

LESSON
11.5

Areas of Triangles and Trapezoids

BEFORE

You found the areas of parallelograms.

Now

You'll find the areas of triangles and trapezoids.

WHY?

So you can find the wing area of a space shuttle, as in Ex. 25.

Word Watch

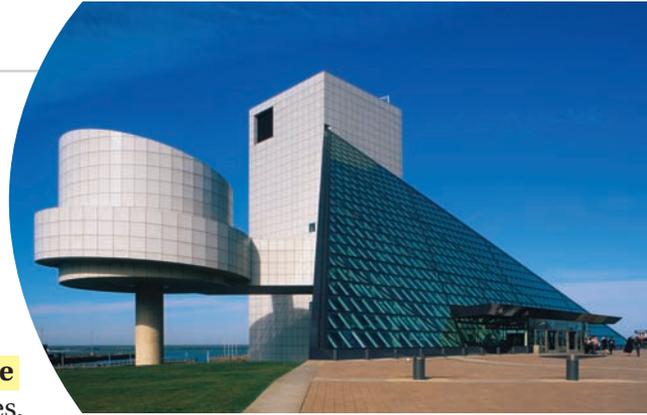
base of a triangle, p. 558
height of a triangle, p. 558
bases of a trapezoid, p. 559
height of a trapezoid, p. 559

In the Real World

Museums The Rock and Roll Hall of Fame and Museum in Cleveland, Ohio, has a triangular shaped wall. What is the area of the wall?

You can use the *base* and *height* of a triangle to find the area of the triangle. The **base of a triangle** is the length of any one of the sides.

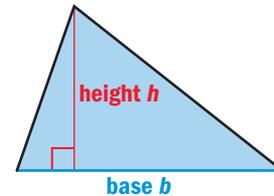
The **height of a triangle** is the perpendicular distance between the side whose length is the base and the vertex opposite that side.



Area of a Triangle

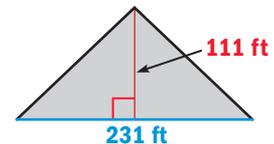
Words The area A of a triangle is half the product of a base and the corresponding height.

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



EXAMPLE 1 Finding the Area of a Triangle

To find the area of the wall of the Rock and Roll Hall of Fame and Museum described above, use the diagram shown.



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

Write formula for area of a triangle.

$$= \frac{1}{2}(231)(111)$$

Substitute 231 for b and 111 for h .

$$= 12,820.5$$

Multiply.

ANSWER The area of the wall is 12,820.5 square feet.

EXAMPLE 2 Finding the Base of a Triangle

A triangle has a height of 10 centimeters and an area of 35 square centimeters. Find the base of the triangle.

$$A = \frac{1}{2}bh \quad \text{Write formula for area of a triangle.}$$

$$35 = \frac{1}{2}b(10) \quad \text{Substitute 35 for } A \text{ and 10 for } h.$$

$$35 = 5b \quad \text{Simplify.}$$

$$7 = b \quad \text{Divide each side by 5.}$$

ANSWER The base of the triangle is 7 centimeters.

HELP with Reading

Because a trapezoid has more than one base, the bases of a trapezoid are usually labeled b_1 and b_2 . b_1 is read “ b sub one.”

Your turn now Find the unknown area or height of the triangle.

1. $A = ?$, $b = 9$ ft, $h = 6$ ft
2. $A = 61.6$ m², $b = 11$ m, $h = ?$

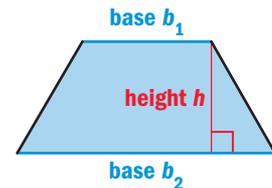
Trapezoids You can use the *bases* and the *height* of a trapezoid to find the area of the trapezoid. The lengths of the parallel sides of a trapezoid are the **bases of a trapezoid**. The **height of a trapezoid** is the perpendicular distance between the bases.



Area of a Trapezoid

Words The area A of a trapezoid is half the product of the sum of the bases and the height.

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



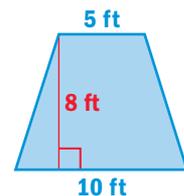
EXAMPLE 3 Finding the Area of a Trapezoid

Find the area of the trapezoid shown.

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

$$= \frac{1}{2}(5 + 10)(8) \quad \text{Substitute 5 for } b_1, \text{ 10 for } b_2, \text{ and 8 for } h.$$

$$= 60 \quad \text{Simplify.}$$



ANSWER The area of the trapezoid is 60 square feet.

EXAMPLE 4 Finding the Height of a Trapezoid

A trapezoid has an area of 66 square meters. The bases are 8 meters and 14 meters. Find the height.

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

$$66 = \frac{1}{2}(8 + 14)h \quad \text{Substitute 66 for } A, 8 \text{ for } b_1, \text{ and } 14 \text{ for } b_2.$$

$$66 = \frac{1}{2}(22)h \quad \text{Add.}$$

$$66 = 11h \quad \text{Multiply.}$$

$$6 = h \quad \text{Divide each side by 11.}$$

ANSWER The height of the trapezoid is 6 meters.

Your turn now Find the unknown area, base, or height of the trapezoid.

3. $A = 180 \text{ cm}^2$, $b_1 = \underline{\quad}$, $b_2 = 12 \text{ cm}$, $h = 5 \text{ cm}$

4. $A = \underline{\quad}$, $b_1 = 13 \text{ in.}$, $b_2 = 15 \text{ in.}$, $h = 6 \text{ in.}$

5. $A = 216 \text{ m}^2$, $b_1 = 11 \text{ m}$, $b_2 = 13 \text{ m}$, $h = \underline{\quad}$

11.5 Exercises

More Practice, p. 715

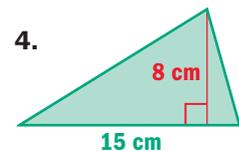
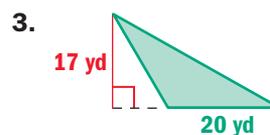
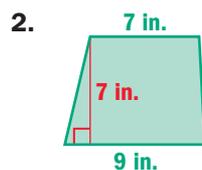


Getting Ready to Practice



1. **Vocabulary** Draw a triangle and trapezoid. Label the bases and heights.

Find the area of the triangle or trapezoid.



5. **Backpacks** You are making a reflective patch for your backpack. The patch is a triangle with a base of 12 centimeters and a height of 6 centimeters. What is the area of the patch?

HELP

with Homework

Example Exercises

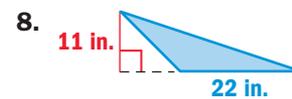
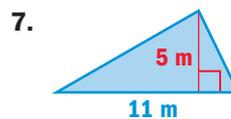
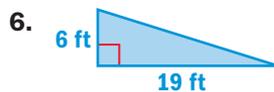
- | | |
|---|--------------|
| 1 | 6-8, 22-24 |
| 2 | 9-12 |
| 3 | 13-15, 22-24 |
| 4 | 16-20 |

**Online Resources**

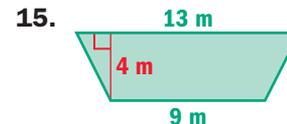
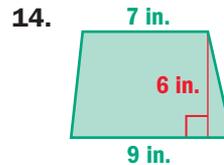
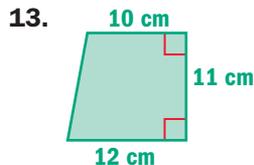
CLASSZONE.COM

- More Examples
- eTutorial Plus

Practice and Problem Solving

Find the area of the triangle.**Find the unknown base or height of the triangle.**

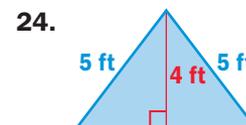
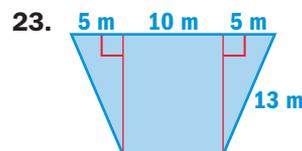
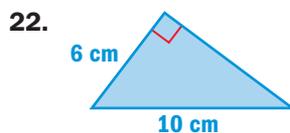
9. $A = 45 \text{ km}^2$, $b = \underline{\quad}$, $h = 15 \text{ km}$ 10. $A = 71.5 \text{ mm}^2$, $b = 11 \text{ mm}$, $h = \underline{\quad}$
 11. $A = 98 \text{ mi}^2$, $b = 21 \text{ mi}$, $h = \underline{\quad}$ 12. $A = 13 \text{ cm}^2$, $b = \underline{\quad}$, $h = 2.5 \text{ cm}$

Find the area of the trapezoid.**Find the unknown base or height of the trapezoid.**

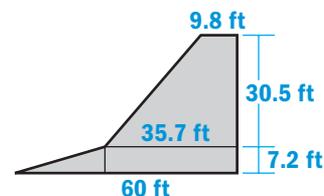
16. $A = 180 \text{ ft}^2$, $b_1 = \underline{\quad}$, $b_2 = 26 \text{ ft}$, $h = 9 \text{ ft}$
 17. $A = 114 \text{ cm}^2$, $b_1 = 13 \text{ cm}$, $b_2 = \underline{\quad}$, $h = 6 \text{ cm}$
 18. $A = 444.5 \text{ m}^2$, $b_1 = 18 \text{ m}$, $b_2 = 17 \text{ m}$, $h = \underline{\quad}$
 19. $A = 33 \text{ in.}^2$, $b_1 = 3\frac{3}{4} \text{ in.}$, $b_2 = \underline{\quad}$, $h = 6 \text{ in.}$
 20. A trapezoid has an area of 311.2 square feet. The bases are 25.2 feet and 13.7 feet. Find the height of the trapezoid.



21. **Writing** If the base of a triangle is doubled and the height is doubled, how does the area change? Give an example to support your conclusion.

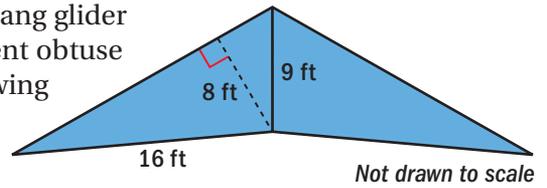
Find the area of the triangle or trapezoid.

25. **Space Shuttle** Find the area of a wing of the space shuttle shown. The wing is composed of a triangle, a rectangle, and a trapezoid.

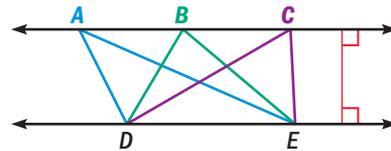




26. **Hang Glider** The wings of a hang glider are composed of two congruent obtuse triangles as shown. Find the wing area. Round to the nearest square foot.



27. **Challenge** Explain why triangles ADE , BDE , and CDE have the same area.



Mixed Review

Classify the triangle by its angle measures. (Lesson 10.3)

28. $27^\circ, 90^\circ, 63^\circ$ 29. $84^\circ, 54^\circ, 42^\circ$ 30. $38^\circ, 62^\circ, 80^\circ$ 31. $33^\circ, 43^\circ, 104^\circ$
 32. A parallelogram has an area of 234 square inches. The base is 13 inches. What is the height? (Lesson 11.4)

Basic Skills Find the product.

33. 5.2×12.8 34. 20.6×8.54 35. 34×9.88 36. 5.678×3.2

Test-Taking Practice

37. **Extended Response** A trapezoid's bases are 10 inches and 15 inches, and the height is 5 inches. What happens to the area of the trapezoid if you double only the bases? What happens to the area of the trapezoid if you double only the height? What happens to the area of the trapezoid if you double the bases and the height?



BRAIN GAME

Getting Bigger

Order the polygons from least area to greatest area to spell out the secret message.

