Introduction to Equations and Solutions

Name: _____	Date: _____	Score: _____ / 24

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

_____

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Answer Keys

1. Yes
2. Yes
3. No
4. Yes
5. Yes
6. Yes
7. $x + 8 = 15$
8. $3x = 21$
9. $x - 4 = 10$
10. Yes
11. Yes
12. $\frac{1}{2}x = 9$
13. Yes
14. Yes
15. Yes
16. Yes
17. $2x + 5 = 13$
18. $x - 5 = 12$
19. $\frac{x}{4} = 7$
20. Yes
21. $m = 5$
22. No
23. $9
24. $x = 6$

Step-by-Step Tutor Notes

1. 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.
2. 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.
3. 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 $4(4) + 1 = 17$.).
4. 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.
5. 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.
6. 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.
7. "Plus" is $+$, "is" is $=$. Pick a letter — x is traditional — and you've got $x + 8 = 15$.
8. 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 $3x = 21$.
9. 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 $x - 4 = 10$.
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.
11. 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.
12. "Half a number" is the same as $\frac{1}{2}$ times the number. Equation: $\frac{1}{2}x = 9$ (or equivalently $\frac{x}{2} = 9$).
13. 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.
14. 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.).
15. 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.
16. 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.
17. "Twice a number" is $2x$. "Increased by 5" adds 5. "Is 13" makes it equal 13. Put it together: $2x + 5 = 13$.
18. 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 $x - 5 = 12$.
19. "Quotient" means division. "A number divided by 4" is $\frac{x}{4}$. "Is 7" makes it equal 7. So $\frac{x}{4} = 7$.
20. 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.
21. 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.
22. 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.).
23. 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.
24. 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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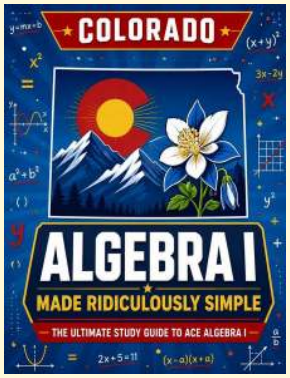

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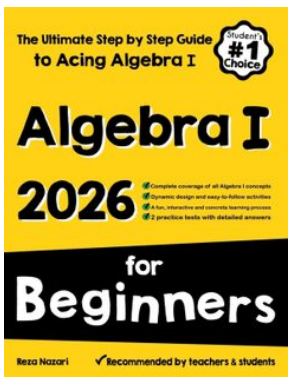

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