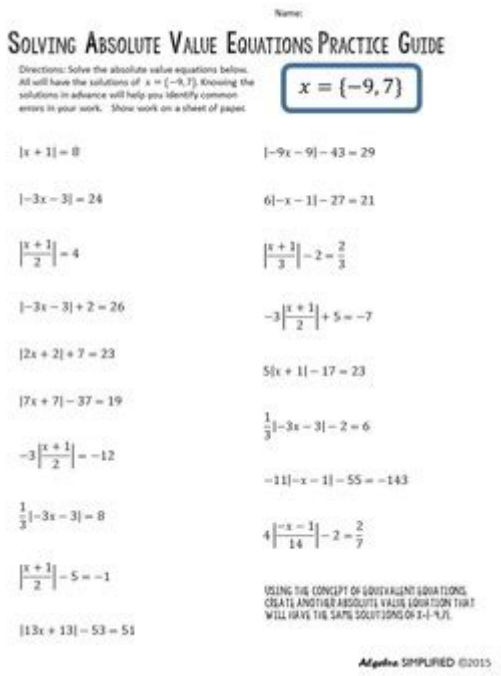
2 5 Practice Solving Equations Involving Absolute Value



Name:

SOLVING ABSOLUTE VALUE EQUATIONS PRACTICE GUIDE

Directions: Solve the absolute value equations below. All will have the solutions of $x = \{-9, 7\}$. Knowing the solutions in advance will help you identify common errors in your work. Show work on a sheet of paper.

$x = \{-9, 7\}$

$|x + 1| = 8$

$|-3x - 3| = 24$

$\left|\frac{x+1}{2}\right| = 4$

$|-3x - 3| + 2 = 26$

$|2x + 2| + 7 = 23$

$|7x + 7| - 37 = 19$

$-3\left|\frac{x+1}{2}\right| = -12$

$\frac{1}{3}|-3x - 3| = 8$

$\left|\frac{x+1}{2}\right| - 5 = -1$

$|13x + 13| - 53 = 51$

$|-9x - 9| - 43 = 29$

$6|-x - 1| - 27 = 21$

$\left|\frac{x+1}{3}\right| - 2 = \frac{2}{3}$

$-3\left|\frac{x+1}{2}\right| + 5 = -7$

$5|x + 1| - 17 = 23$

$\frac{1}{9}|-3x - 3| - 2 = 6$

$-11|-x - 1| - 55 = -143$

$4\left|\frac{-x-1}{14}\right| - 2 = \frac{2}{7}$

USING THE CONCEPT OF EQUIVALENT EQUATIONS, CREATE ANOTHER ABSOLUTE VALUE EQUATION THAT WILL HAVE THE SAME SOLUTIONS OF $\{-9, 7\}$.

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2 5 practice solving equations involving absolute value is an essential mathematical skill that serves as a foundation for many advanced concepts in algebra. Absolute value, denoted as |x|, represents the distance of a number from zero on the number line, regardless of direction. This fundamental property makes absolute value equations unique, as they can yield multiple solutions. In this article, we will explore the concept of absolute value, delve into methods for solving equations that involve it, and provide practice problems to enhance your understanding and proficiency.

Understanding Absolute Value

To grasp how to solve equations involving absolute value, it's crucial to first understand what absolute value means. The absolute value of a number is defined as follows:

- For any positive number \(x \), \(|x| = x \).
- For any negative number \(x \), \(|x| = -x \).
- For zero, \(|0| = 0 \).

This definition tells us that absolute value measures distance. For example, both \(|3| \) and \(|-3| \) equal 3 because both numbers are three units away from zero.

Types of Absolute Value Equations

There are two primary types of absolute value equations:

1. Simple Absolute Value Equations

A simple absolute value equation is one that can be expressed in the form:

$$ |x| = a $$

where $ a $ is a non-negative number. To solve this type of equation, you can split it into two separate equations:

- $ x = a $
- $ x = -a $

For example, to solve $ |x| = 5 $:

1. Set up the two equations:
- $ x = 5 $
- $ x = -5 $

2. The solutions are $ x = 5 $ and $ x = -5 $.

2. Absolute Value Equations with Expressions

These equations involve expressions on one or both sides, such as:

$$ |ax + b| = c $$

To solve these equations, follow these steps:

1. Isolate the absolute value expression.
2. Set up two cases based on the definition of absolute value.
3. Solve each case for $ x $.

For example, consider the equation $ |2x - 3| = 7 $:

1. Isolate the absolute value (it's already isolated).

2. Set up the two cases:
- $2x - 3 = 7$
- $2x - 3 = -7$

3. Solve each case:
- For $2x - 3 = 7$:
- $2x = 10$
- $x = 5$

- For $2x - 3 = -7$:
- $2x = -4$
- $x = -2$

4. The solutions are $x = 5$ and $x = -2$.

Steps to Solve Absolute Value Equations

To systematically approach solving absolute value equations, follow these steps:

1. Isolate the Absolute Value: Make sure the absolute value expression is alone on one side of the equation.
2. Set Up Cases: Create two separate equations based on the definition of absolute value.
3. Solve Each Case: Solve for the variable in each case separately.
4. Check for Extraneous Solutions: Substitute your solutions back into the original equation to ensure they work.

Practice Problems

Now that we've reviewed the concepts, it's time to practice solving absolute value equations. Below are several problems of varying difficulty, along with their solutions.

Problem Set

1. Solve the equation $|x + 4| = 10$.
2. Solve the equation $|3x - 5| = 8$.
3. Solve the equation $|2x + 1| = 7$.
4. Solve the equation $|x - 2| + 3 = 6$.
5. Solve the equation $|x^2 - 4| = 0$.

Solutions

1. For $|x + 4| = 10$:
- $x + 4 = 10$ or $x + 4 = -10$
- Solutions: $x = 6$ and $x = -14$.

2. For $|3x - 5| = 8$:
- $3x - 5 = 8$ or $3x - 5 = -8$
- Solutions: $x = \frac{13}{3}$ and $x = -1$.

3. For $|2x + 1| = 7$:
- $2x + 1 = 7$ or $2x + 1 = -7$
- Solutions: $x = 3$ and $x = -4$.

4. For $|x - 2| + 3 = 6$:
- $|x - 2| = 3$
- $x - 2 = 3$ or $x - 2 = -3$
- Solutions: $x = 5$ and $x = -1$.

5. For $|x^2 - 4| = 0$:
- $x^2 - 4 = 0$
- $x^2 = 4$
- Solutions: $x = 2$ and $x = -2$.

Conclusion

Solving absolute value equations is a vital skill in algebra that enhances problem-solving capabilities. By understanding the definition of absolute value and practicing various types of equations, you can develop a strong foundation in mathematics. The key to mastering these problems lies in consistently practicing the steps outlined above and working through a variety of examples. With time and effort, you will find that solving equations involving absolute value becomes straightforward and even enjoyable!

Frequently Asked Questions

What is the absolute value of an equation?

The absolute value of an equation refers to the distance of a number from zero on the number line, regardless of direction. For example, $|x| = a$ means x can be either a or $-a$.

How do you solve an equation that includes absolute value?

To solve an equation involving absolute value, you typically split the equation into two separate cases: one where the expression inside the absolute value is equal to the positive value and another where it is equal to the negative value.

What does the equation |x - 3| = 5 represent?

The equation |x - 3| = 5 represents two separate equations: x - 3 = 5 and x - 3 = -5. Solving these gives x = 8 and x = -2.

Can absolute value equations have no solution?

Yes, an absolute value equation can have no solution if the equation sets the absolute value equal to a negative number. For example, |x| = -3 has no solution.

What are the steps to graph an absolute value equation?

To graph an absolute value equation, identify the vertex (the point where the graph changes direction), plot the key points based on the equation, and then draw the V-shaped graph reflecting the positive and negative parts of the absolute value.

How do you check your solution for an absolute value equation?

To check your solution, substitute the found values back into the original equation. If both sides are equal after substitution, the solution is correct.

What is the difference between |x| = a and |x| < a?

The equation |x| = a has two solutions, x = a and x = -a, while |x| < a indicates that x can take any value between -a and a, which represents an interval solution.

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