

### CONCEPT SUMMARY Literal Equations and Formulas

#### WORDS

Literal equations can use letters for both constants and variables. A formula is a kind of literal equation where one quantity is related to one or more other quantities.

To solve for a particular variable in a literal equation, you rewrite the equation, isolating the variable.

#### ALGEBRA

The volume of a rectangular prism is given by the following formula.

$$V = \ell wh$$

To find a formula for  $h$ , the height of the prism, solve for  $h$ .

$$V = \ell hw$$

$$\frac{V}{\ell w} = \frac{\ell hw}{\ell w}$$

Divide each side by  $\ell w$ .

$$\frac{V}{\ell w} = h$$

$$h = \frac{V}{\ell w}$$

### Do You UNDERSTAND?

- ESSENTIAL QUESTION** How is rewriting literal equations useful when solving problems?
- Communicate Precisely** How is solving  $2x + c = d$  similar to solving  $2x + 1 = 9$  for  $x$ ? How are they different? How can you use  $2x + c = d$  to solve  $2x + 1 = 9$ ? **MP.6**
- Vocabulary** Explain how literal equations and formulas are related.
- Error Analysis** Dyani began solving the equation  $g = \frac{x-1}{k}$  for  $x$  by adding 1 to each side. Explain Dyani's error. Then describe how to solve for  $x$ . **MP.3**

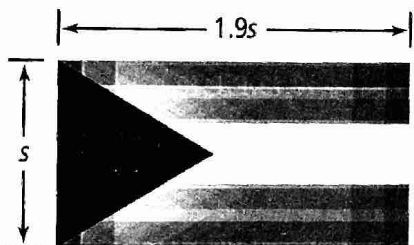
### Do You KNOW HOW?

Solve each literal equation for the given variable.

- $y = x + 12$ ;  $x$
- $n = \frac{4}{5}(m + 7)$ ;  $m$
- Use your equation from Exercise 6 to find  $m$  when  $n = 40$ .
- William got scores of  $q_1$ ,  $q_2$ , and  $q_3$  on three quizzes.
  - Write a formula for the average  $x$  of all three quizzes.
  - William got an 85 and an 88 on the first two quizzes. What formula can William use to determine the score he needs on the third quiz to get an average of 90? What score does he need?

**PRACTICE & PROBLEM SOLVING****UNDERSTAND**

9. **Mathematical Connections** Some two-step equations can be written in the form  $ax + b = c$ , where  $a$ ,  $b$ , and  $c$  are constants and  $x$  is the variable.
- Write the equation  $ax + b = c$  in terms of  $x$ .
  - Use the formula to solve  $3x + 7 = 19$  and  $\frac{1}{2}x - 1 = 5$ .
10. **Make Sense and Persevere** The flag of the Bahamas includes an equilateral triangle. The perimeter of the triangle is  $P = 3s$ , where  $s$  is the side length. Solve for  $s$ . Use your formula to find the dimensions of the flag in feet and the area in square feet when the perimeter of the triangle is 126 inches. © MP.1



11. **Error Analysis** Describe and correct the error a student made when solving  $kx + 3x = 4$  for  $x$ . © MP.3

$$\begin{aligned} kx + 3x &= 4 \\ kx + 3x - 3x &= 4 - 3x \\ kx &= 4 - 3x \\ \frac{kx}{k} &= \frac{4 - 3x}{k} \end{aligned}$$

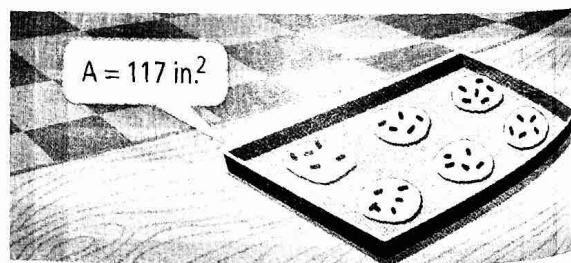
$$x = \frac{4 - 3x}{k} \quad \times$$

12. **Higher Order Thinking** Given the equation  $ax + b = c$ , solve for  $x$ . Describe each statement as *always*, *sometimes*, or *never* true. Explain your answer.
- If  $a$ ,  $b$ ,  $c$ , are whole numbers,  $x$  is a whole number.
  - If  $a$ ,  $b$ ,  $c$ , are integers,  $x$  is an integer.
  - If  $a$ ,  $b$ ,  $c$ , are rational numbers,  $x$  is a rational number.

**PRACTICE**

Solve each equation for the indicated variable.  
SEE EXAMPLES 1 AND 2

- $\frac{b}{c} = a; c$
  - $dfg = h; f$
  - $2x + 3y = 12; y$
  - $abc = \frac{1}{2}; b$
  - $8(x - a) = 2(2a - x); x$
  - $12(m + 3x) = 18(x - 3m); m$
  - $V = \frac{1}{3}\pi r^2 h; h$
  - $V = \frac{1}{3}\pi r^2(h - 1); h$
  - $y(a - b) = c(y + a); y$
  - $x = \frac{3(y - b)}{m}; y$
  - $F = -\frac{Gm}{r^2}; G$
  - $k = a - y; y$
  - $w = \frac{x}{a - b}; x$
  - $2n = 4x + 2y; n$
  - $y = \frac{3}{5u} + 5; u$
28. Use the area formula  $A = \ell w$  to write a formula for the length  $\ell$  of the baking sheet shown.  
SEE EXAMPLE 3



29. You can determine the approximate temperature in degrees Fahrenheit by counting the number of times a cricket chirps in one minute. Then multiply that by 7, divide by 30, and add 40. SEE EXAMPLE 4
- Write a formula for estimating the temperature based on the number of cricket chirps.
  - Write a new formula for the number of chirps you would expect in one minute at a given Fahrenheit temperature.
  - Use the formula to find the number of chirps in one minute when the temperature is  $89^\circ\text{F}$ .