

# 2-8

# Solving Equations: Undoing

## FOCUS

Use equations to solve a variety of real-life problems.

A version of the following puzzle problem can be found in many books about mathematics:

“Some generous person likes to pick apples, but doesn’t much enjoy eating them. So she picks a sackful of apples and then proceeds to give most of them away. Each person who receives apples gets a whole number of apples; no apples are cut. She does this in the following way: The first person she meets gets half the apples in the sack. The second person gets half the remaining apples. The third person gets half the remaining apples. And the fourth person gets half the remaining apples. The generous person has one apple left. How many apples were in the sack? ”

The puzzle can be solved by working backward, undoing the process of giving away the apples.

## UNDERSTANDING THE MAIN IDEAS

### Solving equations by undoing

Many problems in mathematics and in real-world applications of mathematics can be solved by first writing an equation and then finding the solution(s) of that equation. When you solve an equation, you can use the fact that subtracting is the inverse of adding and the fact that dividing is the inverse of multiplying.

### Sample 1

The total cost for 3 lb of grapes and a 98¢ melon is \$2.75. How much do the grapes cost per pound?

### Sample Response

Write and solve an equation. Let  $g$  = the cost per pound for the grapes. Then  $3g$  = the cost of 3 pounds of grapes.

$$3g + 0.98 = 2.75 \quad \leftarrow \text{cost of grapes} + \text{cost of melon} = \text{total cost}$$

$$3g + 0.98 - 0.98 = 2.75 - 0.98 \quad \leftarrow \begin{array}{l} \text{Undo the addition of 0.98} \\ \text{by subtracting 0.98 from both sides.} \end{array}$$

$$3g = 1.77$$

$$\frac{3g}{3} = \frac{1.77}{3} \quad \leftarrow \begin{array}{l} \text{Undo the multiplication by 3} \\ \text{by dividing both sides by 3.} \end{array}$$

$$g = 0.59$$

The grapes cost 59¢ per pound.

## Sample 2

Ari's lunch cost her \$4.80. This amount included the price of the lunch plus 5% sales tax and a tip of 15% of the price of the lunch. What was the price of the lunch?

## Sample Response

Write and solve an equation. Let  $p$  = the price of the lunch. Then  $0.05p$  = the amount for sales tax and  $0.15p$  = the amount of the tip.

$$p + 0.05p + 0.15p = 4.80 \quad \leftarrow \text{price of lunch} + \text{tax} + \text{tip} = \text{total amount}$$

$$1.20p = 4.80 \quad \leftarrow \text{Combine like terms; } p = 1p.$$

$$\frac{1.20p}{1.20} = \frac{4.80}{1.20} \quad \leftarrow \text{Undo the multiplication by dividing both sides by 1.20.}$$

$$p = 4.00$$

The price of the lunch was \$4.00.

For Exercises 1–6, solve.

1.  $4x - 7 = 45$

2.  $-2y + 6 = 0$

3.  $4n + 6n = 80$

4.  $\frac{a}{5} = 75$

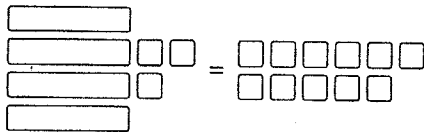
5.  $\frac{x}{2} - 2.8 = 1.7$

6.  $1.5b + 3.2b = 28.2$

7. **Open-ended** Write a problem situation that could be solved using the equation  $15 + 3n = 60$ .

## Review PREVIEW

8. a. What equation does the diagram below illustrate? (Section 2-7)



b. Show how to solve for  using the model in part (a).

Write each number in decimal notation. (Section 2-3)

9.  $7.413 \times 10^6$

10.  $1.39 \times 10^{-4}$

Replace each ? with the correct number. (Section 1-3)

11.  $13^2 = \underline{\quad ? \quad} \cdot \underline{\quad ? \quad} = \underline{\quad ? \quad}$

12.  $8^3 = \underline{\quad ? \quad} \cdot \underline{\quad ? \quad} \cdot \underline{\quad ? \quad} = \underline{\quad ? \quad}$