

## 2-1

## Solving Two-Step Equations


**Check Skills You'll Need**

- 1. Vocabulary Review**  
What does it mean to *isolate* the variable?

Solve each equation.

2.  $x + 4 = -3$
3.  $c - 5 = 1$
4.  $5 + a = 35$

**GO for Help**  
Problem Solving Handbook p. xlviii


**CONTENT STANDARDS**

8.EE.7, 8.EE.7b

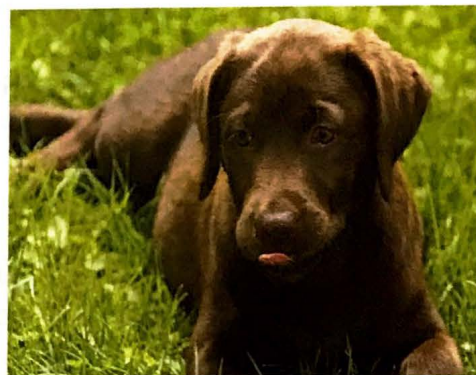
**What You'll Learn**

To solve two-step equations and to use two-step equations to solve problems

**Why Learn This?**

Many real-world situations are modeled by equations with multiple steps.

Suppose you adopt a puppy from an animal shelter and buy 3 bags of dog food. The adoption fee is \$125 and you spend a total of \$154.97. How much does each bag of dog food cost?



Total cost \$154.97	
Adoption fee \$125	Bags $3b$

The model at the left shows that you can use the equation  $125 + 3b = 154.97$  to represent the problem. This equation requires two steps to solve. Use the order of operations in reverse to choose the operation to undo first.

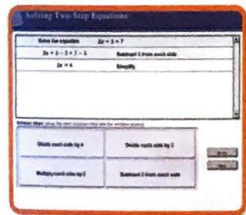
**EXAMPLE Solving Using Subtraction and Division**

- 1 Solve  $125 + 3b = 154.97$ .  
 $125 + 3b = 154.97$   
 $125 - 125 + 3b = 154.97 - 125$  ← Subtract 125 from each side.  
 $3b = 29.97$  ← Simplify.  
 $\frac{3b}{3} = \frac{29.97}{3}$  ← Divide each side by 3.  
 $b = 9.99$  ← Simplify.

**Check**  $125 + 3b = 154.97$   
 $125 + 3(9.99) \stackrel{?}{=} 154.97$  ← Substitute 9.99 for  $b$ .  
 $154.97 = 154.97$  ✓ ← The solution checks.


**Quick Check**

1. Solve  $4g + 11.6 = -23.2$ . Check the solution.


**Online active math**


For: Two-Step Equations Activity  
 Use: Interactive Textbook, 2-1

## EXAMPLE Application: Sharing Costs

- 2 Multiple Choice** Suppose you buy a slice of pizza for \$1.50. You also split the cost of renting a video with two friends. Your total cost is \$2.75. Which equation can you use to find the cost of renting the video?

(A)  $1.50 + v = 2.75$

(C)  $1.50 + \frac{v}{3} = 2.75$

(B)  $1.50 + \frac{v}{2} = 2.75$

(D)  $\frac{1.50 + v}{3} = 2.75$

### Test Prep Tip

You can represent the relationships in Example 2 with the model below.

Total amount paid \$2.75	
Pizza \$1.50	Video $\frac{v}{3}$

**Words** cost of pizza plus (cost of video  $\div$  3) is \$2.75



Let  $v$  = the cost of the video.

**Equation**  $1.50 + \frac{v}{3} = 2.75$

The correct answer is C. You can solve the equation to find the cost.

$$1.50 + \frac{v}{3} = 2.75$$

$$1.50 - 1.50 + \frac{v}{3} = 2.75 - 1.50 \quad \leftarrow \text{Subtract 1.50 from each side.}$$

$$\frac{v}{3} = 1.25 \quad \leftarrow \text{Simplify.}$$

$$(3)\frac{v}{3} = (3)1.25 \quad \leftarrow \text{Multiply each side by 3.}$$

$$v = 3.75 \quad \leftarrow \text{Simplify.}$$

The cost of renting the video is \$3.75.

### Quick Check

- 2. Telephone Bill** To make a long-distance call, it costs \$.50 per call and \$.85 per minute. You make a long-distance call that costs \$3.90. Write and solve an equation to find the length of the call.

## Check Your Understanding

Write an equation for each model.



Write the first step in solving each equation.

3.  $\frac{t}{-2} - 8 = 10$

4.  $-5 = \frac{x}{2} - 5$

5.  $4m - 12 = 0$

6.  $1.5q + 9 = 3$

7. **Estimation** Use estimation to solve  $10.67 + \frac{x}{1.95} = 38.9$ .

# Homework Exercises

For more exercises, see Extra Skills and Word Problems.

## GO for Help

For Exercises	See Examples
8–13	1
14–18	2

Solve each equation. Check the solution.

8.  $4x + 7 = 3$

9.  $1 + 2g = -7$

10.  $15 = \frac{2}{3}y + 6$

11.  $-1.4b + 10 = -18$

12.  $23 + 8b = -4.2$

13.  $17 + 2.6b = 30$

14.  $7 + \frac{x}{4} = 3$

15.  $17 + \frac{b}{26} = 30$

16.  $15 = \frac{y}{3} + 6$

Write and solve an equation to answer each question. You may find a model helpful.

17. Leo ordered 4 DVDs by mail. Each DVD cost the same amount. With a \$5 shipping charge, the total cost was \$68.96. How much did each DVD cost?

18. **School Supplies** Annamarie bought a notebook for \$1.19 and pencils for \$.39 each. The total cost was \$3.92. How many pencils did she buy?

## GPS

19. **Guided Problem Solving** A bag of rice costs \$1.99. You buy 1 bag of rice and 6 cans of black beans for a total cost of \$7.33. If you have \$8.25, can you buy another can of beans? Explain.

- What equation can you use to find  $c$ , the cost of a can of beans?
- Knowing  $c$ , how can you determine whether you have enough money for another can of beans?

20. **Error Analysis** Which student's work is correct? Explain.

Wendy

$$-20 = \frac{x}{2} + 7$$

$$-20 - 7 = \frac{x}{2} + 7 - 7$$

$$(2)(-27) = (2)\left(\frac{x}{2}\right)$$

$$-54 = x$$

Ben

$$-20 = \frac{x}{2} + 7$$

$$(2)(-20) = \left(\frac{x}{2} + 7\right)(2)$$

$$-40 - 7 = x + 7 - 7$$

$$-47 = x$$

21. **Nutrition** According to the Food and Drug Administration, the recommended daily intake of iron is 18 mg. This is 4 less than twice the recommended daily intake of zinc. What is the recommended daily intake of zinc?

22. **Estimation** Use estimation to check whether 24.27 is a reasonable solution for  $6p + 39.95 = 105.65$ . Show your work.

23. Solve  $7b + 3 = 24$ . Justify your steps.

Solve each equation.

24.  $\frac{y}{3} - 9 = 30$

25.  $\frac{n}{1.4} + 1 = 10$

26.  $-8.2 + \frac{t}{-2} = 1.7$

27.  $12 = -6 - \frac{3}{4}v$

28.  $1.2 = 3s - 1.8$

29.  $10 = 3q - 2.6$

30. a. **Jobs** Two students want to save \$200 each. One student starts with \$60 and rakes leaves for \$6 per hour. The other student starts with nothing but earns \$9 per hour painting houses. Let  $x$  represent the number of hours worked. Write and solve two equations to find the number of hours each student will have to work.

- b. **Writing in Math** Explain why one of the equations from part (a) is a one-step equation and the other is a two-step equation.

31. **Challenge** Multiply each side of the equation  $0.5x + 1.3 = 4.8$  by 10 and solve for  $x$ . How does this solution compare to the solution to the original equation? Explain why it is helpful to multiply by 10.



## Test Prep and Mixed Review

### Practice

#### Multiple Choice

32. This year, 227 pets were adopted from a shelter. This is 35 fewer than twice the number that were adopted last year. Which equation can you use to find the number of pets adopted last year?

(A)  $n = \frac{227 + 35}{2}$

(C)  $n = \frac{227 - 35}{2}$

(B)  $n = 2(227) - 35$

(D)  $n = 2(227) + 35$

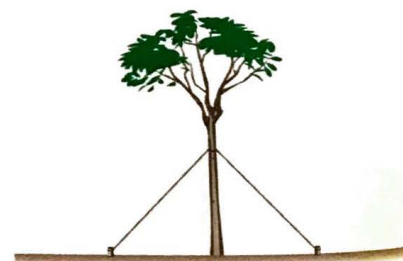
33. Wires are fastened around the trunk of a newly planted tree 5.5 feet above the ground. Each wire is 7 feet long and fastened to a stake in the ground. Which is closest to the distance from the base of the tree to a stake?

(F) 13 ft

(H) 4 ft

(G) 9 ft

(J) 3 ft



34. The area covered by a square pool is  $324 \text{ ft}^2$ . An  $x$ -foot-wide deck surrounds the pool. Which expression describes the total amount of fencing needed, in feet, to enclose the deck and pool?

(A)  $2(18 + x)$

(C)  $4(18 + x)$

(B)  $2(18 + 2x)$

(D)  $4(18 + 2x)$

35. A baseball player has 35 hits out of 104 at bats. What is the player's batting average?

### GO for Help

For Exercise

See Lesson

35

1-1