What You'll Learn

To find the area of a trapezoid and the areas of irregular figures

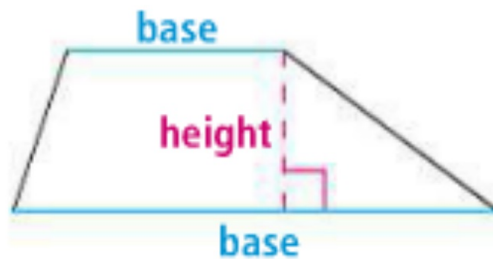🔊 **New Vocabulary**   bases of a trapezoid, height of a trapezoid

Why Learn This?

If you know how to find the area of simple figures, you can find the area of an irregular figure, such as the area of a backyard deck.

The formula for the area of a trapezoid follows from the formula for the area of a parallelogram.

The two parallel sides of a trapezoid are the **bases of a trapezoid**, with lengths b_1 and b_2. The **height of a trapezoid** h is the length of a perpendicular segment connecting the bases.

If you put two identical trapezoids together, you get a parallelogram. The area of the parallelogram is $(b_1 + b_2)h$. The area of one trapezoid equals $\frac{1}{2}(b_1 + b_2)h$.
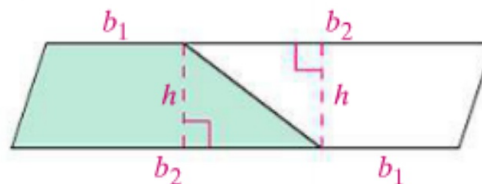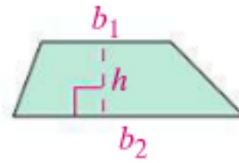
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Vocabulary and Key Concepts

Area of a Trapezoid

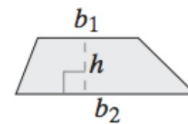The area of a trapezoid is [**one half**] the product of the [**height**] and the sum of the lengths of the [**bases**].

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

If you put two identical trapezoids together, you get a parallelogram. The area of the parallelogram is $\boxed{(b_1 + b_2)h}$. The area of one trapezoid is $\boxed{\frac{1}{2}(b_1 + b_2)h}$.

The bases of a trapezoid are __the two parallel sides.__

The height of a trapezoid is __the length of a perpendicular segment connecting__ __the bases.__

EXAMPLE   Finding the Area of a Trapezoid

1 Find the area of the trapezoid shown at the right.

$$A = \frac{1}{2}h(b_1 + b_2) \quad \leftarrow \text{Use the area formula for a trapezoid.}$$

$$= \frac{1}{2}(15)(8.5 + 13.5) \quad \leftarrow \text{Substitute for } h, b_1, \text{ and } b_2.$$

$$= \frac{1}{2}(15)(22) \quad \leftarrow \text{Add.}$$

$$= 165 \quad \leftarrow \text{Multiply.}$$
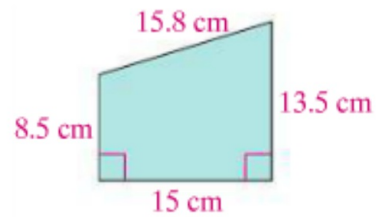
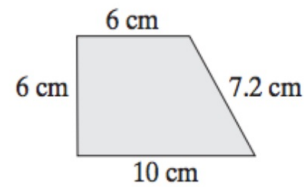The area of the trapezoid is 165 cm².

15.8 cm

13.5 cm

8.5 cm

15 cm

Examples

1 Finding the Area of a Trapezoid Find the area of the trapezoid.

$$A = \frac{1}{2}\boxed{}\left(\boxed{} + \boxed{}\right) \quad \leftarrow \text{Use the area formula for a trapezoid.}$$

$$= \frac{1}{2}\left(\boxed{}\right)\left(\boxed{} + \boxed{}\right) \quad \leftarrow \text{Substitute for } h, b_1, \text{ and } b_2.$$

$$= \frac{1}{2}\left(\boxed{}\right)(16) \quad \leftarrow \text{Add.}$$

$$= \boxed{} \quad \leftarrow \text{Multiply.}$$

The area is $\boxed{}$ cm².

6 cm

6 cm

7.2 cm

10 cm

You can estimate the area of states shaped like trapezoids.

EXAMPLE **Application: Geography**

② Estimate the area of Arkansas by finding the area of the trapezoid shown.

$A = \frac{1}{2}h(b_1 + b_2)$ ← Use the area formula for a trapezoid.

$= \frac{1}{2}(242)(250 + 190)$ ← Substitute for h, b_1, and b_2.

$= \frac{1}{2}(242)(440)$ ← Add.

$= 53{,}240$ ← Multiply.

The area of Arkansas is about 53,240 mi².

At Crater of Diamonds State Park in Arkansas, visitors can search for and keep diamonds and other gems.

250 mi

Mammoth Spring

ARKANSAS

Fort Smith   Little Rock ★

242 mi

190 mi

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❷ **Geography** Estimate the area of the figure by finding the area of the trapezoid.

$A = \frac{1}{2}\boxed{}\left(\boxed{} + b_2\right)$ ← Use the area formula for a trapezoid.

$= \frac{1}{2}\left(\boxed{}\right)\left(\boxed{} + \boxed{}\right)$ ← Substitute for h, b_1, and b_2.

$= \frac{1}{2}\left(\boxed{}\right)\left(\boxed{}\right)$ ← Add.

$= \boxed{272}$ ← Multiply.

The area of the figure is about $\boxed{272}$ ft².

16 ft

22 ft

12 ft

18 ft
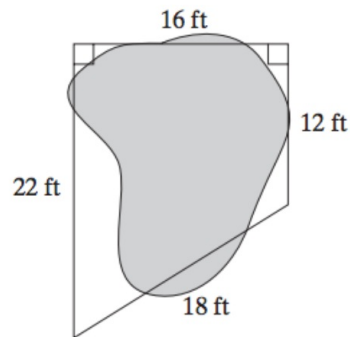
● More Than One Way

Anna and Ryan are helping their friends build a large wooden deck. What is the area of the deck?
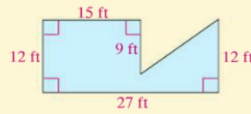
Anna's Method

I'll subtract the area of the triangle from the area of the rectangle.
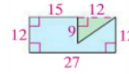

Area of the rectangle:

$A = bh$
$= (27)(12) = 324$

Area of the triangle:

$A = \frac{1}{2}bh$
$= \frac{1}{2}(12)(9) = 54$

Now I'll subtract the area of the triangle from the area of the rectangle.

$A = 324 - 54 = 270$

The area of the deck is 270 ft².

Ryan's Method

I'll add the areas of the rectangle and the trapezoid.

Area of the rectangle:

$A = bh$
$= (15)(12)$
$= 180$

Area of the trapezoid:

$A = \frac{1}{2}h(b_1 + b_2)$
$= \frac{1}{2}(12)(3 + 12)$
$= 90$

Now I'll add the two areas together.

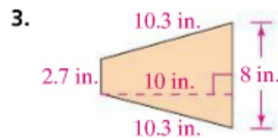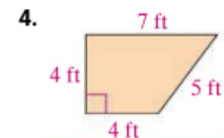$A = 180 + 90 = 270$

The area of the deck is 270 ft².
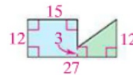
✓ Check Your Understanding

1. **Vocabulary** The perpendicular distance between the two parallel sides of a trapezoid is called the __?__ of the trapezoid.

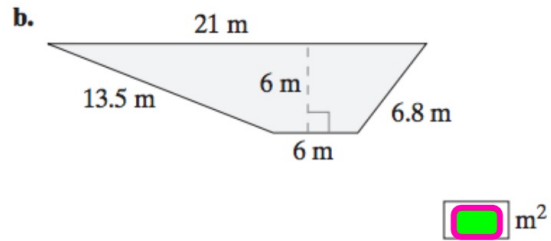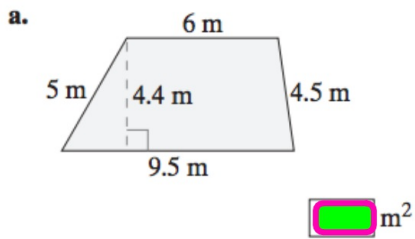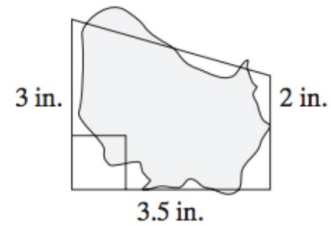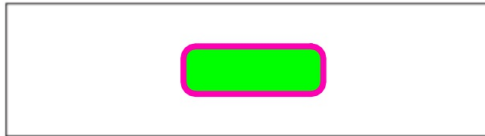**Identify the bases b_1 and b_2 and height h of each trapezoid below.**
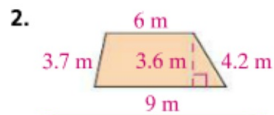
2.

3.

4.

1. Find the area of each trapezoid.

a.

6 m

5 m / 4.4 m 4.5 m

9.5 m

[　] m²

b.

21 m

13.5 m

6 m

6.8 m

6 m

[　] m²

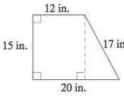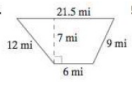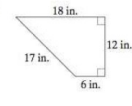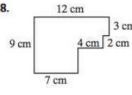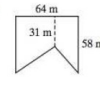**2.** Estimate the area of the figure by finding the area of the trapezoid.

[　]

3 in. 2 in.

3.5 in.
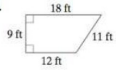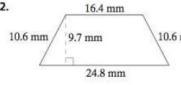
You have an assignment worksheet, and time to begin working on it.

Name _____ Class _____ Date _____

Practice 6-4
Areas of Other Figures

Find the area of each trapezoid.

1.
18 ft
9 ft
11 ft
12 ft

_____

2.
16.4 mm
10.6 mm
9.7 mm
10.6 mm
24.8 mm

_____

3.
12 in.
15 in.
17 in.
20 in.

_____

4.
21.5 mi
7 mi
12 mi
9 mi
6 mi

_____

5.
8 m
8 m
10 m
14 m

_____

6.
18 in.
17 in.
12 in.
6 in.

_____

Find the area of each irregular figure.

7.
6 ft   18 ft
26 ft
39 ft
29 ft

_____

8.
12 cm
3 cm
9 cm
4 cm   2 cm
7 cm

_____

9.
64 m
31 m
58 m

_____

Solve.

10. The flag of Switzerland features a white cross on a red background.

   a. Each of the 12 sides of the cross has a length of 15 cm.
      Find the area of the white cross.   _____

   b. The flag has dimensions 60 cm by 60 cm.
      Find the area of the red region.   _____

11. A trapezoid has an area of 4 square units, and a height of 1 unit. What are
    the possible whole-number lengths for the bases?   _____