

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

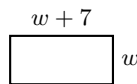
Solve each equation.

- | | | | |
|---------------------------|-------|-------------------------------|-------|
| 1. $2x + 3 = 11$ | _____ | 11. $-4w - 8 = 12$ | _____ |
| 2. $5n - 4 = 16$ | _____ | 12. $\frac{y}{6} + 1.5 = 3.5$ | _____ |
| 3. $-3a + 7 = 1$ | _____ | 13. $8 - 3x = 23$ | _____ |
| 4. $4y + 1 = -15$ | _____ | 14. $\frac{2x}{3} + 1 = 7$ | _____ |
| 5. $\frac{x}{2} + 5 = 9$ | _____ | 15. $5(x + 2) = 35$ | _____ |
| 6. $\frac{m}{3} - 4 = 2$ | _____ | 16. $-2x + 11 = 5$ | _____ |
| 7. $-6p + 10 = -8$ | _____ | 17. $\frac{x - 4}{3} = 2$ | _____ |
| 8. $7k - 3 = 25$ | _____ | 18. $6 + \frac{x}{4} = 9$ | _____ |
| 9. $\frac{n}{-5} + 2 = 6$ | _____ | 19. $0.5x - 3 = 4$ | _____ |
| 10. $9 + 2x = 3$ | _____ | 20. $\frac{3}{5}x + 2 = 14$ | _____ |

◆ VISUAL PRACTICE

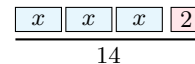
Use the graph, table, chart, or diagram to answer the question.

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. $x = 4$

2. $n = 4$

3. $a = 2$

4. $y = -4$

5. $x = 8$

6. $m = 18$

7. $p = 3$

8. $k = 4$

9. $n = -20$

10. $x = -3$

11. $w = -5$

12. $y = 12$

13. $x = -5$

14. $x = 9$

15. $x = 5$

16. $x = 3$

17. $x = 10$

18. $x = 12$

19. $x = 14$

20. $x = 20$

21. $w = 8$

22. 4

23. $m = 8$ miles

24. $n = 27$

25. $m = 5$

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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