# Lesson 19: Rearranging Formulas

## Classwork

### Exercise 1

Solve each equation for $x$. For part (c), remember a variable symbol, like $a$, $b$, and $c$, represents a number.

a. $2x - 6 = 10$ b. $-3x - 3 = -12$ c. $ax - b = c$

### Exercise 2

Compare your work in parts (a) through (c) above. Did you have to do anything differently to solve for $x$ in part (c)?

### Exercise 3

Solve the equation $ax - b = c$ for $a$. The variable symbols $x$, $b$, and $c$ represent numbers.

## Example 1: Rearranging Familiar Formulas

The area $A$ of a rectangle is $25$ in$^2$. The formula for area is $A = lw$.

- If the width $w$ is $10$ inches, what is the length $l$?

- If the width $w$ is $15$ inches, what is the length $l$?

- Rearrange the area formula to solve for $l$. $A = lw$

$$\frac{A}{w} = \frac{lw}{w}$$

$$\frac{A}{w} = l \text{ or } l = \frac{A}{w}$$

- Verify that the area formula, solved for $l$, will give the same results for $l$ as having solved for $l$ in the original area formula.

### Exercise 4

Solve each problem two ways. First, substitute the given values and solve for the given variable. Then, solve for the given variable and substitute the given values.

a. The perimeter formula for a rectangle is $p = 2(l + w)$, where $p$ represents the perimeter, $l$ represents the length, and $w$ represents the width. Calculate $l$ when $p = 70$ and $w = 15$.

b. The area formula for a triangle is $A = \frac{1}{2}bh$, where $A$ represents the area, $b$ represents the length of the base, and $h$ represents the height. Calculate $b$ when $A = 100$ and $h = 20$.

**Exercise 5**

Rearrange each formula to solve for the specified variable. Assume no variable is equal to $0$.

a. Given $A = P(1 + rt)$,

i. Solve for $P$.

ii. Solve for $t$.

b. Given $K = \frac{1}{2}mv^2$,

i. Solve for $m$.

ii. Solve for $v$.

## Example 2: Comparing Equations with One Variable to Those With More Than One Variable

| Equation Containing More Than One Variable | Related Equation |
|---|---|
| Solve $ax + b = d - cx$ for $x$. | Solve $3x + 4 = 6 - 5x$ for $x$. |
| Solve for $x$. $\frac{ax}{b} + \frac{cx}{d} = e$ | Solve for $x$. $\frac{2x}{5} + \frac{x}{7} = 3$ |

**Lesson Summary**

The properties and reasoning used to solve equations apply regardless of how many variables appear in an equation or formula. Rearranging formulas to solve for a specific variable can be useful when solving applied problems.

## Problem Set

For Problems 1–8, solve for $x$.

1. $ax + 3b = 2f$
2. $rx + h = sx - k$
3. $3px = 2q(r - 5x)$
4. $\frac{x+b}{4} = c$
5. $\frac{x}{5} - 7 = 2q$
6. $\frac{x}{6} - \frac{x}{7} = ab$
7. $\frac{x}{m} - \frac{x}{n} = \frac{1}{p}$
8. $\frac{3ax+2b}{c} = 4d$
9. Solve for $m$.
   $t = \frac{ms}{m+n}$
10. Solve for $u$.
    $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$
11. Solve for $s$.
    $A = s^2$
12. Solve for $h$.
    $V = \pi r^2 h$
13. Solve for $m$.
    $T = 4\ \overline{m}$
14. Solve for $d$.
    $F = G\frac{mn}{d^2}$
15. Solve for $y$.
    $ax + by = c$
16. Solve for $b_1$
    $A = \frac{1}{2}h\ b_1 + b_2$
17. The science teacher wrote three equations on a board that relate velocity, $v$, distance traveled, $d$, and the time to travel the distance, $t$, on the board.

    $v = \frac{d}{t}$ $\quad t = \frac{d}{v}$ $\quad d = vt$

    Would you need to memorize all three equations or could you just memorize one? Explain your reasoning.