezoid</p> <p>$A = \frac{1}{2}(b_1 + b_2)h$, where b_1 and b_2 represent the base lengths and h represents the height.</p>	

Example 1

What is the area of this trapezoid?

Strategy Use the formula for the area of a trapezoid.

Step 1

Write the formula for the area of a trapezoid.

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

Step 2

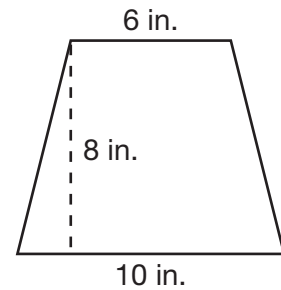
Substitute the known values in the formula and simplify.

$$\text{Let } b_1 = 10 \text{ in. and let } b_2 = 6 \text{ in.}$$

$$A = \frac{1}{2}(10 \text{ in.} + 6 \text{ in.}) \times 8 \text{ in.}$$

$$= \frac{1}{2}(16 \text{ in.}) \times 8 \text{ in.}$$

$$= 8 \text{ in.} \times 8 \text{ in.} = 64 \text{ in.}^2$$



Solution The area of the trapezoid is 64 in.^2

Example 2

Phillip drew the figure on the right to represent the design of his new garage. What is the area of the figure?

Strategy Divide the figure into smaller, familiar figures. Find the area of each figure. Then add to find the total area.

Step 1

Divide the figure into familiar figures.

The figure is divided into a triangle and a rectangle.

Step 2

Find the area of the triangle.

The height, h , of the triangle is 3 cm.

To determine the base length, subtract the two known horizontal lengths: $10 \text{ cm} - 6 \text{ cm} = 4$.

So, the base, b , of the triangle is 4 cm.

$$A \text{ of triangle} = \frac{1}{2}bh$$

$$= \frac{1}{2} \times 4 \times 3 = 6 \text{ cm}^2$$

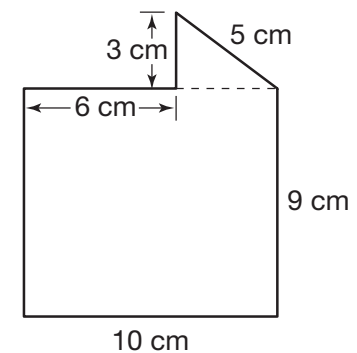
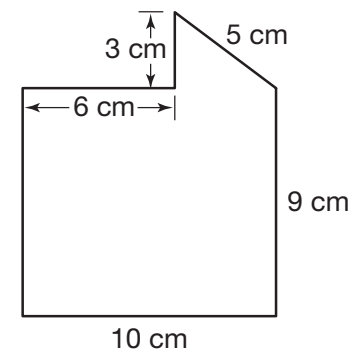
Step 3

Find the area of the rectangle.

The length, l , is 10 cm, and the width, w , is 9 cm.

$$A \text{ of rectangle} = lw$$

$$= 10 \times 9 = 90 \text{ cm}^2$$



Step 4 Add those areas to find the total area of the figure.

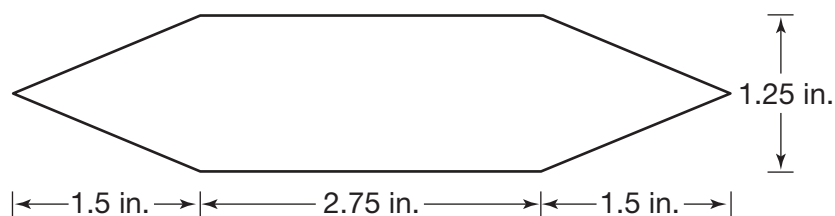
$$A \text{ of composite figure} = 6 + 90 = 96 \text{ cm}^2$$

Solution The area of the figure is 96 square centimeters.

Sometimes you will not need an exact answer. Use rounding to find an estimate.

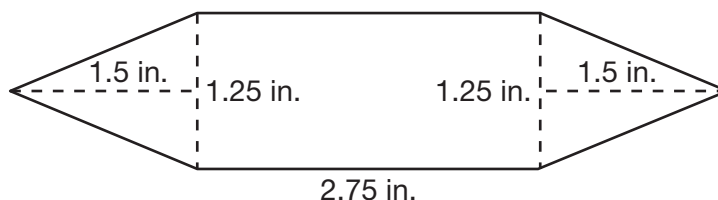
Example 3

What is the approximate area of the figure?



Strategy Divide the figure into shapes whose area formulas you know.

Step 1 Divide the figure into 1 rectangle and 2 triangles.



Step 2 Find the approximate area of the rectangle.

$$A = lw$$

$$A = 2.75 \times 1.25$$

$$\approx 3 \times 1$$

Round each decimal to the nearest whole number.

$$\approx 3 \text{ in.}^2$$

Step 3 Find the approximate area of the 2 triangles.

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

$$A = \frac{1}{2} \times 1.25 \times 1.5$$

$$\approx \frac{1}{2} \times 1 \times 2$$

Round each decimal to the nearest whole number.

$$\approx 1 \text{ in.}^2$$

$$\text{There are 2 triangles: } 2 \times 1 \text{ in.}^2 = 2 \text{ in.}^2$$

Step 4 Add to find the approximate total area of the figure.

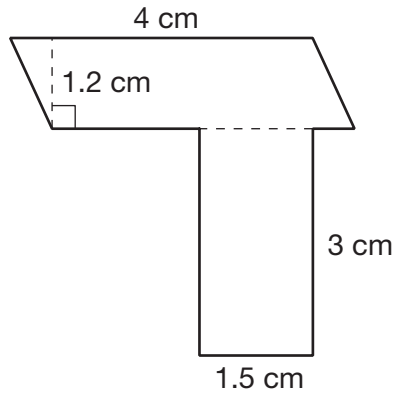
$$3 \text{ in.}^2 + 2 \text{ in.}^2 = 5 \text{ in.}^2$$

Solution The approximate area of the figure is 5 square inches.



Coached Example

Aster made a sticker in the shape shown below.



What is the area of the sticker?

A parallelogram and a _____ are combined to form the sticker.

What is the formula for the area of a parallelogram? _____

Find the area of the parallelogram.

What is the formula for the area of a rectangle? _____

Find the area of the rectangle.

Add to find the total area of the figure.

The area of the sticker is _____.



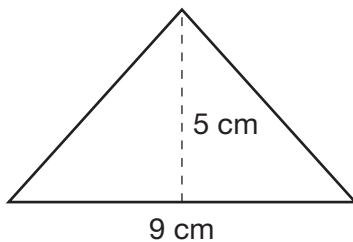
Lesson Practice

Choose the correct answer.

1. A rectangular playground is 85 feet long and 60 feet wide. What is the area of the playground?

A. 290 ft^2 C. $2,550 \text{ ft}^2$
 B. 510 ft^2 D. $5,100 \text{ ft}^2$

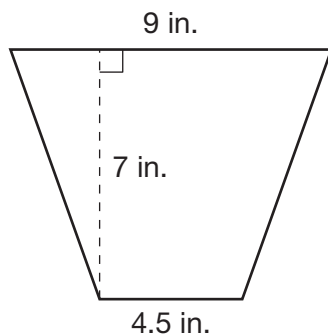
2. A banner is shaped like the triangle shown below.



What is the area of the banner?

A. 14 cm^2 C. 28 cm^2
 B. 22.5 cm^2 D. 45 cm^2

3. A window is shaped like the trapezoid shown below.



What is the area of the window?

A. 47.25 in.^2 C. 141.75 in.^2
 B. 63 in.^2 D. 283.5 in.^2

4. Which of the figures below have the same area?

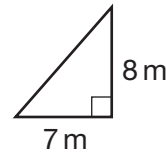


Figure 1

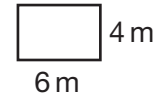


Figure 2

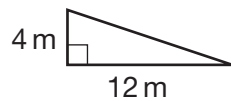


Figure 3

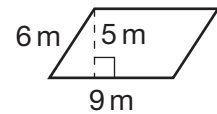


Figure 4

- A. figures 1 and 2
 B. figures 2 and 3
 C. figures 2 and 4
 D. figures 3 and 4

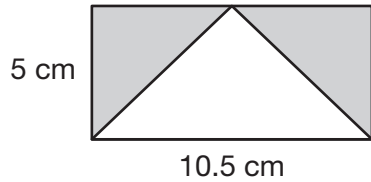
5. What is the area of a parallelogram with a base length of 12 yd and a height of 9 yd?

- A. 60 square yards
 B. 90 square yards
 C. 108 square yards
 D. 120 square yards

6. Which figure has the least area?

- A. square with a side length of 9 cm
 B. parallelogram with a base of 12 cm and a height of 6 cm
 C. triangle with a base of 18 cm and a height of 6 cm
 D. rectangle with a width of 7 cm and a length of 8 cm

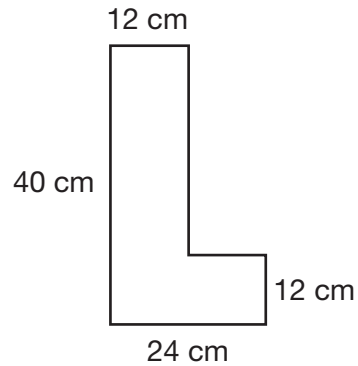
7. Carl cut two triangular boards from the corners of a rectangular board as shown by the shaded sections below.



What is the combined area of the shaded sections?

- A. 15.5 cm^2
- B. 26.25 cm^2
- C. 27.5 cm^2
- D. 52.5 cm^2

8. What is the area of the figure below?



- A. 960 cm^2
- B. 768 cm^2
- C. 624 cm^2
- D. 480 cm^2

9. Ross uses nylon string as a border around a square picture. The string is 60 inches long.

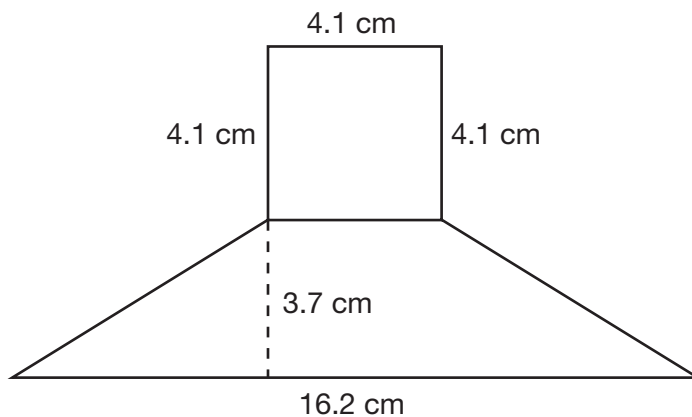
- A. What is the area of the picture in square inches? Show your work.

- B. Ross doubles the length of each side of the picture. What is the area of the new square picture in square inches? Show your work.

10. Which figure has an area of 144 square inches? Circle all that apply.

- A. triangle with base 12 inches and height 24 inches
- B. parallelogram with base 24 inches and height 6 inches
- C. rectangle with length 18 inches and width 9 inches
- D. square with side 12 inches
- E. trapezoid with bases 8 inches and 10 inches and height 8 inches

11. Use numbers from the box to make each statement true.



The approximate area of the square is _____ square centimeters.

The approximate area of the trapezoid is _____ square centimeters.

The approximate area of the composite figure is _____ square centimeters.

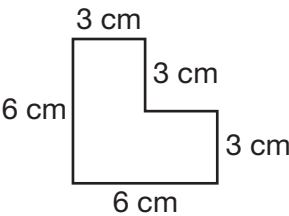
17	38
20	55
30	65

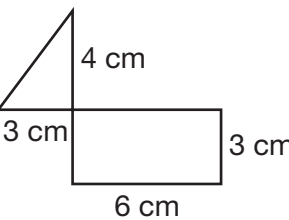
12. Find the area of each polygon. Write each polygon in the correct box.

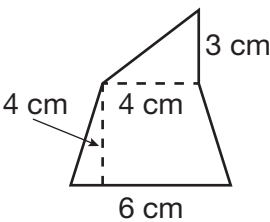
Triangle $b = 10$ m $h = 6$ m	Parallelogram $b = 14$ m $h = 10$ m	Rectangle $l = 2$ m $w = 9$ m	Square $s = 8$ m	Trapezoid $b_1 = 6$ m $b_2 = 12$ m $h = 10$ m
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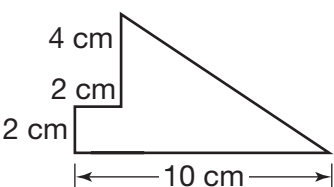
Area is a Multiple of 4.	Area is a Multiple of 6.

13. Draw a line from each figure to its area.

A.  • • 24 cm^2

B.  • • 26 cm^2

C.  • • 27 cm^2

D.  • • 28 cm^2