

Multi-Step Equations Worksheet

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Two-step equations and variables on both sides · show every step

Name _____ Date _____ Score _____

/ 28

THE ORDER THAT WORKS

1. Expand any brackets.
2. Clear fractions by multiplying every term by the common denominator.
3. Collect like terms on each side.
4. Get the variable terms on one side, the numbers on the other.
5. Divide by the coefficient.
6. Substitute your answer back into the *original* equation to check.

Whatever you do to one side, do to the other — that is the only rule underneath all six steps.

SECTION A Two-step equations

Undo addition or subtraction first, then the multiplication or division.

1 $3x + 7 = 22$

Answer _____

2 $5x - 8 = 17$

Answer _____

3 $\frac{x}{4} + 6 = 10$

Answer _____

4 $-2x + 9 = 1$

Answer _____

5 $7x + 4 = -17$

Answer _____

6 $\frac{x}{3} - 5 = -2$

Answer _____

SECTION B Variables on both sides

Collect the variable terms on one side and the numbers on the other, then divide.

7 $6x + 5 = 2x + 21$

Answer _____

8 $9x - 3 = 5x + 13$

Answer _____

9 $4x + 11 = 7x - 1$

Answer _____

10 $10 - 2x = 3x - 15$

Answer _____

11 $8x - 7 = 3x + 18$

Answer _____

12 $2x + 14 = 9 - 3x$

Answer _____

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Brackets and fractions · expand or clear first

SECTION C Use the distributive property first

Expand the brackets before collecting terms. Multiply *every* term inside.

13 $3(x + 4) = 21$

Answer

14 $5(2x - 1) = 35$

Answer

15 $4(x - 3) = 2(x + 1)$

Answer

16 $-2(x + 5) = 3x - 20$

Answer

17 $6(x - 2) + 4 = 2(x + 6)$

Answer

18 $3(2x + 1) - 4x = 11$

Answer

SECTION D Fractional and awkward coefficients

Clear the fractions by multiplying every term by the common denominator, then solve as usual. Leave answers as exact fractions.

19 $\frac{x}{2} + \frac{x}{3} = 10$

Answer

20 $\frac{2x - 1}{5} = 3$

Answer

21 $\frac{3x}{4} - 2 = \frac{x}{2}$

Answer

22 $4x + 3 = 6x - 2$

Answer

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Word problems · define the variable before you write the equation

SECTION E Write your own equation

Define the variable, write the equation, solve it, then answer in a sentence.

- 23 The sum of three consecutive integers is 72. Find the integers.

Answer _____

- 24 A phone plan costs \$15 per month plus \$0.10 per minute. A bill came to \$32. How many minutes were used?

Answer _____

- 25 A rectangle is 5 cm longer than it is wide, and its perimeter is 38 cm. Find its dimensions.

Answer _____

- 26 Two taxi firms charge differently. Firm A charges \$4 plus \$2 a mile; firm B charges \$10 plus \$1.25 a mile. At what distance do they cost the same?

Answer _____

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Reasoning · answer in your own words

SECTION F Explain your reasoning

A sentence or two each.

- 27 A student solves $3(x + 2) = 18$ by writing $3x + 2 = 18$. Explain the error and give the correct solution.

Answer _____

- 28 How can you check a solution without re-solving the equation? Demonstrate with $x = 5$ in $4x - 3 = 17$.

Answer _____

THE MISTAKE TO AVOID

Distributing to only the first term inside the brackets. $3(x + 2)$ is $3x + 6$, never $3x + 2$. The same applies with a negative outside: $-2(x - 5)$ is $-2x + 10$, because the minus multiplies both terms.

Answer Key

ANSWER KEY · PAGE 1 OF 3

Every solution substituted back into its original equation at build time.

SECTION A

1. $x = 5$ -7 , then $\div 3$

2. $x = 5$ $+8$, then $\div 5$

3. $x = 16$ -6 , then $\times 4$

4. $x = 4$ -9 , then $\div -2$

5. $x = -3$ -4 , then $\div 7$

6. $x = 9$ $+5$, then $\times 3$

SECTION B

7. $x = 4$ $4x = 16$

8. $x = 4$ $4x = 16$

9. $x = 4$ $12 = 3x$

10. $x = 5$ $25 = 5x$

11. $x = 5$ $5x = 25$

12. $x = -1$ $5x = -5$

Answer Key

ANSWER KEY · PAGE 2 OF 3

Every solution substituted back into its original equation at build time.

SECTION C

13. $x = 3$ $3x + 12 = 21$

14. $x = 4$ $10x - 5 = 35$

15. $x = 7$ $4x - 12 = 2x + 2$

16. $x = 2$ $-2x - 10 = 3x - 20$

17. $x = 5$ $6x - 8 = 2x + 12$

18. $x = 4$ $2x + 3 = 11$

SECTION D

19. $x = 12$ $\times 6: 3x + 2x = 60$

20. $x = 8$ $\times 5: 2x - 1 = 15$

21. $x = 8$ $\times 4: 3x - 8 = 2x$

22. $x = \frac{5}{2}$ $5 = 2x$, so $x = \frac{5}{2}$

Answer Key

ANSWER KEY · PAGE 3 OF 3

Every solution substituted back into its original equation at build time.

SECTION E

23. Let the smallest be x : $x + (x + 1) + (x + 2) = 72$, so $3x + 3 = 72$ and $x = 23$. The integers are **23, 24 and 25**.

24. $15 + 0.10m = 32$, so $0.10m = 17$ and $m = 170$. **170 minutes**.

25. Let the width be w : $2w + 2(w + 5) = 38$, so $4w + 10 = 38$ and $w = 7$. **7 cm by 12 cm**.

26. $4 + 2m = 10 + 1.25m$, so $0.75m = 6$ and $m = 8$. They cost the same at **8 miles**.

SECTION F

27. They multiplied only the first term inside the brackets. The 3 must multiply *every* term: $3x + 6 = 18$, so $3x = 12$ and $x = 4$. Their version gives $x = \frac{16}{3}$, which does not satisfy the original equation.

28. Substitute it into the original equation and check both sides match. $4(5) - 3 = 20 - 3 = 17$, and the right side is 17, so $x = 5$ is correct. Substituting catches arithmetic slips that re-solving the same way would repeat.