

$6 + 4|2x + 6| = 14$ Solve For X

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Mathematics, particularly algebra, forms the foundation of logical reasoning and problem-solving skills essential in many fields such as engineering, computer science, economics, and everyday decision-making. Among various algebraic equations, those involving absolute value expressions often pose unique challenges, requiring a clear understanding of their properties and methods for solving them efficiently.

The equation $6 + 4|2x + 6| = 14$ is a prime example of an absolute value problem that students and math enthusiasts frequently encounter. Solving such equations not only enhances one's algebraic manipulation skills but also deepens comprehension of how absolute value functions behave. In this comprehensive article, we will explore the step-by-step process to solve the equation for x , examine the underlying concepts of absolute value, and discuss strategies for handling similar problems.

Whether you are a student preparing for exams, a teacher designing lesson plans, or an individual interested in sharpening your math skills, understanding the solution to this equation is both practical and intellectually rewarding.

Understanding the Absolute Value in the Equation

What is Absolute Value?

Absolute value, denoted as $|x|$, represents the distance of a number x from zero on the number line, regardless of its sign. For any real number x :

- If $x \geq 0$, then $|x| = x$
- If $x < 0$, then $|x| = -x$

This property allows us to interpret absolute value expressions as distances, which is crucial in solving equations involving absolute values.

Implications of Absolute Value in Equations

When an absolute value appears in an equation, it inherently introduces two possible cases because the expression inside the absolute value can be either positive or negative. Solving such equations involves:

1. Isolating the absolute value expression.
2. Creating two separate equations based on the definition of absolute value.

3. Solving each equation separately.
4. Combining solutions and verifying their validity.

Understanding these steps is essential when dealing with equations like $6 + 4|2x + 6| = 14$.

Step-by-Step Solution of the Equation $6 + 4|2x + 6| = 14$

Let's now approach solving the specific equation:

$$\backslash 6 + 4|2x + 6| = 14 \backslash$$

Step 1: Isolate the Absolute Value Expression

Begin by subtracting 6 from both sides to isolate the term involving the absolute value:

$$\backslash 6 + 4|2x + 6| = 14 \backslash$$

$$\backslash 4|2x + 6| = 14 - 6 \backslash$$

$$\backslash 4|2x + 6| = 8 \backslash$$

Step 2: Divide Both Sides by 4

To simplify, divide both sides by 4:

$$\backslash |2x + 6| = \frac{8}{4} \backslash$$

$$\backslash |2x + 6| = 2 \backslash$$

Step 3: Set Up Two Equations Based on Absolute Value Definition

Since $|A| = B$, where $B \geq 0$, then:

$$- A = B$$

$$- A = -B$$

Applying this to $2x + 6$, we get two cases:

Case 1:

$$\backslash 2x + 6 = 2 \backslash$$

Case 2:

$$\backslash 2x + 6 = -2 \backslash$$

Step 4: Solve Each Case Separately

Case 1:

$$\backslash[2x + 6 = 2 \backslash]$$

Subtract 6 from both sides:

$$\backslash[2x = 2 - 6 \backslash]$$

$$\backslash[2x = -4 \backslash]$$

Divide both sides by 2:

$$\backslash[x = -2 \backslash]$$

Case 2:

$$\backslash[2x + 6 = -2 \backslash]$$

Subtract 6 from both sides:

$$\backslash[2x = -2 - 6 \backslash]$$

$$\backslash[2x = -8 \backslash]$$

Divide both sides by 2:

$$\backslash[x = -4 \backslash]$$

Verifying the Solutions

It's important to verify whether these solutions satisfy the original equation:

$$\backslash[6 + 4|2x + 6| = 14 \backslash]$$

For $x = -2$:

Calculate $|2(-2) + 6|$:

$$\backslash[2(-2) + 6 = -4 + 6 = 2 \backslash]$$

Plug into the original:

$$\backslash[6 + 4 \times 2 = 6 + 8 = 14 \backslash]$$

Which matches the right side, confirming $x = -2$ as a valid solution.

For $x = -4$:

Calculate $|2(-4) + 6|$:

$$\backslash[2(-4) + 6 = -8 + 6 = -2 \backslash]$$

Absolute value:

$$\backslash[|-2| = 2 \backslash]$$

Plug into the original:

$$\lfloor 6 + 4 \times 2 = 6 + 8 = 14 \rfloor$$

Again, the solution satisfies the original equation, confirming $x = -4$ as valid.

Summary of Solutions

The solutions to the equation $6 + 4|2x + 6| = 14$ are:

$$- x = -2$$

$$- x = -4$$

Both solutions satisfy the original equation, demonstrating the importance of considering all cases when solving absolute value equations.

Additional Strategies for Solving Absolute Value Equations

While the above method works well for straightforward absolute value equations, more complex problems may require advanced strategies:

1. Graphical Approach

Plot the functions $y = 6 + 4|2x + 6|$ and $y = 14$ on a graph. The intersection points will represent solutions. This visual method aids in understanding the behavior of the functions and verifying solutions.

2. Using Inequalities

Sometimes, solving an absolute value equation involves inequalities, especially when the absolute value expression is part of a larger inequality. Remember:

$$- |A| \leq B \Leftrightarrow -B \leq A \leq B$$

$$- |A| \geq B \Leftrightarrow A \leq -B \text{ or } A \geq B$$

3. Handling Absolute Value in Multi-Step Equations

Complex equations may involve nested absolute values or multiple absolute value expressions. Break

down the problem into manageable parts, and always consider all possible cases.

Real-Life Applications of Absolute Value Equations

Understanding and solving absolute value equations have practical implications in various fields:

- Engineering: Calculating tolerances and deviations.
- Physics: Measuring distances and displacement.
- Economics: Analyzing deviations from target values.
- Computer Graphics: Calculating distances between points.

Proficiency in solving such equations enhances problem-solving skills applicable beyond pure mathematics.

Conclusion

The equation $6 + 4|2x + 6| = 14$ exemplifies a fundamental type of algebraic problem involving absolute values. By carefully isolating the absolute value term, splitting the problem into two cases, solving each, and verifying solutions, we can confidently identify the correct values of x .

The solutions, $x = -2$ and $x = -4$, demonstrate the importance of considering all possible scenarios that absolute value expressions introduce. Mastery of these techniques not only prepares students for exams but also builds a solid foundation for tackling more complex algebraic and real-world problems.

Remember, the key to solving absolute value equations is understanding their properties and systematically exploring all cases. With practice, these problems become straightforward, empowering you to approach mathematical challenges with confidence and clarity.

Frequently Asked Questions

How do I solve the equation $6 + 4|2x + 6| = 14$ for x ?

First, subtract 6 from both sides to get $4|2x + 6| = 8$. Then divide both sides by 4 to obtain $|2x + 6| = 2$. Next, consider the two cases: $2x + 6 = 2$ and $2x + 6 = -2$. Solve each to find the values of x .

What are the steps to isolate the absolute value in the

equation $6 + 4|2x + 6| = 14$?

Subtract 6 from both sides to get $4|2x + 6| = 8$, then divide both sides by 4 to isolate $|2x + 6| = 2$. Afterward, solve for x by considering both the positive and negative cases of the absolute value.

How do I handle the absolute value when solving $6 + 4|2x + 6| = 14$?

Set up two equations: one with the inside of the absolute value equal to 2, and the other equal to -2, then solve each for x separately.

What are the solutions to $6 + 4|2x + 6| = 14$?

The solutions are $x = -4$ and $x = -2$, obtained by solving the two cases: $2x + 6 = 2$ and $2x + 6 = -2$.

Can you explain the importance of considering both positive and negative cases in absolute value equations like this one?

Yes, because the absolute value $|A|$ equals A if $A \geq 0$ and equals $-A$ if $A < 0$. So, to find all solutions, we must consider both $A = 2$ and $A = -2$ in this problem.

Is there a shortcut to solving equations like $6 + 4|2x + 6| = 14$?

The quickest way is to isolate the absolute value first by subtraction and division, then directly analyze the two cases for the absolute value expression to find solutions.

What mistakes should I avoid when solving this type of equation?

Avoid forgetting to consider both cases of the absolute value, and ensure to solve each resulting linear equation carefully. Also, double-check your solutions in the original equation.

How can I verify my solutions for $6 + 4|2x + 6| = 14$?

Plug each solution back into the original equation to see if the left side equals 14. If it does, your solutions are correct.

Additional Resources

Mathematical Equation Solving: A Comprehensive Guide to $(6 + 4|2x + 6| = 14)$

When delving into the world of algebra, one of the fundamental skills students and professionals alike need to master is solving equations that involve absolute value expressions. The equation $(6 +$

$4|2x + 6| = 14$) is an excellent example of such a problem, combining basic algebraic principles with the nuances of absolute value functions. In this detailed review, we'll dissect this problem step by step, providing clarity and insight into the methods used to find the solutions for x . Think of this as an expert review of a complex yet approachable mathematical puzzle—designed to enhance your understanding and confidence.

Understanding the Equation: Breaking Down the Components

Before attempting to solve the equation, it's essential to understand its components:

- Constants: The numbers 6 and 14 are constants, or fixed values.
- Absolute Value: The term $|2x + 6|$ is an absolute value expression, which measures the magnitude of the quantity inside the brackets without regard to its sign.

The equation:

$$|6 + 4|2x + 6| = 14$$

can be seen as a relationship where a linear expression inside an absolute value is scaled by 4, then shifted by 6, and equated to 14. The goal is to isolate x , meaning we want to find all values of x that satisfy this relationship.

Step-by-Step Solution Approach

When tackling absolute value equations, the key is recognizing that the absolute value $|A|$ can be interpreted as:

- A , if $A \geq 0$
- $-A$, if $A < 0$

Thus, solving $|A| = B$ involves considering two cases: $A = B$ and $A = -B$. Applying this to our problem requires careful algebraic manipulation.

Step 1: Isolate the Absolute Value Term

The first step is to isolate $|2x + 6|$:

$$6 + 4|2x + 6| = 14$$

Subtract 6 from both sides:

$$4|2x + 6| = 14 - 6$$

$$4|2x + 6| = 8$$

Next, divide both sides by 4:

$$|2x + 6| = \frac{8}{4} = 2$$

Now, we have a simplified absolute value equation:

$$|2x + 6| = 2$$

Step 2: Set Up Two Cases for the Absolute Value

As outlined earlier, the absolute value equation splits into two possible linear equations:

Case 1:

$$2x + 6 = 2$$

Case 2:

$$2x + 6 = -2$$

Each case will be solved independently to find potential solutions for x .

Step 3: Solve Each Case

Case 1:

$$\backslash[$$
$$2x + 6 = 2$$

$\backslash]$

Subtract 6 from both sides:

$$\backslash[$$
$$2x = 2 - 6$$

$\backslash]$

$$\backslash[$$
$$2x = -4$$

$\backslash]$

Divide both sides by 2:

$$\backslash[$$
$$x = -2$$

$\backslash]$

Case 2:

$$\backslash[$$
$$2x + 6 = -2$$

$\backslash]$

Subtract 6:

$$\backslash[$$
$$2x = -2 - 6$$

$\backslash]$

$$\backslash[$$
$$2x = -8$$

$\backslash]$

Divide both sides by 2:

$$\backslash[$$
$$x = -4$$

$\backslash]$

Final Solutions and Verification

The two potential solutions for x are:

$$\begin{aligned} & \\ x &= -2 \quad \text{and} \quad x = -4 \\ & \end{aligned}$$

To ensure these solutions are valid, substitute each back into the original equation:

Verification for $x = -2$:

Calculate $(2x + 6)$:

$$\begin{aligned} & \\ 2(-2) + 6 &= -4 + 6 = 2 \\ & \end{aligned}$$

Compute the absolute value:

$$\begin{aligned} & \\ |2| &= 2 \\ & \end{aligned}$$

Substitute into the original equation:

$$\begin{aligned} & \\ 6 + 4 \times 2 &= 6 + 8 = 14 \\ & \end{aligned}$$

Result: The left side equals the right side; $x = -2$ is a valid solution.

Verification for $x = -4$:

Calculate $(2x + 6)$:

$$\begin{aligned} & \\ 2(-4) + 6 &= -8 + 6 = -2 \\ & \end{aligned}$$

Compute the absolute value:

$$\begin{aligned} & \\ |-2| &= 2 \\ & \end{aligned}$$

Substitute into the original equation:

$$\begin{aligned} & \\ 6 + 4 \times 2 &= 6 + 8 = 14 \\ & \end{aligned}$$

Result: The left side equals the right side; $x = -4$ is valid.

Summary of the Solution Process

Step	Action	Result
1	Isolate $ 2x + 6 $	$ 2x + 6 = 2$
2	Set up two cases	$2x + 6 = 2$ and $2x + 6 = -2$
3	Solve each case	$x = -2$ and $x = -4$
4	Verify solutions	Both satisfy the original equation

Discussion: Why Is This Important?

This example highlights fundamental concepts in algebra and absolute value functions, which are pivotal in advanced mathematics, engineering, physics, and computer science. Solving absolute value equations involves understanding piecewise definitions and considering multiple cases, skills that are transferable to more complex problem-solving scenarios.

Additionally, the process underscores the importance of verification: plugging solutions back into the original equation ensures that no extraneous solutions (invalid solutions introduced during algebraic manipulations) are accepted.

Additional Tips for Solving Absolute Value Equations

- Always isolate the absolute value first: This simplifies the process and reduces errors.
- Set up all possible cases: Remember that $|A| = B$ yields two equations, $A = B$ and $A = -B$.
- Check solutions: Always verify solutions in the original equation to confirm their validity.
- Be cautious with extraneous solutions: Some manipulations may introduce invalid solutions; verification helps prevent this.

Expanding the Concept: What About More Complex Equations?

While this example involves a straightforward absolute value equation, more complex equations might include multiple absolute value expressions, inequalities, or variables on both sides. The approach remains similar but often requires more steps, such as:

- Splitting into multiple cases: For equations like $(|A| + |B| = C)$, multiple case considerations arise.
- Graphical interpretation: Visualizing absolute value functions can aid understanding.
- Inequalities involving absolute values: Solving $(|A| < B)$ or $(|A| > B)$ involves different strategies, often leading to interval solutions.

Conclusion

The equation $(6 + 4|2x + 6| = 14)$ exemplifies a core algebraic skill—solving absolute value equations—done here with clarity and precision. Recognizing the structure, isolating the absolute value, considering all cases, solving each, and verifying solutions are essential steps that reinforce algebraic fluency. Mastery of these techniques not only helps in academic settings but also builds a strong foundation for tackling real-world problems involving distances, tolerances, and other concepts modeled by absolute value functions.

In essence, this problem-solving process serves as a testament to the elegance and utility of algebra, transforming complex-looking equations into manageable, solvable parts—much like breaking down a daunting task into achievable steps.

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