

Rewriting Equations and Formulas 1.4a

An equation that has two or more variables is called a literal equation. To rewrite a literal equation, solve for one variable in terms of the other variable(s).

A formula shows how one variable is related to one or more other variables. A formula is a type of literal equation.

Example 1:

- a. Solve the literal equation for y.

$$\begin{aligned}
 3y + 4x &= 9 \\
 \underline{-4x \quad -4x} \\
 3y &= 9 - 4x \\
 \frac{3y}{3} &= \frac{9-4x}{3} \\
 \boxed{y = 3 - \frac{4}{3}x}
 \end{aligned}$$

- c. Solve the literal equation for y.

$$\begin{aligned}
 20 &= 8x + 4y \\
 \underline{-8x \quad -8x} \\
 20 - 8x &= 4y \\
 \frac{20-8x}{4} &= \frac{4y}{4} \\
 \boxed{5 - 2x = y}
 \end{aligned}$$

- b. Solve the literal equation for x.

both terms have x → factor out x

$$\begin{aligned}
 y &= 3x + 5xz \\
 \underline{y - 3x} &= \underline{5xz - 3x} \\
 y - 3x &= x(5z - 3) \\
 \frac{y - 3x}{5z - 3} &= \frac{x(5z - 3)}{5z - 3} \\
 \boxed{x = \frac{y - 3x}{5z - 3}}
 \end{aligned}$$

* use distributive property to isolate x

⊗ x is being multiplied to 3+5z so use division

- d. Solve the literal equation for x.

$$\begin{aligned}
 3 + 5x - kx &= y \\
 \underline{-3 \quad -3} \\
 5x - kx &= y - 3 \\
 x(5 - k) &= \frac{y - 3}{5 - k} \\
 \boxed{x = \frac{y - 3}{5 - k}}
 \end{aligned}$$

Example 2:

- a. The formula for the surface area S of a rectangular prism is $S = 2lw + 2lh + 2wh$. Solve the formula for the length l .

$$\begin{aligned}
 S &= 2lw + 2lh + 2wh \\
 \underline{-2wh} & \quad \underline{-2wh} \\
 S - 2wh &= 2lw + 2lh \\
 S - 2wh &= l(2w + 2h) \\
 \frac{S - 2wh}{2w + 2h} &= \frac{l(2w + 2h)}{2w + 2h} \\
 \boxed{l = \frac{S - 2wh}{2w + 2h}}
 \end{aligned}$$

frontage
 $A = 100,000$
 500ft

- b. You own a rectangular lot that is 500 feet deep. It has an area of $100,000 \text{ ft}^2$. To pay for a new water system, you are assessed \$5.50 per foot of lot frontage.
- a. Find the frontage of your lot.

$$A = lw$$

$$\frac{100,000}{500} = \frac{500l}{500}$$

$$l = 200 \text{ ft}$$

your lot has 200ft
of frontage

- b. How much are you assessed for the new water system?

5.50 per foot of frontage

$$200(5.50) = 1100$$

\$1100

- c. A truck driver averages 60 miles per hour while delivering freight to a customer. On the return trip, the driver averages 50 miles per hour due to construction. The total driving time is 6.6 hours. How long does each trip take?

We know total time. Solve distance formula for time

① $\frac{d}{R} = \frac{Rt}{R}$

$$t = \frac{d}{R}$$

② trip there + trip back = 6.6 hours
(Rate = 60mph) (Rate = 50mph)

$$\frac{d}{50} + \frac{d}{60} = 6.6$$

$$300 \left(\frac{11d}{300} \right) = (6.6) 300$$

$$\frac{11d}{11} = \frac{1980}{11}$$

$$d = 180$$

③a $t = \frac{\text{distance}}{\text{Rate}}$

$$t = 180 \text{ mi} \div \frac{60 \text{ mi}}{1 \text{ hr}}$$

$$t = 180 \div (60)$$

$$t = 3 \text{ hrs}$$

③b trip back

$$t = \frac{d}{R}$$

$$t = 180 \div \frac{50 \text{ mi}}{1 \text{ hr}}$$

$$t = 3.6 \text{ hrs}$$

total trip
is 180 miles

