Chapter 1 Equations and Inequalities

Course/Section
Lesson Number
Date

Section 1.3 Modeling with Linear Equations

Section Objectives: Students will know how to create verbal models and apply techniques for solving linear equations to real-life applications.

I. Introduction to Problem Solving (pp. 97-98) Pace: 5 minutes

- The process of translating a phrase or sentence into an algebraic expression is called **mathematical modeling**. It is, therefore, very important to know which words translate into which operations. A list of these translations can be found on page 98.

II. Using Mathematical Models (pp. 98-100) Pace: 15 minutes

Example 1. A shirt that normally sells for \$30 is marked down \$6. What percent of the original price is this markdown?

Verbal Model: Markdown = Percent • Original

Labels: Original = 30 (dollars)
Markdown = 6 (dollars)
Percent = r (in decimal form)

Equation:

$$6 = r \cdot 30$$
$$\frac{6}{30} = r$$
$$0.2 = r$$

The shirt was marked down 20%.

Example 2. The length of a rectangular lot is 8 feet longer than the width. The perimeter of the lot is 240 feet. What are the dimensions of the lot?

Verbal Model: 2•Length + 2•Width = Perimeter

Labels: Perimeter = 240 (feet)
Width = w (feet)
Length = $w + 8$ (feet)

Equation:

$$2(w + 8) + 2w = 240$$
$$4w + 16 = 240$$
$$4w = 224$$
$$w = 56$$

The width is 56 feet and length is 64 feet.

Example 3. If you average 65 mph, how long will it take you to drive 280 miles?

Verbal Model: Distance = Rate • Time

Labels: Distance = 280 (miles)
Rate = 65 (miles per hour)
Time = t (hours)

Equation:

$$280 = 65t$$
$$\frac{280}{65} = t$$
$$4.3 \approx t$$

It will take about 4.3 hours.

Example 4. A man 6 feet tall is walking away from a tree. He remains in the shadow of the tree until he is 8 feet from the tip of the tree's shadow. If he is 20 feet from the tree at this point, how tall is the tree?

Verbal Model:

$$\frac{\text{height of tree}}{\text{height of man}} = \frac{\text{length of tree's shadow}}{\text{length of man's shadow}}$$

Labels: Height of tree = x (feet)
Height of man = 6 (feet)
Length of tree's shadow = 28 (feet)
Length of man's shadow = 8 (feet)

Equation:

$$\frac{x}{6} = \frac{28}{8}$$
$$x = 21$$

The tree is 21 feet tall.

III. Mixture Problems (p. 101) Pace: 10 minutes

- There are two types of mixture problems: solution and value. In addition, there are several other types of problems that are solved just as mixture problems are solved.

Example 5. How many ounces of 10% alcohol solution must be mixed with 10 ounces of 16% alcohol solution to make a solution that is 12.4% alcohol?

Verbal Model: Alcohol in 10% + alcohol in 16%
= alcohol in 12.4%

Labels: Alcohol in 10% = $0.10x$ (ounces)
Alcohol in 16% = $0.16(10) = 1.6$ (ounces)
Alcohol in 12.4% = $0.124(10 + x)$ (ounces)

Equation:

$$0.10x + 1.6 = 0.124(10 + x)$$
$$0.10x + 1.6 = 1.24 + 0.124x$$
$$-0.024x + 1.6 = 1.24$$
$$-0.024x = -0.36$$
$$x = 15$$

Alcohol in 10% solution = $0.10x = 0.10(15) = 1.5$, so 1.5 ounces of the 10% alcohol solution are needed.

Example 6. How many pounds of peanuts costing \$2 per pound must be mixed with 2 pounds of walnuts costing \$3 per pound to make a mixture that will cost \$2.40 per pound?

Verbal Model: Value of peanuts + value of walnuts
= value of mixture

Labels: Value of peanuts = $2x$ (dollars)
Value of walnuts = $3 \cdot 2 = 6$ (dollars)
Value of mixture = $2.40(2 + x)$ (dollars)

Equation:

$$2x + 6 = 2.40(2 + x)$$
$$2x + 6 = 4.80 + 2.40x$$
$$-0.40x = -1.20$$
$$x = 3$$

Three pound of peanuts are needed.

IV. Common Formulas (pp. 102-103) Pace: 10 minutes

- Attention should be drawn to the list of formulas on page 102 of the text.

Example 7. A rectangular box with a square base has a volume of 128 cubic inches. If the length of one side of the base is 8 inches, what is the height of the box?

$$V = lwh$$
$$128 = 8 \cdot 8 \cdot h$$
$$128 = 64h$$
$$2 = h$$

Therefore the height is 2 inches.