

# LESSON 13.3 Solving Area Equations

COMMON CORE 6.G.1

Find the area of right triangles, other triangles, special quadrilaterals, and polygons. . . ; apply these techniques in the context of solving. . . problems. Also 6.EE.7



## ESSENTIAL QUESTION

How do you use equations to solve problems about area of rectangles, parallelograms, trapezoids, and triangles?

### EXPLORE ACTIVITY



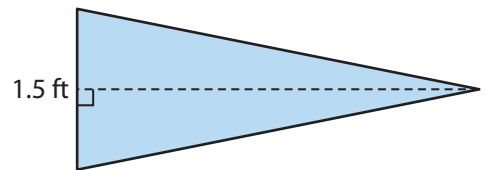
COMMON CORE 6.G.1, 6.EE.7

## Problem Solving Using the Area of a Triangle

Recall that the formula for the area of a triangle is  $A = \frac{1}{2}bh$ . You can also use the formula to find missing dimensions if you know the area and one dimension.



**EXAMPLE 1** The Hudson High School wrestling team just won the state tournament and has been awarded a triangular pennant to hang on the wall in the school gymnasium. The base of the pennant is 1.5 feet long. It has an area of 2.25 square feet. What is the height of the pennant?



Write the formula.

$$A = \frac{\square}{\square} \square \square$$

Substitute the given values into the equation.

$$\square = \frac{1}{2} (\square) h$$

Multiply  $\frac{1}{2}$  and 1.5.

$$2.25 = \square h$$

Divide both sides of the equation by \_\_\_\_\_.

$$\frac{2.25}{\square} = \frac{0.75h}{\square}$$

$$\square = h$$

The height of the pennant is \_\_\_\_\_ feet.



### YOUR TURN

- Renee is sewing a quilt whose pattern contains right triangles. Each quilt piece has a height of 6 in. and an area of  $24 \text{ in}^2$ .

How long is the base of each quilt piece? \_\_\_\_\_



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# Writing Equations Using the Area of a Trapezoid

You can use the formula for area of a trapezoid to write an equation to solve a problem.

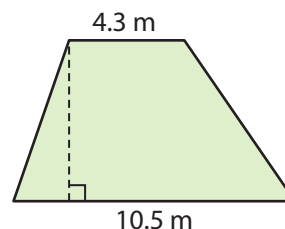
## EXAMPLE 2



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6.G.1, 6.EE.7

A garden in the shape of a trapezoid has an area of 44.4 square meters. One base is 4.3 meters long and the other base is 10.5 meters long. The height of the trapezoid is the width of the garden. How wide is the garden?



$A = \frac{1}{2} h (b_1 + b_2)$  Write the formula.

$44.4 = \frac{1}{2} h (4.3 + 10.5)$  Use the formula to write an equation.

$44.4 = \frac{1}{2} h (14.8)$  Add inside parentheses.

$44.4 = 7.4 h$  Multiply  $\frac{1}{2}$  and 14.8.

$\frac{44.4}{7.4} = \frac{7.4 h}{7.4}$  Divide both sides of the equation by 7.4.

$6 = h$

The garden is 6 meters wide.

### Reflect

2. **Communicate Mathematical Ideas** Explain why the first step after substituting is addition.

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### Math Talk

#### Mathematical Practices

How can you check that the answer is reasonable?

### YOUR TURN

3. The cross section of a water bin is shaped like a trapezoid. The bases of the trapezoid are 18 feet and 8 feet long. It has an area of 52 square feet. What is the height of the cross section?

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# Solving Multistep Problems

You can write and solve equations that represent real-world problems related to relationships in geometry.



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## EXAMPLE 3

Problem Solving

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6.G.1

John and Mary are using rolls of fabric to make a rectangular stage curtain for their class play. The rectangular piece of fabric on each roll measures 2.5 feet by 15 feet. If the area of the curtain is 200 square feet, what is the least number of rolls they need?



### Analyze Information

Rewrite the question as a statement.

- Find the least number of rolls of fabric needed to cover an area of 200 ft<sup>2</sup>.

List the important information.

- Each roll of fabric is a 2.5 foot by 15 foot rectangle.
- The area of the curtain is 200 square feet.



### Formulate a Plan

Write an equation to find the area of each roll of fabric.

Use the area of the curtain and the area of each roll to write an equation to find the least number of rolls.



### Solve

**STEP 1** Write an equation to find the area of each roll of fabric.

$$A = lw$$

$$A = 15 \cdot 2.5$$

$$A = 37.5 \text{ ft}^2$$

**STEP 2** Write an equation to find the least number of rolls.

$$n = 200 \div 37.5$$

$$n = 5\frac{1}{3}$$

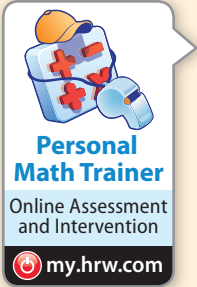
**STEP 3** The problem asks for the least number of rolls needed. Since 5 rolls will not be enough, they will need 6 rolls to make the curtain.

- John and Mary will need 6 rolls of fabric to make the curtain.



### Justify and Evaluate

The area of each roll is about 38 ft<sup>2</sup>. Since  $38 \text{ ft}^2 \cdot 6 = 228 \text{ ft}^2$ , the answer is reasonable.



## YOUR TURN

4. A parallelogram-shaped field in a park needs sod. The parallelogram has a base of 21.5 meters and a height of 18 meters. The sod is sold in pallets of 50 square meters. How many pallets of sod are needed to fill the field?
- \_\_\_\_\_

## Guided Practice

1. A triangular bandana has an area of 70 square inches. The height of the triangle is  $8\frac{3}{4}$  inches. Write and solve an equation to find the length of the base of the triangle. (Explore Activity Example 1)

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2. The top of a desk is shaped like a trapezoid. The bases of the trapezoid are 26.5 and 30 centimeters long. The area of the desk is 791 square centimeters. The height of the trapezoid is the width of the desk. Write and solve an equation to find the width of the desk. (Example 2)

\_\_\_\_\_

3. Taylor wants to paint his rectangular deck that is 42 feet long and 28 feet wide. A gallon of paint covers about 350 square feet. How many gallons of paint will Taylor need to cover the entire deck? (Example 3)

Write an equation to find the \_\_\_\_\_ of the deck.

Write and solve the equation.

Write an equation to find the \_\_\_\_\_.

Write and solve the equation.

Taylor will need \_\_\_\_\_ gallons of paint.



## ESSENTIAL QUESTION CHECK-IN

4. How do you use equations to solve problems about area of rectangles, parallelograms, trapezoids, and triangles?

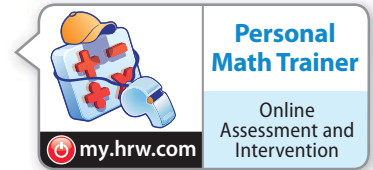
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# 13.3 Independent Practice

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5. A window shaped like a parallelogram has an area of  $18\frac{1}{3}$  square feet. The height of the window is  $3\frac{1}{3}$  feet. How long is the base of the window?
6. A triangular sail has a base length of 2.5 meters. The area of the sail is 3.75 square meters. How tall is the sail?
7. A section in a stained glass window is shaped like a trapezoid. The top base is 4 centimeters and the bottom base is 2.5 centimeters long. If the area of the section of glass is 3.9 square centimeters, how tall is the section?
8. **Multistep** Amelia wants to paint three walls in her family room. Two walls are 26 feet long by 9 feet wide. The other wall is 18 feet long by 9 feet wide.
- What is the total area of the walls that Amelia wants to paint?
  - Each gallon of paint covers about 250 square feet. How many gallons of paint should Amelia buy to paint the walls?
9. **Critical Thinking** The area of a triangular block is 64 square inches. If the base of the triangle is twice the height, how long are the base and the height of the triangle?
10. **Multistep** Alex needs to varnish the top and the bottom of a dozen rectangular wooden planks. The planks are 8 feet long and 3 feet wide. Each pint of varnish covers about 125 square feet and costs \$3.50.
- What is the total area that Alex needs to varnish?
  - How much will it cost Alex to varnish all the wooden planks?
11. **Multistep** Leia cuts congruent triangular patches with an area of 45 square centimeters from a rectangular piece of fabric that is 18 centimeters long and 10 centimeters wide. How many of the patches can Leia cut from 32 pieces of the fabric?
12. **Multistep** A farmer needs to buy fertilizer for two fields. One field is shaped like a trapezoid, and the other is shaped like a triangle. The trapezoidal field has bases that are 35 and 48 yards and a height of 26 yards. The triangular field has the same height as the trapezoidal field and a base of 39 yards. Each bag of fertilizer covers 150 square yards. How many bags of fertilizer does the farmer need to buy?

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- 13.** A tennis court for singles play is 78 feet long and 27 feet wide.
- The court for doubles play is 9 feet wider than the court for singles play. How much more area is covered by the tennis court used for doubles play?
  - The junior court for players 8 and under is 36 feet long and 18 feet wide. How much more area is covered by the tennis court used for singles play?
  - The court for players 10 and under is 18 feet shorter than the court for singles play. How much more area is covered by the tennis court used for singles play?

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- 14. Draw Conclusions** The cross section of a metal ingot is a trapezoid. The cross section has an area of 39 square centimeters. The top base of the cross section is 12 centimeters. The length of the bottom base is 2 centimeters greater than the top base. How tall is the metal ingot? Explain.

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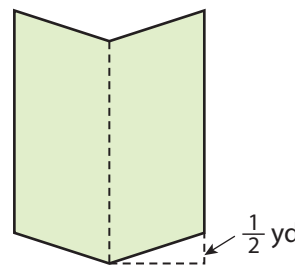
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**H.O.T.** FOCUS ON HIGHER ORDER THINKING

- 15. Analyze Relationships** A mirror is made of two congruent parallelograms as shown in the diagram. The parallelograms have a combined area of  $9\frac{1}{3}$  square yards. The height of each parallelogram is  $1\frac{1}{3}$  yards.



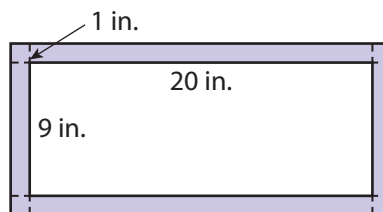
- How long is the base of each parallelogram?
- What is the area of the smallest *rectangle* of wall that the mirror could fit on?

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- 16. Persevere in Problem Solving** A watercolor painting is 20 inches long by 9 inches wide. Ramon makes a border around the watercolor painting by making a mat that adds 1 inch to each side of the length and the width. What is the area of the mat?




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Work Area