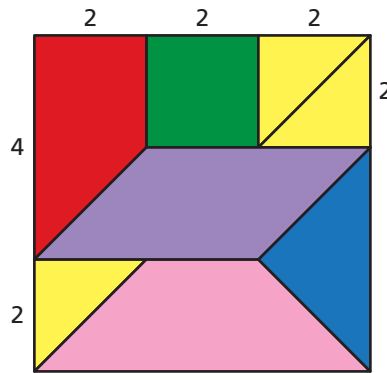


# 1.5 Using Formulas to Solve Problems

**Essential Question** How can you use formulas to find the area of an object with an unusual shape?



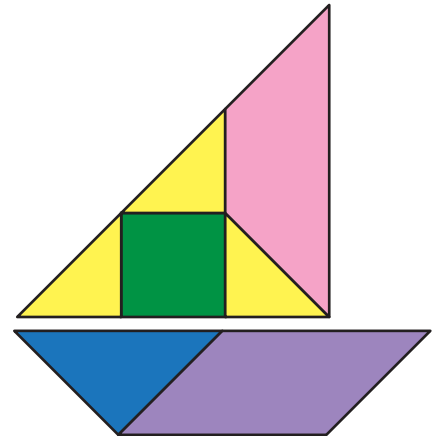
## 1 ACTIVITY: Using an Area Formula

Work with a partner. Copy and complete the table.

Polygon	Name	Area Formula	Area
	Square	$A = s^2$	$s = 2$ $A = 2^2$ $= 4$ square units
	Trapezoid	$A = h(b + B) \div 2$	

## 2 ACTIVITY: Finding an Area

Work with a partner. Use the shapes from Activity 1 to find the area of the sailboat. Explain your reasoning.



## 3 ACTIVITY: Finding an Area

Work with a partner. Use the shapes from Activity 1 to create the picture.

a. house



20 square units

b. rabbit



36 square units

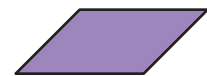
c. bird



32 square units

## What Is Your Answer?

- IN YOUR OWN WORDS** How can you use formulas to find the area of an object with an unusual shape?
- Show how you can use the formula  $A = bh$  for the area of a rectangle to write the formula for the area of a parallelogram.
- Show how you can use the formula  $A = bh$  for the area of a rectangle to write the formula for the area of a triangle.



### Practice

Use what you learned about using formulas to complete Exercises 3–5 on page 32.

**Key Vocabulary**

formula, p. 30  
 solve a formula,  
 p. 30

A **formula** is an equation that tells you how one variable is related to one or more other variables. To **solve a formula**, find the value of one variable by substituting numbers for the other variables.

**EXAMPLE 1** Using a Simple Formula

The formula  $M = 220 - a$  gives a person's maximum heart rate  $M$ , where  $a$  is the person's age in years. Malcolm is 12 years old. His uncle is 40 years old. What is the difference between their maximum heart rates?

<i>Malcolm</i>	<i>His Uncle</i>	
$M = 220 - a$	$M = 220 - a$	Write the formula.
$= 220 - 12$	$= 220 - 40$	Substitute their ages for $a$ .
$= 208$	$= 180$	Subtract.

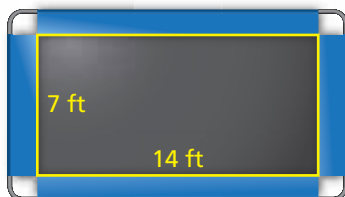
∴ The difference between their maximum heart rates is  $208 - 180$ , or 28 beats per minute.

**On Your Own**

1. What is the difference between the maximum heart rates of Malcolm and his grandmother, who is 85 years old?

**EXAMPLE 2** Using an Area Formula

Find the area of the rectangular jumping surface of the trampoline.



Use the formula for the area of a rectangle.

$A = bh$	Write the formula.
$= 14 \times 7$	Substitute 14 for $b$ and 7 for $h$ .
$= 98$	Multiply.

∴ The area of the jumping surface is 98 square feet.

**On Your Own**

2. Find the area of a rectangular trampoline that measures 12 feet by 6 feet.

### EXAMPLE 3 Using an Area Formula

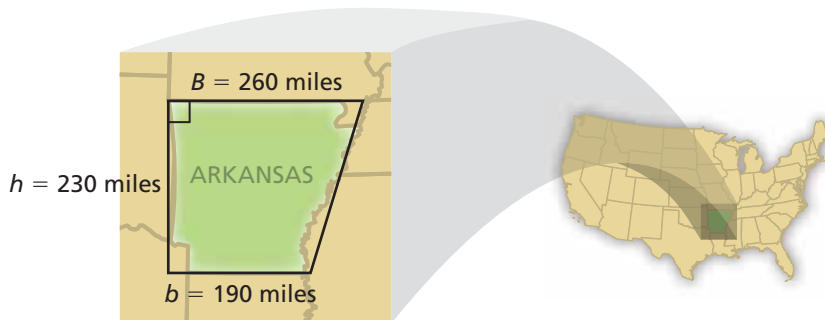
A trapezoid can be used to approximate the shape of Arkansas, as shown on the map.

- Use the formula  $A = h(b + B) \div 2$  to find the area.
- Mississippi has an area of about 46,907 square miles. Is the area of Arkansas greater than or less than the area of Mississippi?

#### Remember



The corner mark  $\square$  in a figure means that the angle formed by the sides is a right angle.



- $A = h(b + B) \div 2$   
 $= 230(190 + 260) \div 2$   
 $= 230(450) \div 2$   
 $= 103,500 \div 2$   
 $= 51,750$   

Write the formula.  
Substitute 230 for  $h$ , 190 for  $b$ , and 260 for  $B$ .  
Add inside parentheses.  
Multiply 230 and 450.  
Divide.

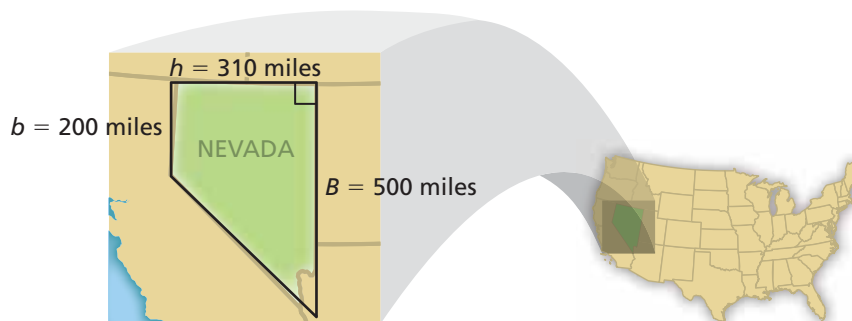
∴ The area of Arkansas is about 51,750 square miles.

- Because 51,750 is greater than 46,907, the area of Arkansas is greater than the area of Mississippi.

#### On Your Own

Now You're Ready  
Exercises 3–8

- A trapezoid can be used to approximate the shape of Nevada, as shown on the map. How much larger is the area of Nevada than the area of Arkansas?





## Vocabulary and Concept Check

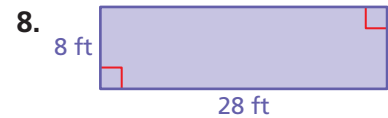
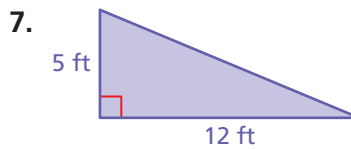
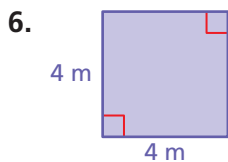
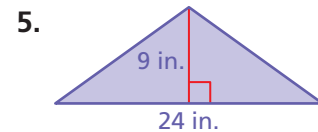
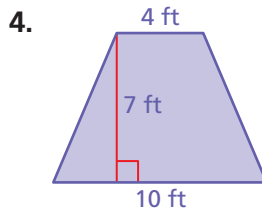
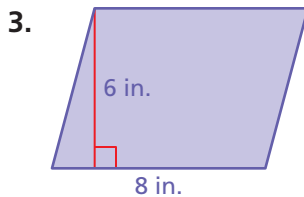
- WRITING** How is using a formula similar to evaluating an expression?
- REASONING** The cost  $C$  (in dollars) to make  $x$  dartboards is  $C = 50 + 10x$ . What do you need to know to solve this formula? Explain.



## Practice and Problem Solving

Use a formula to find the area of the figure.

2 3

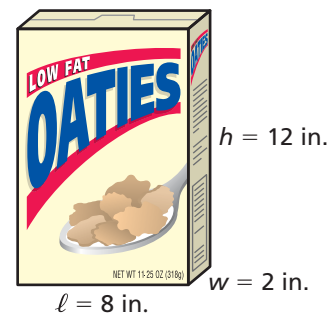


- PARKING SPACE** A parking space is shaped like a parallelogram with a base of 26 feet and a height of 9 feet.
  - What is the area of the parking space?
  - Draw a diagram of what the parking space might look like.
  - Use your diagram to estimate the length of the longest car that will fit in the space. Explain your reasoning.
- LIGHTNING** You can estimate how far you are from lightning.
  - When you see the lightning, count the number of seconds ("One one-thousand, two one-thousand, . . .") until you hear the thunder.
  - Divide the number of seconds by 5.
  - This is how many miles you are from lightning.

You see lightning. After about a second, you hear a crack of thunder and your friend says "Wow, that was close!" Was your friend correct? How close was the lightning?

- VOLUME** The formula  $V = \ell wh$  represents the volume of a rectangular prism with length  $\ell$ , width  $w$ , and height  $h$ .

- What is the volume of the cereal box?
- The volume of a bowl is about 15 cubic inches. How many bowls of cereal does the box hold?

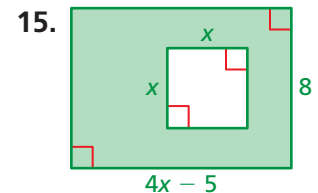
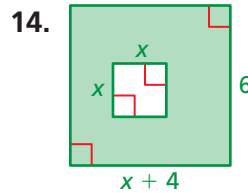
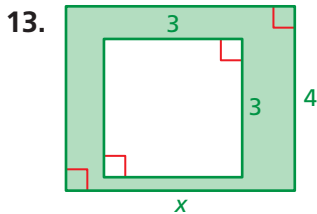


12. **BASEBALL** A pitcher's earned run average is the average number of earned runs given up per nine innings. What is the earned run average of a pitcher who gave up 75 earned runs in 225 innings?

$$\text{Earned Run Average} = \frac{9R}{I}$$

Number of earned runs
Number of innings

Write a formula for the area of the shaded region in terms of  $x$ .



16. **REASONING** You know a parallelogram's area and base. Explain how you can find its height.
17. **GOLD** The purity of gold is measured in carats or in percent. What number of carats represents 100% pure gold? Explain your reasoning.

$$P = (25 \cdot c) \div 6$$

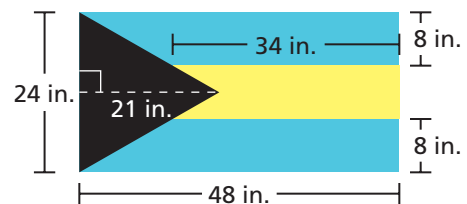
Percent
Carats

18. **SNOWY TREE CRICKET** To find the temperature  $T$  in degrees Fahrenheit, take the number  $c$  of chirps per minute of a snowy tree cricket and subtract 40. Then, divide by 4. Then, add 50.



- Write a formula for the verbal description.
- In the morning, a cricket chirps 56 times in one minute. What is the temperature?
- Later in the afternoon, a cricket chirps 168 times in one minute. What is the temperature now?

19. **Geometry** Find the area of each region in the flag of the Bahamas.



## Fair Game Review What you learned in previous grades & lessons

Estimate the sum or difference using benchmarks.

20.  $\frac{7}{8} + \frac{9}{10}$

21.  $\frac{1}{6} + \frac{2}{5}$

22.  $\frac{4}{7} - \frac{7}{12}$

23.  $\frac{4}{5} - \frac{1}{9}$

24. **MULTIPLE CHOICE** Which expression represents "8 more than  $x$ "?

(A)  $8 - x$

(B)  $8x$

(C)  $x + 8$

(D)  $\frac{8}{x}$