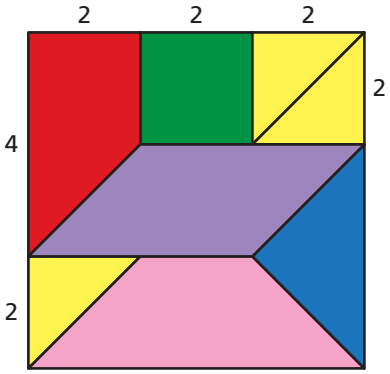
English Spanish

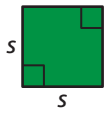
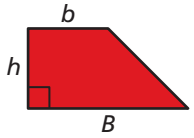
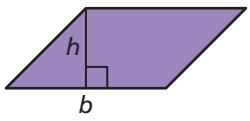
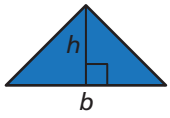
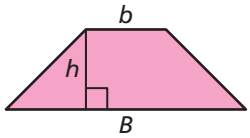
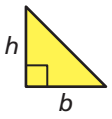
1.5 Using Formulas to Solve Problems

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	$A = h(b + B) \div 2$	
			
			
			
			

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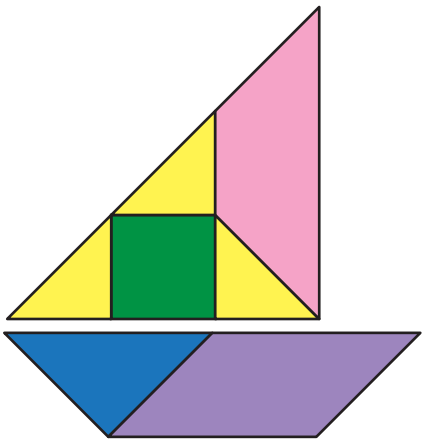
2 ACTIVITY: Finding an Area

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

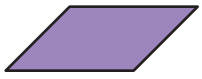
c. bird

32 square units

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you use formulas to find the area of an object with an unusual shape?

5. 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.



6. 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.

English Spanish

1.5 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

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?

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

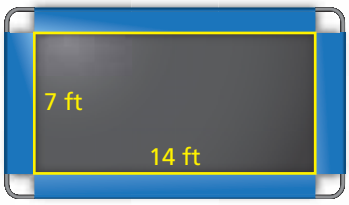
∴ The difference between their maximum heart rates is $208 - 180$, or 28 beats per minute.

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.

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EXAMPLE 3 Using an Area Formula

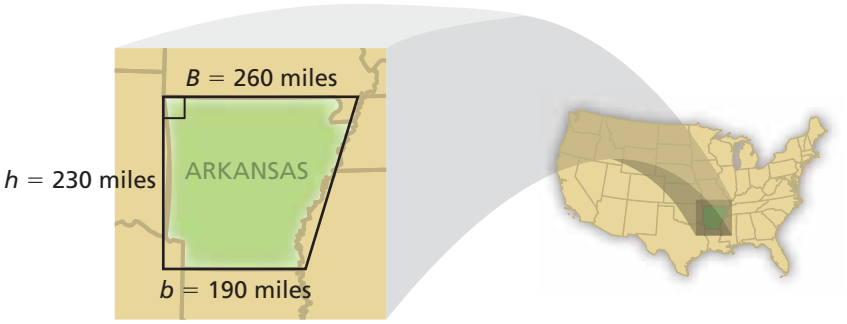
A trapezoid can be used to approximate the shape of Arkansas, as shown on the map.

a. Use the formula $A = h(b + B) \div 2$ to find the area.

b. 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 ⌝ in a figure means that the angle formed by the sides is a right angle.



a. $A = h(b + B) \div 2$ Write the formula.

$= 230(190 + 260) \div 2$ Substitute 230 for h, 190 for b, and 260 for B.

$= 230(450) \div 2$ Add inside parentheses.

$= 103{,}500 \div 2$ Multiply 230 and 450.

$= 51{,}750$ Divide.

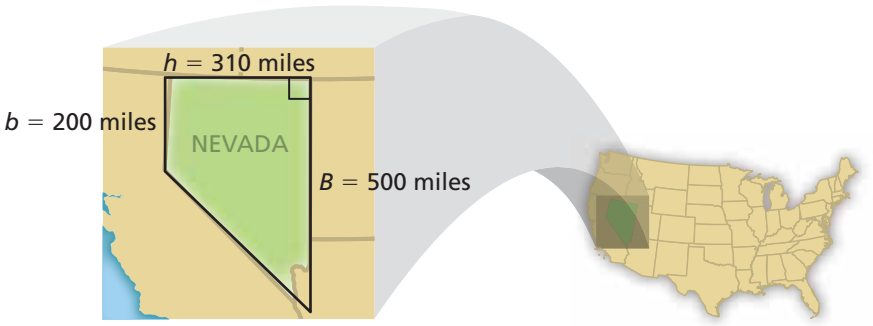
∴ The area of Arkansas is about 51,750 square miles.

b. 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

3. 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?



English Spanish

1.5 Exercises

Check It Out
Help with Homework
BigIdeasMath.com

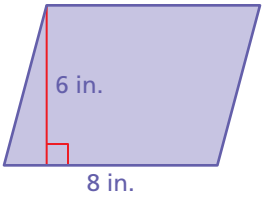
Vocabulary and Concept Check

1. **WRITING** How is using a formula similar to evaluating an expression?
2. **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 3.



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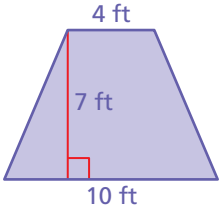

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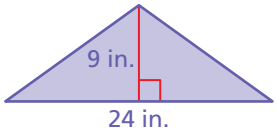

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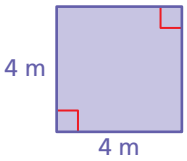

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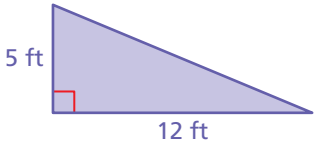

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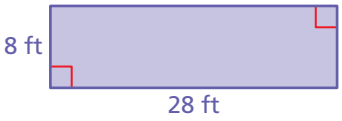


9. **PARKING SPACE** A parking space is shaped like a parallelogram with a base of 26 feet and a height of 9 feet.
   - **a.** What is the area of the parking space?
   - **b.** Draw a diagram of what the parking space might look like.
   - **c.** Use your diagram to estimate the length of the longest car that will fit in the space. Explain your reasoning.

10. **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?

11. **VOLUME** The formula $V = \ell wh$ represents the volume of a rectangular prism with length ℓ, width w, and height h.
    - **a.** What is the volume of the cereal box?
    - **b.** The volume of a bowl is about 15 cubic inches. How many bowls of cereal does the box hold?

$h = 12$ in.
$w = 2$ in.
$\ell = 8$ in.

English Spanish

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?

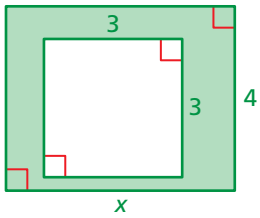
$$\text{Earned Run Average} = \frac{9R}{I}$$

Number of earned runs

Number of innings

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

13.



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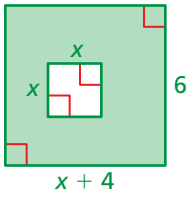

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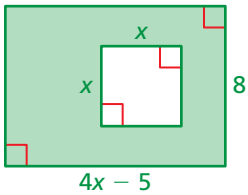


16. REASONING You know a parallelogram's area and base. Explain how you can find its height.

17. GOLD The purity of gold is measured in carats or in percent. What number of carats represents 100% pure gold? Explain your reasoning.

Percent

Carats

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

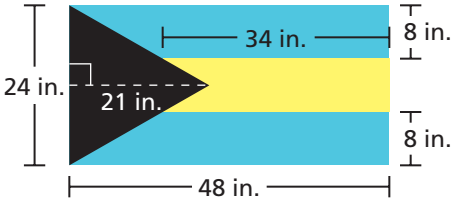
18. SNOWY TREE CRICKET To find the temperature T in degrees Fahrenheit, take the number c of chirps per minute of a snowy tree cricket and subtract 40. Then, divide by 4. Then, add 50.

a. Write a formula for the verbal description.

b. In the morning, a cricket chirps 56 times in one minute. What is the temperature?

c. 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. SKILLS REVIEW HANDBOOK

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"? SECTION 1.2

(A) $8 - x$ (B) $8x$ (C) $x + 8$ (D) $\frac{8}{x}$