

$|3(x-2)|=12$ Please Explain Too!

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Mathematics can sometimes seem daunting, especially when dealing with absolute value equations like $|3(x-2)|=12$. If you're struggling to understand what this equation represents or how to solve it, you're not alone. In this comprehensive guide, we'll explore the meaning of the absolute value, step-by-step solutions to the equation, and tips to help you master similar problems. By the end of this article, you'll have a clear understanding of how to approach and solve equations like $|3(x-2)|=12$ with confidence.

Understanding Absolute Value and Its Significance

Before diving into solving the specific equation, it's crucial to understand what the absolute value symbol $| |$ means in mathematics.

What Is Absolute Value?

Absolute value is a mathematical concept that measures the distance of a number from zero on the number line, regardless of direction. For any real number a :

- If $a \geq 0$, then $|a| = a$.
- If $a < 0$, then $|a| = -a$.

In simple terms, the absolute value of a number is always non-negative.

Visualizing Absolute Value

Imagine the number line:

- The absolute value of 3 ($|3|$) is 3, because 3 is three units away from zero.
- The absolute value of -3 ($|-3|$) is also 3, because -3 is three units away from zero, just in the opposite direction.

Why Is Absolute Value Important?

Absolute value is essential in various real-world applications, such as:

- Distance calculations (e.g., how far apart two points are).
- Engineering tolerances and error margins.

- Financial calculations involving deviations.

Deciphering the Equation $|3(x-2)|=12$

Let's analyze the equation:

$$|3(x-2)| = 12$$

This equation states that the absolute value of the expression $3(x-2)$ equals 12. To solve it, we need to understand what this implies about the expression inside the absolute value.

What Does $|3(x-2)|=12$ Mean?

Since the absolute value of a number equals 12, it means that the number inside the absolute value, which is $3(x-2)$, could be either 12 or -12 because:

$$|A| = B \text{ implies } A = B \text{ or } A = -B.$$

Applying this to our equation:

$$3(x-2) = 12 \text{ or } 3(x-2) = -12.$$

This gives us two separate equations to solve.

Step-by-Step Solution to $|3(x-2)|=12$

Let's break down the process into clear steps.

Step 1: Set Up Two Separate Equations

As established, the absolute value equation splits into:

1. $3(x-2) = 12$
2. $3(x-2) = -12$

Step 2: Solve Each Equation Individually

We'll solve each for x .

Equation 1: $3(x-2) = 12$

- Divide both sides by 3:

$$x - 2 = 4.$$

- Add 2 to both sides:

$$x = 6.$$

Equation 2: $3(x-2) = -12$

- Divide both sides by 3:

$$x - 2 = -4.$$

- Add 2 to both sides:

$$x = -2.$$

Step 3: Write the Final Solution Set

The solutions to the original equation are:

$$x = 6 \text{ and } x = -2.$$

Verifying the Solutions

It's always good practice to check the solutions by substituting them back into the original equation.

Check $x=6$

- Compute $3(6 - 2) = 3(4) = 12$.
- Absolute value: $|12| = 12$, which matches the right side.

Check $x=-2$

- Compute $3(-2 - 2) = 3(-4) = -12$.
- Absolute value: $|-12| = 12$, which matches the right side.

Both solutions are valid.

Additional Tips for Solving Absolute Value Equations

To enhance your understanding and efficiency, keep these tips in mind:

1. Always Split the Equation

Remember, equations involving absolute value can be split into two cases, corresponding to the positive and negative scenarios.

2. Simplify Before Solving

Reduce the equation as much as possible, such as dividing both sides by constants, to make solving easier.

3. Check for Extraneous Solutions

Always verify solutions in the original equation to ensure they are valid.

4. Practice with Different Types

Work through various absolute value equations, including those with more complex expressions inside the absolute value.

Common Mistakes to Avoid

Be mindful of these pitfalls:

- Forgetting to split the equation into two cases.
- Not checking solutions in the original equation.
- Misapplying algebraic steps, such as not dividing both sides properly.

Real-World Applications of Equations Like $|3(x-2)|=12$

Understanding how to solve such equations isn't just an academic exercise; they appear in various practical situations.

Distance Between Points

In coordinate geometry, equations involving absolute values help calculate the distance between points.

Engineering Tolerances

Design specifications often specify allowable deviations, modeled using absolute value equations.

Financial Analysis

Assessing deviations from target values or averages frequently involves absolute value expressions.

Practice Problems to Enhance Your Skills

Try solving these similar equations to strengthen your understanding:

1. $|2x + 5| = 9$

2. $|x - 4| = 7$

3. $|-3x + 1| = 8$

4. $|5(x + 2)| = 15$

For each, follow the same approach: split into two cases, solve, and verify.

Conclusion

Mastering absolute value equations like $|3(x-2)|=12$ enhances your overall algebra skills and prepares you for more complex mathematical concepts. Remember, the key steps involve understanding what the absolute value represents, splitting the equation into two cases, solving each separately, and verifying your solutions. Practice regularly, and you'll find these problems become much more manageable. Whether you're tackling homework, preparing for exams, or applying math in real-world scenarios, these skills are invaluable tools in your mathematical toolkit.

If you want to deepen your understanding, explore related topics such as inequalities involving absolute values, composite functions, and algebraic word problems. With patience and practice, you'll become proficient in solving a wide range of absolute value equations.

Frequently Asked Questions

What is the first step to solve the equation $|3(x - 2)| = 12$?

The first step is to recognize that the absolute value equation $|A| = B$ can be split into two cases: $A = B$ or $A = -B$. So, we set $3(x - 2) = 12$ and $3(x - 2) = -12$.

How do you solve the equation $3(x - 2) = 12$?

Divide both sides by 3 to isolate $(x - 2)$: $x - 2 = 12 / 3$, which simplifies to $x - 2 = 4$. Then, add 2 to both sides: $x = 4 + 2 = 6$.

How do you solve the equation $3(x - 2) = -12$?

Divide both sides by 3: $x - 2 = -12 / 3$, which simplifies to $x - 2 = -4$. Then, add 2 to both sides: $x = -4 + 2 = -2$.

What is the solution set for the equation $|3(x - 2)| = 12$?

The solutions are $x = 6$ and $x = -2$, obtained from solving both cases of the absolute value equation.

Why do we split the absolute value equation into two cases?

Because absolute value represents the distance from zero, it can be either positive or negative. So, $|A| = B$ means $A = B$ or $A = -B$, covering both scenarios.

Can the equation $|3(x - 2)| = 12$ have more than two solutions?

No, because absolute value equations like this typically have two solutions—one positive and one negative case. Unless the absolute value equals zero, which would give one solution, here we have two.

What is the importance of checking the solutions in absolute value equations?

It's important to check solutions to ensure they satisfy the original equation, especially if any extraneous solutions could arise during algebraic manipulations. In this case, both solutions are valid.

How can you interpret the solutions on the number line?

On the number line, $x = -2$ is located to the left of zero, and $x = 6$ is to the right of zero, indicating the points where the expression's absolute value equals 12.

What is the general method to solve absolute value equations like $|A| = B$?

The general method is to set $A = B$ and $A = -B$, then solve each resulting equation separately. Always check that solutions satisfy the original equation.

How does understanding absolute value help in solving equations like $|3(x - 2)| = 12$?

Understanding absolute value helps because it simplifies the process by breaking down the equation into two linear equations, making it easier to find all possible solutions.

Additional Resources

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Mathematics often presents us with equations that challenge our understanding and require careful analysis to solve correctly. Among such equations, those involving absolute values are particularly noteworthy because they require us to consider multiple scenarios due to their nature of representing magnitude without regard to sign. One such example is the equation $|3(x-2)| = 12$. While at first glance it seems straightforward, a deeper exploration reveals the importance of understanding absolute value properties, algebraic manipulation, and the implications of solutions. This article aims to demystify this equation, explore its solutions thoroughly, and provide insights into the broader concepts it embodies.

Understanding Absolute Value and Its Significance

What Is Absolute Value?

Absolute value, denoted by vertical bars $| |$, measures the distance of a number from zero on the number line, regardless of direction. For any real number a , the absolute value is defined as:

- $|a| = a$ if $a \geq 0$
- $|a| = -a$ if $a < 0$

This definition ensures that $|a|$ is always non-negative. For example:

- $|5| = 5$
- $|-5| = 5$
- $|0| = 0$

The absolute value concept is crucial in mathematics because it captures the idea of magnitude without concern for sign, which is essential in many real-world applications like distance calculations, error measurement, and more.

Why Is Absolute Value Important in Equations?

Equations involving absolute values are inherently piecewise, as they often encompass multiple cases due to the definition of absolute value. Solving these equations involves considering all the scenarios where the expression inside the absolute value can be positive or negative. This process ensures that all possible solutions are accounted for, making absolute value equations particularly rich and sometimes tricky.

Dissecting the Equation $|3(x-2)|=12$

Step 1: Recognize the Structure

The given equation is:

$$|3(x-2)| = 12$$

This equation states that the absolute value of 3 times (x minus 2) equals 12. The key is to understand that:

$$|A| = B \text{ has solutions when } A = B \text{ or } A = -B$$

where A is the expression inside the absolute value and B is the magnitude.

Step 2: Break Down into Cases

Applying the property of absolute value, the equation transforms into two separate cases:

Case 1:

$$3(x - 2) = 12$$

Case 2:

$$3(x - 2) = -12$$

Each case will be solved independently to find all potential values of x.

Solving the Equation Step-by-Step

Case 1: $3(x - 2) = 12$

- Divide both sides by 3 to isolate (x - 2):

$$x - 2 = 12 / 3$$

$$x - 2 = 4$$

- Add 2 to both sides to solve for x:

$$x = 4 + 2$$

$$x = 6$$

Solution from Case 1: $x = 6$

Case 2: $3(x - 2) = -12$

- Divide both sides by 3:

$$x - 2 = -12 / 3$$

$$x - 2 = -4$$

- Add 2 to both sides:

$$x = -4 + 2$$

$$x = -2$$

Solution from Case 2: $x = -2$

Summary of Solutions

The solutions to the equation $|3(x-2)|=12$ are:

$$- x = 6$$

$$- x = -2$$

These are the values of x that satisfy the original equation, confirming that the absolute value expression can indeed produce two valid solutions depending on the internal expression's sign.

Verifying the Solutions

Verification is a critical step to ensure that the solutions are correct and satisfy the original equation.

- For $x = 6$:

$$|3(6 - 2)| = |3(4)| = |12| = 12 \quad \checkmark$$

- For $x = -2$:

$$|3(-2 - 2)| = |3(-4)| = |-12| = 12 \quad \checkmark$$

Both solutions satisfy the original equation, confirming their validity.

Broader Context and Applications

Understanding the Significance of Absolute Value Equations

Equations like $|3(x-2)|=12$ are foundational in algebra and appear frequently in various real-world problems, including:

- Distance calculations: The absolute difference between two points.
- Engineering: Tolerance levels and error margins.
- Physics: Quantifying magnitude regardless of direction.

Understanding how to solve such equations equips students and professionals with essential problem-solving tools.

Extensions and Variations

While this example is straightforward, absolute value equations can become more complex:

- Equations involving multiple absolute value expressions, e.g., $|x + 3| + |2x - 5| = 7$
- Equations with inequalities, e.g., $|x - 4| > 3$
- Equations combining absolute values with other functions

Mastering the basic principles in simple equations like $|3(x-2)|=12$ provides a solid foundation for tackling these more advanced problems.

Common Pitfalls and Tips for Solving Absolute Value Equations

- Always consider all cases: When solving $|A|=B$, remember to analyze both $A=B$ and $A=-B$.
- Check solutions: Some solutions might not satisfy the original equation due to extraneous solutions introduced during algebraic manipulation.
- Be cautious with zero: When $B=0$, the equation reduces to $|A|=0$, which implies $A=0$.
- Understand the domain: Absolute value equations typically have solutions across all real numbers unless restricted by context.

Conclusion: Making Sense of $|3(x-2)|=12$

The equation $|3(x-2)|=12$ serves as an excellent demonstration of the principles of absolute value equations. It underscores the importance of understanding the fundamental property that $|A|=B$ corresponds to $A=B$ or $A=-B$, allowing us to split complex problems into manageable cases. Solving for x

involved straightforward algebra, but the underlying logic is applicable to a wide range of problems.

By thoroughly analyzing each step, verifying solutions, and understanding the conceptual framework, students and enthusiasts can approach similar equations with confidence. The clarity gained from dissecting such equations enhances mathematical literacy and problem-solving prowess, essential skills in academia, industry, and everyday reasoning.

Understanding equations like $|3(x-2)|=12$ not only deepens algebraic skills but also enriches our comprehension of how mathematical structures reflect real-world phenomena involving magnitude, distance, and measurement. As such, mastering this seemingly simple equation exemplifies the broader goal of mathematics: to model and interpret the world with precision and insight.

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