

# Solving Two-Step Equations

Name: \_\_\_\_\_

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## Q Quick Review

A **two-step equation** looks like  $ax + b = c$  — there are two things happening to the variable, so it takes two moves to undo them. Always undo in the *reverse* order of operations: **first** use addition or subtraction to peel off the constant, **then** use multiplication or division to free the variable. Each step is justified by a **Property of Equality** — whatever you do to one side, you do to the other. Why undo in reverse? Think of it like getting dressed: socks before shoes putting them on, but shoes before socks taking them off.

## PRACTICE

Solve each equation.

1.  $2x + 3 = 11$  \_\_\_\_\_

2.  $5n - 4 = 16$  \_\_\_\_\_

3.  $-3a + 7 = 1$  \_\_\_\_\_

4.  $4y + 1 = -15$  \_\_\_\_\_

5.  $\frac{x}{2} + 5 = 9$  \_\_\_\_\_

6.  $\frac{m}{3} - 4 = 2$  \_\_\_\_\_

7.  $-6p + 10 = -8$  \_\_\_\_\_

8.  $7k - 3 = 25$  \_\_\_\_\_

9.  $\frac{n}{-5} + 2 = 6$  \_\_\_\_\_

10.  $9 + 2x = 3$  \_\_\_\_\_

11.  $-4w - 8 = 12$  \_\_\_\_\_

12.  $\frac{y}{6} + 1.5 = 3.5$  \_\_\_\_\_

13.  $8 - 3x = 23$  \_\_\_\_\_

14.  $\frac{2x}{3} + 1 = 7$  \_\_\_\_\_

15.  $5(x + 2) = 35$  \_\_\_\_\_

16.  $-2x + 11 = 5$  \_\_\_\_\_

17.  $\frac{x - 4}{3} = 2$  \_\_\_\_\_

18.  $6 + \frac{x}{4} = 9$  \_\_\_\_\_

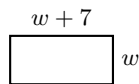
19.  $0.5x - 3 = 4$  \_\_\_\_\_

20.  $\frac{3}{5}x + 2 = 14$  \_\_\_\_\_

## ◆ VISUAL PRACTICE

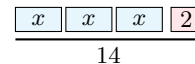
Use the graph, table, chart, or diagram to answer the question.

21. The rectangle has perimeter 46. Find  $w$ .



Answer: \_\_\_\_\_

22. The tape diagram represents  $3x + 2 = 14$ . Find  $x$ .



Answer: \_\_\_\_\_

## ◆ Word Problems

23. A taxi ride costs \$3 plus \$2 per mile. If the total fare was \$19, how many miles was the ride? \_\_\_\_\_

24. A bag of marbles is divided equally among 6 friends. Each friend receives 4 marbles, and 3 marbles are left over. How many marbles were in the bag? \_\_\_\_\_

25. A gym charges a \$30 sign-up fee plus \$25 a month. After  $m$  months, Carlos has paid \$155. How many months has he been a member? \_\_\_\_\_

26. Maya is thinking of a number. When you take half of her number and add 7, you get 19. What's her number? \_\_\_\_\_



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## Answer Keys

- |              |                   |
|--------------|-------------------|
| 1. $x = 4$   | 14. $x = 9$       |
| 2. $n = 4$   | 15. $x = 5$       |
| 3. $a = 2$   | 16. $x = 3$       |
| 4. $y = -4$  | 17. $x = 10$      |
| 5. $x = 8$   | 18. $x = 12$      |
| 6. $m = 18$  | 19. $x = 14$      |
| 7. $p = 3$   | 20. $x = 20$      |
| 8. $k = 4$   | 21. $w = 8$       |
| 9. $n = -20$ | 22. $4$           |
| 10. $x = -3$ | 23. $m = 8$ miles |
| 11. $w = -5$ | 24. $n = 27$      |
| 12. $y = 12$ | 25. $m = 5$       |
| 13. $x = -5$ | 26. $x = 24$      |

### Step-by-Step Tutor Notes

1. Work one inverse operation at a time and keep both sides balanced. Subtract 3 first:  $2x = 8$ . Then divide by 2:  $x = 4$ . After simplifying, the answer is  $x = 4$ .
2. Keep the order of operations in view, then simplify without skipping the sign check. Add 4:  $5n = 20$ . Divide by 5:  $n = 4$ . After simplifying, the answer is  $n = 4$ .
3. Work one inverse operation at a time and keep both sides balanced. Subtract 7:  $-3a = -6$ . Divide by  $-3$ :  $a = 2$ . Two negatives divide to a positive. After simplifying, the answer is  $a = 2$ .
4. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract 1:  $4y = -16$ . Divide by 4:  $y = -4$ . After simplifying, the answer is  $y = -4$ .
5. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract 5:  $\frac{x}{2} = 4$ . Multiply by 2:  $x = 8$ . After simplifying, the answer is  $x = 8$ .
6. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Add 4:  $\frac{m}{3} = 6$ . Multiply by 3:  $m = 18$ . After simplifying, the answer is  $m = 18$ .
7. Keep the order of operations in view, then simplify without skipping the sign check. Subtract 10:  $-6p = -18$ . Divide by  $-6$ :  $p = 3$ . After simplifying, the answer is  $p = 3$ .
8. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Add 3:  $7k = 28$ . Divide by 7:  $k = 4$ . After simplifying, the answer is  $k = 4$ .
9. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract 2:  $\frac{n}{5} = 4$ . Multiply by  $-5$ :  $n = -20$ . After simplifying, the answer is  $n = -20$ .
10. Subtract 9:  $2x = -6$ . Divide by 2:  $x = -3$ . (The constant being on the left of the variable doesn't change anything.)
11. Work one inverse operation at a time and keep both sides balanced. Add 8:  $-4w = 20$ . Divide by  $-4$ :  $w = -5$ . After simplifying, the answer is  $w = -5$ .
12. Keep the order of operations in view, then simplify without skipping the sign check. Subtract 1.5:  $\frac{y}{6} = 2$ . Multiply by 6:  $y = 12$ . After simplifying, the answer is  $y = 12$ .
13. Subtract 8 from both sides:  $-3x = 15$ . Divide by  $-3$ :  $x = -5$ . (Watch the sign on  $-3x$  — the negative stays attached to the coefficient.)
14. Subtract 1:  $\frac{2x}{3} = 6$ . Multiply both sides by  $\frac{3}{2}$  (the reciprocal):  $x = 6 \cdot \frac{3}{2} = 9$ .
15. You could distribute first, but it's faster to divide both sides by 5:  $x + 2 = 7$ . Then subtract 2:  $x = 5$ . (When everything on one side has the same factor, dividing first saves a step.)
16. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract 11:  $-2x = -6$ . Divide by  $-2$ :  $x = 3$ . After simplifying, the answer is  $x = 3$ .
17. Multiply both sides by 3:  $x - 4 = 6$ . Add 4:  $x = 10$ . (When the whole expression is divided, undo the division first.)
18. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Subtract 6:  $\frac{x}{4} = 3$ . Multiply by 4:  $x = 12$ . After simplifying, the answer is  $x = 12$ .
19. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Add 3:  $0.5x = 7$ . Divide by 0.5 (or multiply by 2):  $x = 14$ . After simplifying, the answer is  $x = 14$ .
20. Work one inverse operation at a time and keep both sides balanced. Subtract 2:  $\frac{3}{5}x = 12$ . Multiply by  $\frac{5}{3}$ :  $x = 12 \cdot \frac{5}{3} = 20$ . After simplifying, the answer is  $x = 20$ .
21. Take it one clear step at a time and keep the original question in mind. Perimeter gives  $2w + 2(w + 7) = 46$ , so  $4w + 14 = 46$  and  $w = 8$ . So the answer is  $w = 8$ .
22. Keep the order of operations in view, then simplify without skipping the sign check. Remove 2 to get  $3x = 12$ , then divide by 3. After simplifying, the answer is 4.
23. Let  $m$  be the miles. The fare is \$2 per mile plus a \$3 base:  $2m + 3 = 19$ . Subtract 3:  $2m = 16$ . Divide by 2:  $m = 8$  miles.
24. If  $n$  is the total and 3 are left over, then  $n - 3$  get divided among 6 friends, with each getting 4:  $\frac{n-3}{6} = 4$ . Multiply by 6:  $n - 3 = 24$ . Add 3:  $n = 27$  marbles.
25. Total cost is the fee plus monthly payments:  $25m + 30 = 155$ . Subtract 30:  $25m = 125$ . Divide by 25:  $m = 5$  months.
26. Let  $x$  be her number. "Half plus 7 equals 19" is  $\frac{x}{2} + 7 = 19$ . Subtract 7:  $\frac{x}{2} = 12$ . Multiply by 2:  $x = 24$ .



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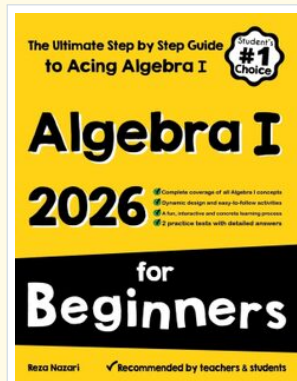
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