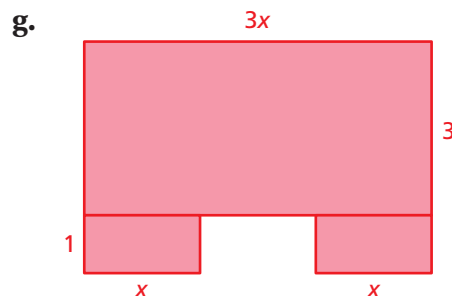
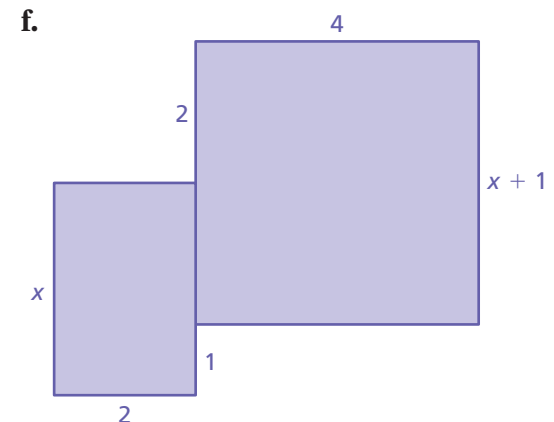
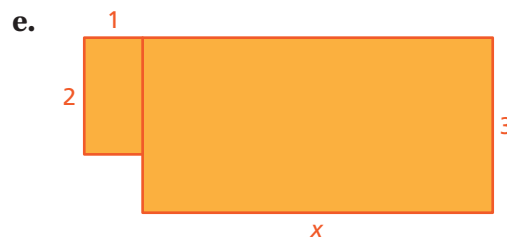
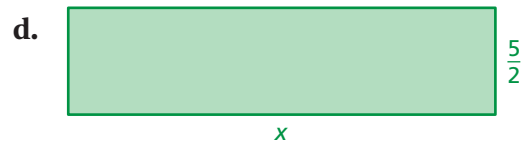
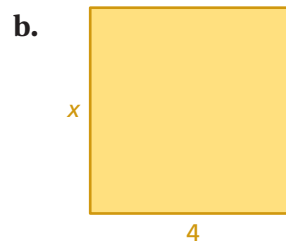
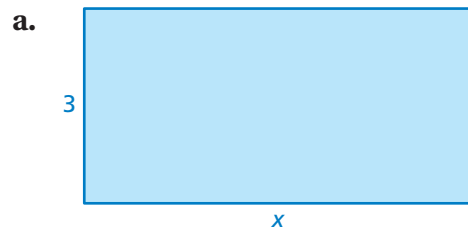


**Essential Question** How can you solve an equation that has variables on both sides?

**1 ACTIVITY: Perimeter and Area**

Work with a partner. Each figure has the unusual property that the value of its perimeter (in feet) is equal to the value of its area (in square feet).

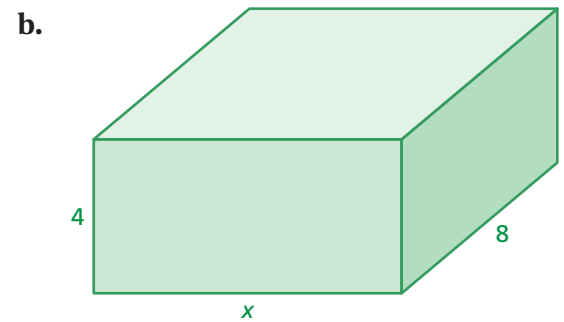
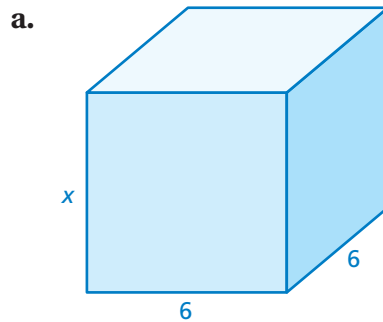
- Write an equation (value of perimeter = value of area) for each figure.
- Solve each equation for  $x$ .
- Use the value of  $x$  to find the perimeter and area of each figure.
- Check your solution by comparing the value of the perimeter and the value of the area of each figure.



## 2 ACTIVITY: Surface Area and Volume

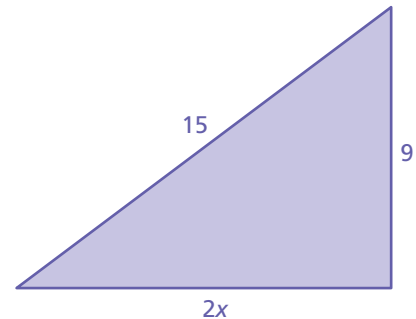
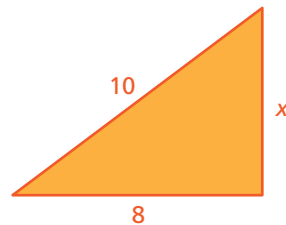
Work with a partner. Each solid has the unusual property that the value of its surface area (in square inches) is equal to the value of its volume (in cubic inches).

- Write an equation (value of surface area = value of volume) for each figure.
- Solve each equation for  $x$ .
- Use the value of  $x$  to find the surface area and volume of each figure.
- Check your solution by comparing the value of the surface area and the value of the volume of each figure.



## 3 ACTIVITY: Puzzle

Work with a partner. The two triangles are similar. The perimeter of the larger triangle is 150% of the perimeter of the smaller triangle. Find the dimensions of each triangle.



### What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you solve an equation that has variables on both sides? Write an equation that has variables on both sides. Solve the equation.

### Practice

Use what you learned about solving equations with variables on both sides to complete Exercises 3–5 on page 20.

**Key Idea**
**Solving Equations with Variables on Both Sides**

To solve equations with variables on both sides, collect the variable terms on one side and the constant terms on the other side.

**EXAMPLE 1 Solving an Equation with Variables on Both Sides**

Solve  $15 - 2x = -7x$ . Check your solution.

$$15 - 2x = -7x$$

Write the equation.

Undo the subtraction.

$$\rightarrow +2x \quad +2x$$

Add  $2x$  to each side.

$$15 = -5x$$

Simplify.

Undo the multiplication.

$$\rightarrow \frac{15}{-5} = \frac{-5x}{-5}$$

Divide each side by  $-5$ .

$$-3 = x$$

Simplify.

**Check**

$$15 - 2x = -7x$$

$$15 - 2(-3) \stackrel{?}{=} -7(-3)$$

$$21 = 21 \quad \checkmark$$

∴ The solution is  $x = -3$ .

**EXAMPLE 2 Using the Distributive Property to Solve an Equation**

Solve  $-2(x - 5) = 6\left(2 - \frac{1}{2}x\right)$ .

$$-2(x - 5) = 6\left(2 - \frac{1}{2}x\right)$$

Write the equation.

$$-2x + 10 = 12 - 3x$$

Use Distributive Property.

Undo the subtraction.

$$\rightarrow +3x \quad +3x$$

Add  $3x$  to each side.

$$x + 10 = 12$$

Simplify.

Undo the addition.

$$\rightarrow -10 \quad -10$$

Subtract 10 from each side.

$$x = 2$$

Simplify.

∴ The solution is  $x = 2$ .

**On Your Own**

Solve the equation. Check your solution.

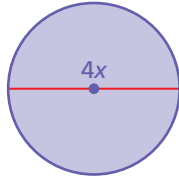
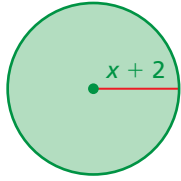
1.  $-3x = 2x + 19$       2.  $2.5y + 6 = 4.5y - 1$       3.  $6(4 - z) = 2z$

### EXAMPLE 3 Standardized Test Practice

The circles are identical. What is the area of each circle?

- (A) 2                      (B) 4                      (C)  $16\pi$                       (D)  $64\pi$

The circles are identical, so the radius of each circle is the same.



$$x + 2 = 2x$$

Write an equation. The radius of the purple circle is  $2x$ .

$$\begin{array}{r} -x \\ \hline \end{array} \quad \begin{array}{r} -x \\ \hline \end{array}$$

Subtract  $x$  from each side.

$$2 = x$$

Simplify.

∴ The area of each circle is  $\pi r^2 = \pi(4)^2 = 16\pi$ . So, the correct answer is (C).

### EXAMPLE 4 Real-Life Application

A boat travels  $x$  miles per hour upstream on the Mississippi River. On the return trip, the boat travels 2 miles per hour faster. How far does the boat travel upstream?



The speed of the boat on the return trip is  $(x + 2)$  miles per hour.

$$\text{Distance upstream} = \text{Distance of return trip}$$

$$3x = 2.5(x + 2)$$

Write an equation.

$$3x = 2.5x + 5$$

Use Distributive Property.

$$\begin{array}{r} -2.5x \\ \hline \end{array} \quad \begin{array}{r} -2.5x \\ \hline \end{array}$$

Subtract  $2.5x$  from each side.

$$0.5x = 5$$

Simplify.

$$\frac{0.5x}{0.5} = \frac{5}{0.5}$$

Divide each side by 0.5.

$$x = 10$$

Simplify.

∴ The boat travels 10 miles per hour for 3 hours upstream. So, it travels 30 miles upstream.

#### On Your Own

- WHAT IF?** In Example 3, the diameter of the purple circle is  $3x$ . What is the area of each circle?
- A boat travels  $x$  miles per hour from one island to another island in 2.5 hours. The boat travels 5 miles per hour faster on the return trip of 2 hours. What is the distance between the islands?



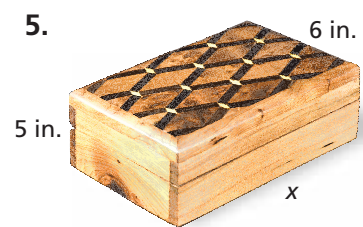
# 1.3 Exercises

## Vocabulary and Concept Check

- WRITING** Is  $x = 3$  a solution of the equation  $3x - 5 = 4x - 9$ ? Explain.
- OPEN-ENDED** Write an equation that has variables on both sides and has a solution of  $-3$ .

## Practice and Problem Solving

The value of the figure's surface area is equal to the value of the figure's volume. Find the value of  $x$ .



Solve the equation. Check your solution.

- |   |   |  |                         |   |
|---|---|--|-------------------------|---|
| 1 | 2 | 6. $m - 4 = 2m$                        | 7. $3k - 1 = 7k + 2$    | 8. $6.7x = 5.2x + 12.3$                               |
|   |   | 9. $-24 - \frac{1}{8}p = \frac{3}{8}p$ | 10. $12(2w - 3) = 6w$   | 11. $2(n - 3) = 4n + 1$                               |
|   |   | 12. $2(4z - 1) = 3(z + 2)$             | 13. $0.1x = 0.2(x + 2)$ | 14. $\frac{1}{6}d + \frac{2}{3} = \frac{1}{4}(d - 2)$ |

15. **ERROR ANALYSIS** Describe and correct the error in solving the equation.
16. **TRAIL MIX** The equation  $4.05p + 14.40 = 4.50(p + 3)$  represents the number  $p$  of pounds of peanuts you need to make trail mix. How many pounds of peanuts do you need for the trail mix?



$$\begin{aligned} 3x - 4 &= 2x + 1 \\ 3x - 4 - 2x &= 2x + 1 - 2x \\ x - 4 &= 1 \\ x - 4 + 4 &= 1 - 4 \\ x &= -3 \end{aligned}$$

17. **CARS** Write and solve an equation to find the number of miles you must drive to have the same cost for each of the car rentals.



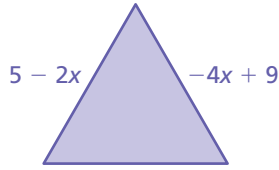
\$15 plus \$0.50 per mile



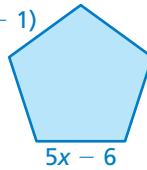
\$25 plus \$0.25 per mile

A polygon is *regular* if each of its sides has the same length. Find the perimeter of the regular polygon.

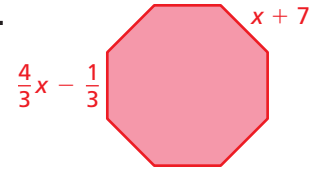
18.



19.  $3(x - 1)$

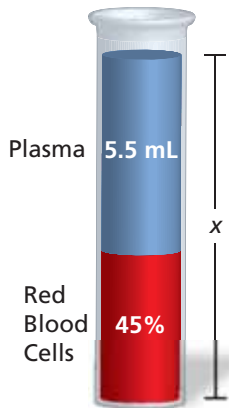


20.



21. **POSTAGE** The cost of mailing a DVD in an envelope by express mail is equal to the cost of mailing a DVD in a box by priority mail. What is the weight of the DVD with its packing material? Round your answer to the nearest hundredth.

	Packing Material	Priority Mail	Express Mail
<b>Box</b>	\$2.25	\$2.50 per lb	\$8.50 per lb
<b>Envelope</b>	\$1.10	\$2.50 per lb	\$8.50 per lb

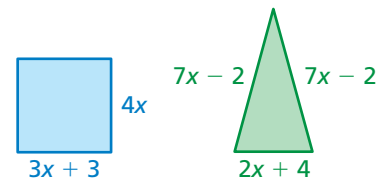


22. **REASONING** Would you solve the equation  $0.25x + 7 = \frac{1}{3}x - 8$  using fractions or decimals? Explain.

23. **BLOOD SAMPLE** The amount of red blood cells in a blood sample is equal to the total amount in the sample minus the amount of plasma. What is the total amount  $x$  of blood drawn?

24. **NUTRITION** One serving of oatmeal provides 16% of the fiber you need daily. You must get the remaining 21 grams of fiber from other sources. How many grams of fiber should you consume daily?

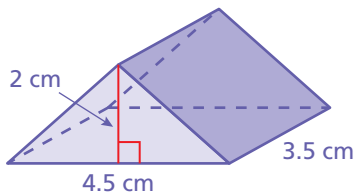
25. **Geometry** The perimeter of the square is equal to the perimeter of the triangle. What are the side lengths of each figure?



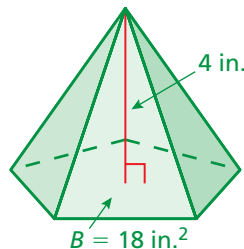
## Fair Game Review what you learned in previous grades & lessons

Find the volume of the figure. Use 3.14 for  $\pi$ . (*Skills Review Handbook*)

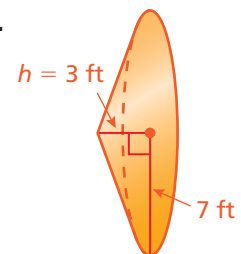
26.



27.



28.



29. **MULTIPLE CHOICE** A car travels 480 miles on 15 gallons of gasoline. How many miles does the car travel per gallon? (*Section 1.1*)

(A) 28 mi/gal

(B) 30 mi/gal

(C) 32 mi/gal

(D) 35 mi/gal