Absolute Value Equations

Name: _____	Date: _____	Score: _____ / 24

Quick Review

Absolute value measures **distance from zero**. To solve $|A| = c$, first make sure the absolute value is isolated. If $c < 0$, there is no solution because distance cannot be negative. If $c \geq 0$, split into two equations: $A = c$ or $A = -c$. Then solve both and check for any extraneous answers if the equation had extra steps before the split.

PRACTICE

Solve each absolute value equation.

1. $|x| = 9$ _____
2. $|x - 4| = 6$ _____
3. $|n + 3| = 5$ _____
4. $|2x| = 14$ _____
5. $|3x - 6| = 12$ _____
6. $|x + 7| = 0$ _____
7. $|x| = -4$ _____
8. $|x - 1| + 3 = 10$ _____
9. $2|x + 5| = 18$ _____
10. $5 - |x| = 1$ _____
11. $|4x + 1| = 9$ _____
12. $|x/3| = 5$ _____
13. $|2x - 7| = 1$ _____
14. $|x + 2| - 4 = 0$ _____
15. $3|x - 8| = 0$ _____
16. $|6 - 2x| = 10$ _____
17. $|x + 1| = |5|$ _____
18. $|x - 10| = 2.5$ _____
19. $|0.5x| = 3$ _____
20. $|x + 4| + 2 = -1$ _____

Word Problems

21. A target value is 50. A measurement is exactly 7 units away from the target. Write and solve an absolute value equation.

_____

22. A student's score is exactly 4 points from 86. What are the possible scores?

_____

23. A machine part should be 12 cm long. One part is exactly 0.3 cm from the target length. Find the possible lengths.

_____

24. A city block is centered at avenue 0. A store is exactly 5 blocks from the center. What avenue numbers are possible?

_____

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Answer Keys

1. $x = 9$ or $x = -9$
2. $x = 10$ or $x = -2$
3. $n = 2$ or $n = -8$
4. $x = 7$ or $x = -7$
5. $x = 6$ or $x = -2$
6. $x = -7$
7. no solution
8. $x = 8$ or $x = -6$
9. $x = 4$ or $x = -14$
10. $x = 4$ or $x = -4$
11. $x = 2$ or $x = -\frac{5}{2}$
12. $x = 15$ or $x = -15$
13. $x = 4$ or $x = 3$
14. $x = 2$ or $x = -6$
15. $x = 8$
16. $x = -2$ or $x = 8$
17. $x = 4$ or $x = -6$
18. $x = 12.5$ or $x = 7.5$
19. $x = 6$ or $x = -6$
20. no solution
21. $|m - 50| = 7;\ m = 57$ or 43
22. 82 or 90
23. 11.7 cm or 12.3 cm
24. -5 or 5

Step-by-Step Tutor Notes

1. Absolute value is distance from 0. The numbers 9 units from 0 are 9 and -9.
2. The expression $x - 4$ must be 6 or -6. Solving $x - 4 = 6$ gives $x = 10$; solving $x - 4 = -6$ gives $x = -2$.
3. Split the distance equation: $n + 3 = 5$ or $n + 3 = -5$. That gives $n = 2$ or $n = -8$.
4. The inside can equal 14 or -14. So $2x = 14$ gives $x = 7$, and $2x = -14$ gives $x = -7$.
5. Make two linear equations: $3x - 6 = 12$ and $3x - 6 = -12$. They solve to $x = 6$ and $x = -2$.
6. An absolute value is 0 only when the inside is exactly 0. Solve $x + 7 = 0$ to get $x = -7$.
7. Use the clue in the question first, then let the arithmetic finish the job. Distance can never be negative, so no real value of x can make $|x| = -4$. So the answer is no solution.
8. Isolate the absolute value first: $|x - 1| = 7$. Then solve $x - 1 = 7$ or $x - 1 = -7$, giving $x = 8$ or $x = -6$.
9. Divide by 2 before splitting: $|x + 5| = 9$. Then $x + 5 = 9$ or $x + 5 = -9$, so $x = 4$ or $x = -14$.
10. Subtract 5 to get $-|x| = -4$, then multiply by -1: $|x| = 4$. The solutions are $x = 4$ and $x = -4$.
11. Solve both cases. $4x + 1 = 9$ gives $x = 2$; $4x + 1 = -9$ gives $4x = -10$, so $x = -\frac{5}{2}$.
12. The quantity $\frac{x}{3}$ is 5 units from 0, so $\frac{x}{3} = 5$ or $\frac{x}{3} = -5$. Multiply by 3.
13. Set the inside equal to 1 and -1. The equations $2x-7 = 1$ and $2x-7 = -1$ give $x = 4$ and $x = 3$.
14. Add 4 first: $|x + 2| = 4$. Then $x + 2 = 4$ or $x + 2 = -4$, so $x = 2$ or $x = -6$.
15. Divide by 3 to get $|x - 8| = 0$. The inside must be 0, so $x - 8 = 0$ and $x = 8$.
16. Use $6 - 2x = 10$ or $6 - 2x = -10$. The first gives $x = -2$; the second gives $x = 8$.
17. First simplify the right side: $|5| = 5$. Now solve $|x + 1| = 5$, so $x + 1 = 5$ or $x + 1 = -5$.
18. The value is 2.5 units from 10. Move 2.5 to the right and left of 10: 12.5 and 7.5.
19. Split into $0.5x = 3$ and $0.5x = -3$. Dividing by 0.5 gives $x = 6$ or $x = -6$.
20. Subtracting 2 would require $|x + 4| = -3$. Since absolute value cannot be negative, there is no solution.
21. Distance from 50 is modeled by $|m - 50|$. A distance of 7 gives $m = 50 + 7$ or $m = 50 - 7$.
22. Name the quantities first so the model is easy to read. Use $|s - 86| = 4$. The two scores are $86 - 4 = 82$ and $86 + 4 = 90$.
23. Set up the model from the story, then calculate carefully. The equation is $|L - 12| = 0.3$. Move 0.3 below and above 12.
24. Distance from 0 is $|a|$. The equation $|a| = 5$ has two solutions: $a = -5$ and $a = 5$.

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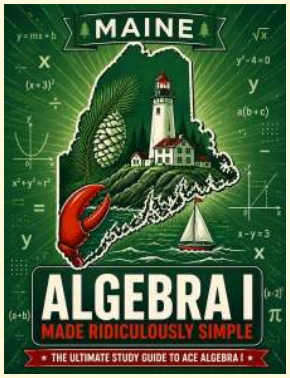

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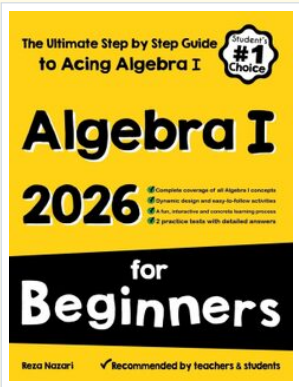

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