

Introduction to Equations and Solutions

Name: _____

Date: _____

Score: _____ / 24

Q Quick Review

An **equation** is a mathematical sentence that uses an equals sign to say two expressions have the same value. The equation $2x + 3 = 11$ reads “two times a number, plus three, equals eleven.” A **solution** is a value that makes the equation true when you substitute it. To **check** if a value is a solution, substitute it for the variable and simplify both sides. If the two sides come out equal, you’ve found a solution; if not, you haven’t. When **translating words to equations**, certain phrases are reliable signals: “sum,” “more than,” or “increased by” $\rightarrow +$; “difference,” “less than,” or “decreased by” $\rightarrow -$ (and watch out — “less than” *reverses* the order!); “product” or “times” $\rightarrow \times$; “quotient” or “divided by” $\rightarrow \div$; and “is” or “equals” $\rightarrow =$.

PRACTICE

Determine if the value is a solution (Yes/No), or translate.

- | | | | |
|-----------------------------------|-------|---|-------|
| 1. $x + 9 = 14$; $x = 5$? | _____ | 11. $2(x + 3) = 14$; $x = 4$? | _____ |
| 2. $2x - 3 = 7$; $x = 5$? | _____ | 12. “Half a number is 9” | _____ |
| 3. $4a + 1 = 17$; $a = 3$? | _____ | 13. $6x = 24$; $x = 4$? | _____ |
| 4. $5n - 10 = 0$; $n = 2$? | _____ | 14. $x^2 - 9 = 0$; $x = 3$? | _____ |
| 5. $\frac{x}{3} = 6$; $x = 18$? | _____ | 15. $5x + 2 = 22$; $x = 4$? | _____ |
| 6. $3(y - 2) = 12$; $y = 6$? | _____ | 16. $\frac{x - 1}{2} = 3$; $x = 7$? | _____ |
| 7. “A number plus 8 is 15” | _____ | 17. “Twice a number, increased by 5, is 13” | _____ |
| 8. “Three times a number is 21” | _____ | 18. “Five less than a number is 12” | _____ |
| 9. “A number minus 4 equals 10” | _____ | 19. “The quotient of a number and 4 is 7” | _____ |
| 10. $7 - x = 3$; $x = 4$? | _____ | 20. $3x + 1 = 10$; $x = 3$? | _____ |

◆ Word Problems

21. A gym charges a one-time fee of \$25 plus \$10 per month. After m months Carlos has paid \$75. Write an equation and find the number of months.

22. Priya is checking homework and says $x = 3$ is a solution of $2x + 4 = 12$. Test her claim carefully and decide whether $x = 3$ really makes the equation true.

23. A book costs \$3 less than twice the price of a magazine. If a book costs \$15, write an equation and find the price of the magazine.

24. Aisha is thinking of a number. When she triples it and adds 7, she gets 25. Write an equation and find her number.



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Answer Keys

- | | |
|--|--|
| 1. <input type="text" value="Yes"/> | 13. <input type="text" value="Yes"/> |
| 2. <input type="text" value="Yes"/> | 14. <input type="text" value="Yes"/> |
| 3. <input type="text" value="No"/> | 15. <input type="text" value="Yes"/> |
| 4. <input type="text" value="Yes"/> | 16. <input type="text" value="Yes"/> |
| 5. <input type="text" value="Yes"/> | 17. <input type="text" value="2x + 5 = 13"/> |
| 6. <input type="text" value="Yes"/> | 18. <input type="text" value="x - 5 = 12"/> |
| 7. <input type="text" value="x + 8 = 15"/> | 19. <input type="text" value="x/4 = 7"/> |
| 8. <input type="text" value="3x = 21"/> | 20. <input type="text" value="Yes"/> |
| 9. <input type="text" value="x - 4 = 10"/> | 21. <input type="text" value="m = 5"/> |
| 10. <input type="text" value="Yes"/> | 22. <input type="text" value="No"/> |
| 11. <input type="text" value="Yes"/> | 23. <input type="text" value="\$9"/> |
| 12. <input type="text" value="1/2 x = 9"/> | 24. <input type="text" value="x = 6"/> |

Step-by-Step Tutor Notes

- Check the proposed value by substituting 5 for x : $5 + 9 = 14$. The left side equals the right side, so $x = 5$ is a solution.
- Put the given value into the expression first, then simplify from the inside out. Substitute: $2(5) - 3 = 10 - 3 = 7$. Equals the right side, so yes. That confirms the final answer is Yes.
- Substitute: $4(3) + 1 = 12 + 1 = 13$. But the right side is 17, and $13 \neq 17$. So no. (The actual solution would be $a = 4$, since $4(4) + 1 = 17$.)
- Put the given value into the expression first, then simplify from the inside out. Substitute: $5(2) - 10 = 10 - 10 = 0$. Both sides are 0, so yes. That confirms the final answer is Yes.
- Put the given value into the expression first, then simplify from the inside out. Substitute: $\frac{18}{3} = 6$. Match, so yes. That confirms the final answer is Yes.
- Put the given value into the expression first, then simplify from the inside out. Substitute: $3(6 - 2) = 3(4) = 12$. Match, so yes. That confirms the final answer is Yes.
- "Plus" is +, "is" is =. Pick a letter — x is traditional — and you've got $x + 8 = 15$.
- Move carefully through the arithmetic; one clean operation usually unlocks the next one. "Times" means multiply. Three times the unknown is $3x$, and "is" equates: $3x = 21$. After simplifying, the answer is $3x = 21$.
- Focus on the main idea of the problem, then simplify carefully. Pretty direct: "minus" is -, "equals" is =. Result: $x - 4 = 10$. So the answer is $x - 4 = 10$.
- The safest move is to replace the variable, keep the arithmetic organized, and simplify one step at a time. Substitute: $7 - 4 = 3$. Match, so yes. That confirms the final answer is Yes.
- Put the given value into the expression first, then simplify from the inside out. Substitute: $2(4 + 3) = 2(7) = 14$. Match, so yes. That confirms the final answer is Yes.
- "Half a number" is the same as $\frac{1}{2}$ times the number. Equation: $\frac{1}{2}x = 9$ (or equivalently $\frac{x}{2} = 9$).
- Put the given value into the expression first, then simplify from the inside out. Substitute: $6(4) = 24$. Match, so yes. That confirms the final answer is Yes.
- Substitute: $(3)^2 - 9 = 9 - 9 = 0$. Match, so yes. (Fun fact: $x = -3$ also works here, because $(-3)^2 = 9$ too. Squared equations often have two solutions.)
- Put the given value into the expression first, then simplify from the inside out. Substitute: $5(4) + 2 = 20 + 2 = 22$. Match, so yes. That confirms the final answer is Yes.
- Start by substituting the given value or values carefully, using parentheses when a value is negative. Substitute: $\frac{7-1}{2} = \frac{6}{2} = 3$. Match, so yes. That confirms the final answer is Yes.
- "Twice a number" is $2x$. "Increased by 5" adds 5. "Is 13" makes it equal 13. Put it together: $2x + 5 = 13$.
- Here's the tricky one. "Less than" reverses the order — "five less than a number" means "a number minus five," not "five minus a number." So $x - 5 = 12$.
- "Quotient" means division. "A number divided by 4" is $\frac{x}{4}$. "Is 7" makes it equal 7. So $\frac{x}{4} = 7$.
- Start by substituting the given value or values carefully, using parentheses when a value is negative. Substitute: $3(3) + 1 = 9 + 1 = 10$. Match, so yes. That confirms the final answer is Yes.
- Total paid is the one-time fee plus monthly fees: $10m + 25 = 75$. To solve, peel off the 25 first — subtract 25 from both sides: $10m = 50$. Then divide both sides by 10: $m = 5$. Carlos has been a member for 5 months.
- Substitute $x = 3$ into the left side: $2(3) + 4 = 6 + 4 = 10$. But the right side is 12, and $10 \neq 12$, so $x = 3$ is not a solution. (For reference, the real solution is $x = 4$: $2(4) + 4 = 12$, checked.)
- Let m be the magazine price. "Twice the price of a magazine" is $2m$, and "three dollars less than that" subtracts 3: $2m - 3$. That equals the book price of 15, so the equation is $2m - 3 = 15$. Add 3 to both sides: $2m = 18$. Divide by 2: $m = 9$. The magazine costs \$9.
- Let her number be x . "Triple it and add 7" gives $3x + 7$, and the result is 25, so the equation is $3x + 7 = 25$. Subtract 7 first: $3x = 18$. Divide by 3: $x = 6$. Aisha was thinking of 6.



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