

8.6

Area of Trapezoids

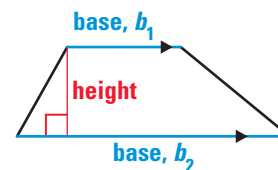
Goal

Find the area of trapezoids.

Key Words

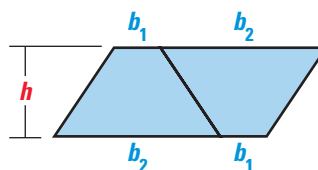
- trapezoid p. 332
- base of a trapezoid p. 332
- height of a trapezoid

Recall that the parallel sides of a trapezoid are called the *bases* of the trapezoid, with lengths denoted by b_1 and b_2 .



The shortest distance between the bases is the **height of the trapezoid**.

Suppose that two congruent trapezoids with bases b_1 and b_2 and height h are arranged to form a parallelogram as shown.



Student Help

LOOK BACK

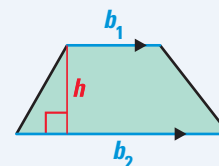
To review more about trapezoids, see p. 332.

The area of the parallelogram is $h(b_1 + b_2)$. Because the two trapezoids are congruent, the area of one of the trapezoids is half the area of the parallelogram.

AREA OF A TRAPEZOID

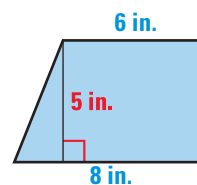
Words Area = $\frac{1}{2}$ (height)(sum of bases)

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



EXAMPLE 1 Find the Area of a Trapezoid

Find the area of the trapezoid.



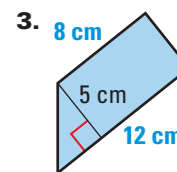
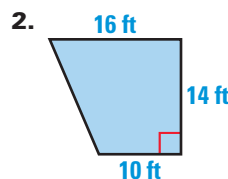
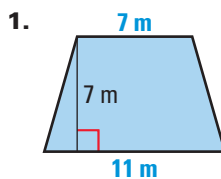
Solution

$$\begin{aligned}
 A &= \frac{1}{2}h(b_1 + b_2) && \text{Formula for the area of a trapezoid} \\
 &= \frac{1}{2}(5)(6 + 8) && \text{Substitute 5 for } h, 6 \text{ for } b_1, \text{ and } 8 \text{ for } b_2. \\
 &= \frac{1}{2}(5)(14) && \text{Simplify within parentheses.} \\
 &= 35 && \text{Simplify.}
 \end{aligned}$$

ANSWER ▶ The area of the trapezoid is 35 square inches.

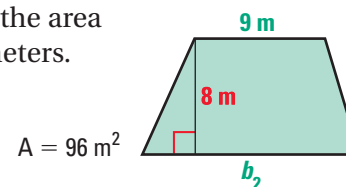
Checkpoint Area of Trapezoids

Find the area of the trapezoid.



EXAMPLE 2 Use the Area of a Trapezoid

Find the value of b_2 given that the area of the trapezoid is 96 square meters.



Student Help

STUDY TIP

The equation is easier to solve without the fraction. So, multiply each side by 2 before distributing.

Solution

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

Formula for the area of a trapezoid

$$\rightarrow 96 = \frac{1}{2}(8)(9 + b_2)$$

Substitute 96 for A , 8 for h , and 9 for b_1 .

$$192 = 8(9 + b_2)$$

Multiply each side by 2.

$$192 = 72 + 8b_2$$

Use the distributive property.

$$120 = 8b_2$$

Subtract 72 from each side.

$$15 = b_2$$

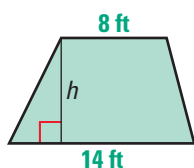
Divide each side by 8.

ANSWER ▶ The value of b_2 is 15 meters.

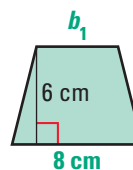
Checkpoint Use the Area of a Trapezoid

A gives the area of the trapezoid. Find the missing measure.

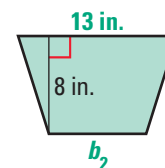
4. $A = 77 \text{ ft}^2$



5. $A = 39 \text{ cm}^2$



6. $A = 84 \text{ in.}^2$



7. A trapezoid has an area of 294 square yards. Its height is 14 yards and the length of one base is 30 yards. Find the length of the other base.

8.6 Exercises

Guided Practice

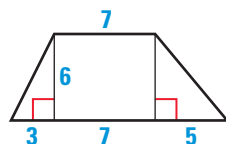
Vocabulary Check

1. Sketch a trapezoid. Label its height h and its bases b_1 and b_2 .

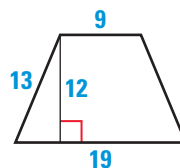
Skill Check

Find the height and the lengths of the bases of the trapezoid.

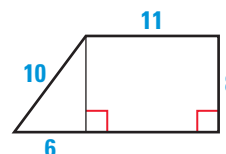
2.



3.



4.



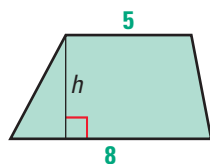
Match the trapezoid with the equation used to find the height.

A. $A = \frac{1}{2}h(5 + 13)$

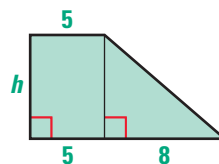
B. $A = \frac{1}{2}h(8 + 13)$

C. $A = \frac{1}{2}h(5 + 8)$

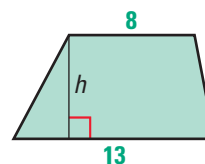
5.



6.



7.



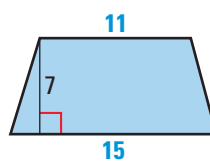
Practice and Applications

Extra Practice

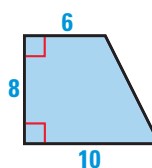
See p. 690.

Area of a Trapezoid Find the area of the trapezoid.

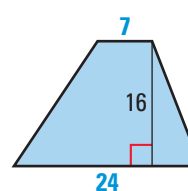
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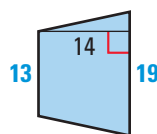
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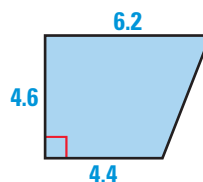
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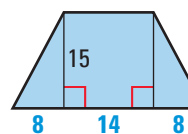
11.



12.




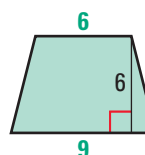
13.



Homework Help

Example 1: Exs. 8–13
Example 2: Exs. 18–22

14.  **You be the Judge** A classmate states that if you double the dimensions of the trapezoid at the right, then its area doubles. Do you agree? Explain your answer.



15. **Visualize It!** Draw three different trapezoids with a height of 5 units and bases of 3 units and 7 units. Then find the areas of the trapezoids. What do you notice?

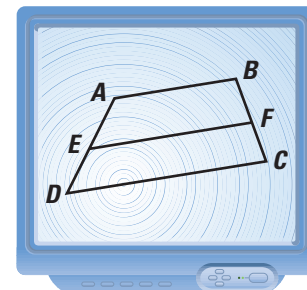
Student Help

LOOK BACK

To review the midsegment of a trapezoid, see p. 333.

Technology In Exercises 16 and 17, use geometry software.

- 1 Draw a trapezoid.
 - 2 Draw the midsegment.
16. Find the length of the midsegment and the height of the trapezoid. Multiply the two measures.
17. Find the area of the trapezoid. How does the area compare to your answer for Exercise 16?

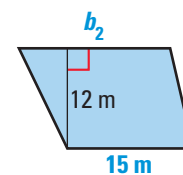
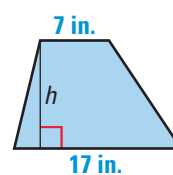
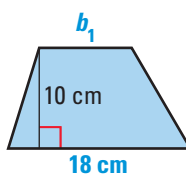


Using Algebra In Exercises 18–20, A gives the area of the trapezoid. Find the missing measure.

18. $A = 135 \text{ cm}^2$

19. $A = 132 \text{ in.}^2$

20. $A = 198 \text{ m}^2$



21. A trapezoid has an area of 50 square units. The lengths of the bases are 10 units and 15 units. Find the height.
22. A trapezoid has an area of 24 square units. The height is 3 units and the length of one of the bases is 5 units. Find the length of the other base.

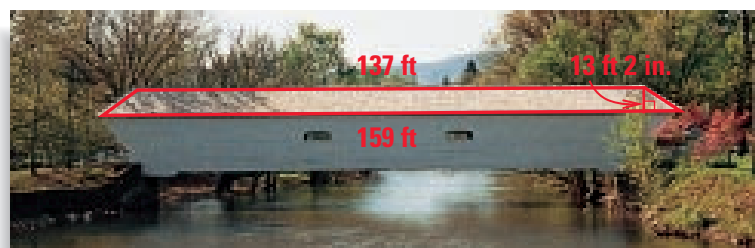
Student Help

HOMEWORK HELP

Extra help with problem solving in Exs. 21–22 is at classzone.com

Bridges In Exercises 23–25, use the following information.

The roof on the bridge below, consists of four sides: two congruent trapezoids and two congruent triangles.



Doe River Covered Bridge in Elizabethton, Tennessee

23. Find the combined area of the two trapezoids.
24. Use the diagram at the right to find the combined area of the two triangles.
25. What is the area of the entire roof?

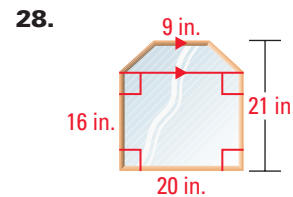
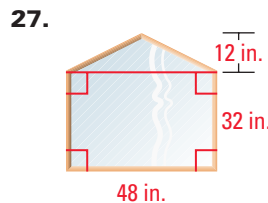
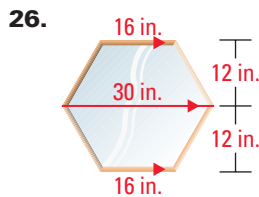


Student Help

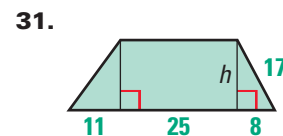
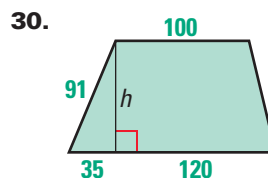
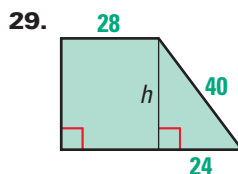
VISUAL STRATEGY

To find the area of a complex polygon, you can add the areas of the simpler shapes that make up the polygon, as shown on p. 410.

Windows Find the area of the window.



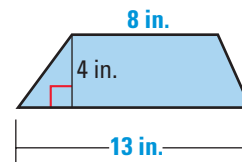
Using the Pythagorean Theorem Find the height using the Pythagorean Theorem and a calculator. Then find the area of the trapezoid.



Standardized Test Practice

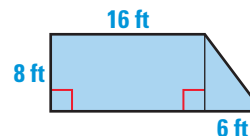
32. **Multiple Choice** What is the area of the trapezoid?

- (A) 25 in.²
- (B) 42 in.²
- (C) 68 in.²
- (D) 84 in.²



33. **Multiple Choice** What is the area of the trapezoid?

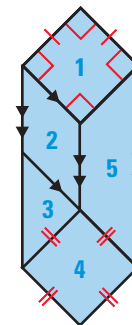
- (F) 88 ft²
- (G) 128 ft²
- (H) 152 ft²
- (J) 176 ft²



Mixed Review

Finding Area Match the region with a formula for its area. Use each formula exactly once. (Lessons 8.3–8.6)

- 34. Region 1 A. $A = s^2$
- 35. Region 2 B. $A = \frac{1}{2}d_1d_2$
- 36. Region 3 C. $A = \frac{1}{2}bh$
- 37. Region 4 D. $A = \frac{1}{2}h(b_1 + b_2)$
- 38. Region 5 E. $A = bh$



Algebra Skills

Fraction Operations Add or subtract. Write the answer as a fraction in simplest form. (Skills Review, p. 658)

- 39. $\frac{3}{8} + \frac{5}{8}$
- 40. $\frac{5}{9} - \frac{2}{9}$
- 41. $\frac{3}{4} + \frac{1}{12}$
- 42. $\frac{4}{7} - \frac{1}{5}$