

Skill Check:

$$3t + 4 = 12 + 3t$$

Vocabulary:

Literal equation: An equation that has two or more variables

Temperature $F =$ degrees Fahrenheit, $C =$ degrees Celsius

$$C = \frac{5}{9}(F - 32)$$

Simple Interest $I =$ interest, $P =$ principal,
 $r =$ annual interest rate (decimal form),
 $t =$ time (years)

$$I = Prt$$

Distance $d =$ distance traveled, $r =$ rate, $t =$ time

$$d = rt$$

EXAMPLE 1 **Rewriting a Literal Equation**

Solve the literal equation $3y + 4x = 9$ for y .

SOLUTION

$$3y + 4x = 9$$

Write the equation.

$$3y + 4x - 4x = 9 - 4x$$

Subtract $4x$ from each side.

$$3y = 9 - 4x$$

Simplify.

$$\frac{3y}{3} = \frac{9 - 4x}{3}$$

Divide each side by 3.

$$y = 3 - \frac{4}{3}x$$

Simplify.

► The rewritten literal equation is $y = 3 - \frac{4}{3}x$.

EXAMPLE 2 Rewriting a Literal Equation

Solve the literal equation $y = 3x + 5xz$ for x .

SOLUTION

$$y = 3x + 5xz \quad \text{Write the equation.}$$

$$y = x(3 + 5z) \quad \text{Distributive Property}$$

$$\frac{y}{3 + 5z} = \frac{x(3 + 5z)}{3 + 5z} \quad \text{Divide each side by } 3 + 5z.$$

$$\frac{y}{3 + 5z} = x \quad \text{Simplify.}$$

► The rewritten literal equation is $x = \frac{y}{3 + 5z}$.

➤ In Example 2, you must assume that $z \neq -\frac{3}{5}$ in order to divide by $3 + 5z$. In general, if you have to divide by a variable or variable expression when solving a literal equation, you should assume that the variable or variable expression does not equal 0.

Practice:

Solve the literal equation for y .

1. $3y - x = 9$

2. $2x - 2y = 5$

3. $20 = 8x + 4y$

Solve the literal equation for x .

4. $y = 5x - 4x$

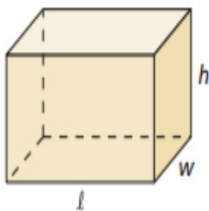
5. $2x + kx = m$

6. $3 + 5x - kx = y$

Answers:

EXAMPLE 3 Rewriting a Formula for Surface Area

The formula for the surface area S of a rectangular prism is $S = 2\ell w + 2\ell h + 2wh$. Solve the formula for the length ℓ .



SOLUTION

$$S = 2\ell w + 2\ell h + 2wh$$

Write the equation.

$$S - 2wh = 2\ell w + 2\ell h + 2wh - 2wh$$

Subtract $2wh$ from each side.

$$S - 2wh = 2\ell w + 2\ell h$$

Simplify.

$$S - 2wh = \ell(2w + 2h)$$

Distributive Property

$$\frac{S - 2wh}{2w + 2h} = \frac{\ell(2w + 2h)}{2w + 2h}$$

Divide each side by $2w + 2h$.

$$\frac{S - 2wh}{2w + 2h} = \ell$$

Simplify.

► When you solve the formula for ℓ , you obtain $\ell = \frac{S - 2wh}{2w + 2h}$.

EXAMPLE 4 Using a Formula for Area

You own a rectangular lot that is 500 feet deep. It has an area of 100,000 square feet. To pay for a new water system, you are assessed \$5.50 per foot of lot frontage.

- Find the frontage of your lot.
- How much are you assessed for the new water system?

SOLUTION

- a. In the formula for the area of a rectangle, let the width w represent the lot frontage.

$$A = \ell w \quad \text{Write the formula for area of a rectangle.}$$

$$\frac{A}{\ell} = w \quad \text{Divide each side by } \ell \text{ to solve for } w.$$

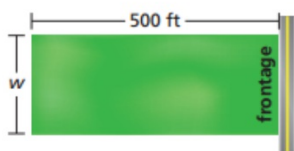
$$\frac{100,000}{500} = w \quad \text{Substitute 100,000 for } A \text{ and 500 for } \ell.$$

$$200 = w \quad \text{Simplify.}$$

- The frontage of your lot is 200 feet.

- b. Each foot of frontage costs \$5.50, and $\frac{\$5.50}{1 \text{ ft}} \cdot 200 \text{ ft} = \1100 .

- So, your total assessment is \$1100.



EXAMPLE 5 Rewriting the Formula for Temperature

Solve the temperature formula for F .

SOLUTION

$$C = \frac{5}{9}(F - 32) \quad \text{Write the temperature formula.}$$

$$\frac{9}{5}C = F - 32 \quad \text{Multiply each side by } \frac{9}{5}.$$

$$\frac{9}{5}C + 32 = F - 32 + 32 \quad \text{Add 32 to each side.}$$

$$\frac{9}{5}C + 32 = F \quad \text{Simplify.}$$

► The rewritten formula is $F = \frac{9}{5}C + 32$.

EXAMPLE 6 Using the Formula for Temperature

Which has the greater surface temperature: Mercury or Venus?

SOLUTION

Convert the Celsius temperature of Mercury to degrees Fahrenheit.

$$F = \frac{9}{5}C + 32 \quad \text{Write the rewritten formula from Example 5.}$$

$$= \frac{9}{5}(427) + 32 \quad \text{Substitute 427 for } C.$$

$$= 800.6 \quad \text{Simplify.}$$

▶ Because 864°F is greater than 800.6°F , Venus has the greater surface temperature.