

Solving Two-Step Equations



Interactive Study Guide

See pages 171–172 for:

- Getting Started
- Real-World Link
- Notes



Essential Question

How are equations and inequalities used to describe and solve multi-step problems?



Common Core State Standards

Content Standards
7.EE.4, 7.EE.4a, 8.EE.7,
8.EE.7b

Mathematical Practices
1, 3, 4, 7



Vocabulary

two-step equation

What You'll Learn

- Solve two-step equations.
- Solve real-world problems involving two-step equations.



Real-World Link

Cheerleading Cheerleaders on a middle school squad must purchase cheer shoes for \$35, plus several pairs of white ankle socks. An equation involving two operations can be used to find the total cost.

Solve Two-Step Equations

A **two-step equation** contains two operations. To solve a two-step equation, use inverse operations to undo each operation in reverse order of the order of operations.

Example 1



Solve $3a + 9 = 33$. Check your solution.

Method 1 The Vertical Method

$$3a + 9 = 33$$

Write the equation.

$$3a + 9 = 33$$

$$\underline{-9 = -9}$$

Subtraction Property of Equality

$$3a = 24$$

Simplify.

$$\frac{3a}{3} = \frac{24}{3}$$

Division Property of Equality

$$a = 8$$

Simplify.

Method 2 The Horizontal Method

$$3a + 9 = 33$$

Write the equation.

$$3a + 9 - 9 = 33 - 9$$

Subtraction Property of Equality

$$3a = 24$$

Simplify.

$$\frac{3a}{3} = \frac{24}{3}$$

Division Property of Equality

$$a = 8$$

Simplify.

Using either method, the solution is 8.

Check $3a + 9 = 33$

Write the equation.

$$3(8) + 9 \stackrel{?}{=} 33$$

Replace a with 8.

$$24 + 9 \stackrel{?}{=} 33$$

Multiply.

$$33 = 33 \checkmark$$

The sentence is true.

Got It? Do these problems to find out.

Solve each equation. Check your solution.

1a. $6x + 1 = 25$ **4**

1b. $4x - 5 = -33$ **-7**

Properties of Equality

Recall that the Addition and Subtraction Properties of Equality state that the same number can be added to or subtracted from each side of an equation.

Example 2



Solve $\frac{1}{5}p - 12 = 20$.

$$\frac{1}{5}p - 12 = 20$$

Write the equation.

$$\frac{1}{5}p - 12 + 12 = 20 + 12$$

Addition Property of Equality

$$\frac{1}{5}p = 32$$

Simplify.

$$5 \cdot \frac{1}{5}p = 5 \cdot 32$$

Multiplication Property of Equality

$$p = 160$$

Simplify. Check your solution.

Got It? Do these problems to find out.

2a. $8 = 15 + \frac{1}{3}n$ **-21**

2b. $-\frac{1}{6}x - 3 = 2$ **-30**

Example 3



Solve $9 - t = -34$.

$$9 - t = -34$$

Write the equation.

$$9 - 1t = -34$$

Identity Property: $t = 1t$

$$9 + (-1t) = -34$$

Definition of Subtraction

$$-9 + 9 + (-1t) = -9 + (-34)$$

Addition Property of Equality

$$-1t = -43$$

Simplify.

$$\frac{-1t}{-1} = \frac{-43}{-1}$$

Division Property of Equality

$$t = 43$$

Simplify. Check your solution.

Got It? Do these problems to find out.

3a. $-15 - b = 44$ **-59**

3b. $-6.5 = -4.3 - n$ **2.2**

Example 4



Solve $2x + x - 27 = 3$.

$$2x + x - 27 = 3$$

Write the equation.

$$2x + 1x - 27 = 3$$

Identity Property: $x = 1x$

$$3x - 27 = 3$$

Distributive Property: $2x + 1x = (2 + 1)x$ or $3x$

$$3x - 27 + 27 = 3 + 27$$

Addition Property of Equality

$$3x = 30$$

Simplify.

$$\frac{3x}{3} = \frac{30}{3}$$

Division Property of Equality

$$x = 10$$

Simplify. Check your solution.

Got It? Do these problems to find out.

4a. $4 - 9c + 3c = 58$ **-9**

4b. $3.4 = 0.4m - 2 + 0.2m$ **9**

Distributive Property

You use the Distributive Property to mentally simplify $2x + x$.

$$2x + 1x = (2 + 1)x \\ = 3x$$

Solve Real-World Problems

You can write and solve two-step equations to solve many real-world problems.



Example 5



Deon wants to go on a camping trip with his hiking club. The trip costs \$185.75. He paid a deposit of \$45.75 and will save an additional \$17.50 per week to pay for the trip. Solve $45.75 + 17.50w = 185.75$ to find the number of weeks Deon will need to save money for the trip.

$$45.75 + 17.50w = 185.75$$

Write the equation.

$$45.75 - 45.75 + 17.50w = 185.75 - 45.75$$

Subtraction Property of Equality

$$17.50w = 140$$

Simplify.

$$\frac{17.50w}{17.50} = \frac{140}{17.50}$$

Division Property of Equality

$$w = 8$$

Simplify. Check your solution.

Deon will need to save for 8 weeks.

Got It? Do this problem to find out.

5. Salvatore purchased a computer for \$682.20. He paid \$105.40 initially and will pay \$20.60 per month until the computer is paid off. Solve $105.40 + 20.60x = 682.20$ to find the number of months Salvatore will make payments for the computer.

28 months

Guided Practice



Solve each equation. Check your solution. (Examples 1 and 2)

1. $4p + 9 = 25$ **4**

2. $-2x + 1 = 7$ **-3**

3. $5y - 3 = -23$ **-4**

4. $17 = 7x - 4$ **3**

5. $-4 = 8m - 12$ **1**

6. $-13 = 5 - 3z$ **6**

7. $\frac{1}{4}p - 6 = -8$ **-8**

8. $-\frac{1}{6}t + 1 = 3$ **-12**

9. $-\frac{1}{2}r - 12 = -27$ **30**

10. $\frac{1}{2}g + 6 = 4$ **-4**

11. $-\frac{1}{8}x - 5 = -1$ **-32**

12. $9 = 4 + \frac{1}{5}q$ **25**

Solve each equation. Check your solution. (Examples 3 and 4)

13. $-7 - 8d = 17$ **-3**

14. $23 - 2c = 41$ **-9**

15. $1 - 2k = -9$ **5**

16. $12 - m = -7$ **19**

17. $14 = 6 - x$ **-8**

18. $-6 = 4 - 5b$ **2**

19. $-4 = 8y - 9y + 6$ **10**

20. $-1.3j + 0.4 = -1.16$ **1.2**

21. $1.1 - t + 2.2t = 5.9$ **4**

22. $5m + 4 - 7m = 10$ **-3**

23. $\frac{1}{3}p + 6 - \frac{2}{3}p = 0$ **18**

24. $7.8 = 3 + 0.1n + 0.7n$ **6**

25. Kaleigh has \$25. She plans to save \$7.50 each week. Solve $25 + 7.50w = 250$ to find the number of weeks it will take Kaleigh to save \$250. (Example 5) **30 weeks**

26. A caterer is preparing a dinner for a party. She charges a flat fee of \$16 plus \$8.25 per person. Solve $16 + 8.25p = 131.50$ to find the number of people at a dinner that costs \$131.50. (Example 5) **14 people**