

Solve For X: $3(x + 1) = 2(x - 1)$

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When it comes to algebra, one of the fundamental skills students learn is solving for an unknown variable, often represented as "x." Among the many types of equations encountered, linear equations are some of the most common and essential for building a solid mathematical foundation. One such example is the equation $3(x + 1) = 2(x - 1)$. This article provides a detailed, step-by-step guide to solving this equation, explaining the concepts involved, common methods, and tips to enhance your understanding of algebraic problem-solving.

Understanding the Equation: What Does $3(x + 1) = 2(x - 1)$ Mean?

Before diving into the solution process, it's important to interpret what the equation represents.

- The left side: $3(x + 1)$ — this indicates that the quantity $(x + 1)$ is multiplied by 3.
- The right side: $2(x - 1)$ — this indicates that $(x - 1)$ is multiplied by 2.

This is a linear equation involving a single variable, x. The goal is to find the specific value of x that makes the equation true.

Step-by-Step Approach to Solving $3(x + 1) = 2(x - 1)$

Solving an algebraic equation like this typically involves several key steps:

1. Distribute the coefficients across the parentheses.
2. Combine like terms if possible.
3. Isolate the variable on one side of the equation.
4. Solve for x by performing inverse operations.
5. Check your solution to ensure correctness.

Let's explore each step in detail.

Step 1: Distribute the Coefficients

Applying the distributive property, which states that $a(b + c) = ab + ac$, we expand both sides:

- Left side: $3(x + 1) = 3x + 3 \cdot 1 = 3x + 3$

- Right side: $2(x - 1) = 2x - 2$

Now, the equation becomes:

$$3x + 3 = 2x - 2$$

Step 2: Bring Like Terms Together

The goal here is to gather all terms containing x on one side and constants on the other:

- Subtract $2x$ from both sides:

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

which simplifies to:

$$x + 3 = -2$$

- Next, subtract 3 from both sides to isolate x :

$$x + 3 - 3 = -2 - 3$$

which simplifies to:

$$x = -5$$

Step 3: Verify the Solution

Always verify your answer by substituting $x = -5$ back into the original equation:

Original equation:

$$3(x + 1) = 2(x - 1)$$

Substitute $x = -5$:

Left side:

$$3(-5 + 1) = 3(-4) = -12$$

Right side:

$$2(-5 - 1) = 2(-6) = -12$$

Since both sides are equal ($-12 = -12$), the solution $x = -5$ is correct.

Understanding the Concepts Behind the Solution

This problem illustrates several key algebraic concepts:

- Distributive Property: Expanding expressions involving parentheses.
- Combining Like Terms: Simplifying expressions to isolate the variable.
- Inverse Operations: Using addition/subtraction and multiplication/division to solve for x .
- Verification: Substituting the solution back into the original equation to check correctness.

Common Mistakes When Solving Equations Like $3(x + 1) = 2(x - 1)$

While solving such equations seems straightforward, students often make errors. Here are some common pitfalls and how to avoid them:

- **Forgetting to distribute:** Always remember to distribute coefficients across parentheses.
- **Mixing operations:** Be cautious with signs when moving terms across the equality. Remember to change the sign when subtracting or adding terms to both sides.
- **Incorrectly combining like terms:** Only combine terms with the same variable or constants.
- **Skipping the verification step:** Always check your solution by substituting back into the original equation.

Additional Practice Problems

To strengthen your understanding, try solving these similar equations:

1. $2(x + 4) = 3(x - 2)$
2. $5(2x - 3) = 3(4x + 1)$
3. $4(x - 5) = 2(3x + 7)$
4. $7(x + 2) = 5(x + 8)$

5. $3(2x - 1) = 2(5x + 3)$

Work through each problem step-by-step, applying the techniques discussed above.

Real-Life Applications of Solving Equations Like $3(x + 1) = 2(x - 1)$

Linear equations are not just abstract concepts—they have practical applications in various fields:

- Finance: Calculating interest rates and loan payments.
- Physics: Determining unknown quantities like velocity or acceleration.
- Engineering: Solving for forces or material properties.
- Business: Analyzing costs, revenues, and profit margins.

Understanding how to solve equations like $3(x + 1) = 2(x - 1)$ equips students and professionals with essential problem-solving skills applicable across many domains.

Summary of the Solution Process

Here's a quick recap of the key steps to solve the equation:

1. Expand both sides using the distributive property.
2. Simplify both sides.
3. Collect like terms and isolate x .
4. Perform inverse operations to solve for x .
5. Verify your solution by substituting back into the original equation.

The answer to $3(x + 1) = 2(x - 1)$ is $x = -5$.

Final Tips for Solving Similar Equations

- Always write out each step clearly to avoid mistakes.
- Keep track of signs, especially when moving terms across the equality.
- Use inverse operations systematically.
- Practice with a variety of equations to build confidence and proficiency.

In conclusion, mastering how to solve equations like $3(x + 1) = 2(x - 1)$ is fundamental in algebra. By understanding the properties involved, practicing step-by-step solutions, and verifying your answers, you'll develop strong problem-solving skills that are essential for advanced mathematics and real-world applications. Keep practicing, and you'll find that solving for x becomes an intuitive and rewarding process.

Frequently Asked Questions

What is the first step to solve the equation $3(x + 1) = 2(x - 1)$?

Distribute the coefficients: $3x + 3 = 2x - 2$.

How do you isolate the variable x in the equation $3(x + 1) = 2(x - 1)$?

Subtract $2x$ from both sides and subtract 3 from both sides to get x on one side.

What is the value of x in the equation $3(x + 1) = 2(x - 1)$?

x equals -5.

Can you show the step-by-step solution for $3(x + 1) = 2(x - 1)$?

Yes. Distribute: $3x + 3 = 2x - 2$. Subtract $2x$ from both sides: $x + 3 = -2$. Subtract 3 from both sides: $x = -5$.

Is solving for x in $3(x + 1) = 2(x - 1)$ an example of linear equations?

Yes, because the variable x appears to the first power and the equation can be solved through linear methods.

What common mistakes should be avoided when solving $3(x + 1) = 2(x - 1)$?

Avoid forgetting to distribute correctly, neglecting to combine like terms, or making errors when moving variables across the equality.

How can understanding this equation help in solving real-world problems?

It demonstrates the process of simplifying and solving for unknowns, which is useful in budgeting, physics, and other practical applications involving relationships between quantities.

Additional Resources

Algebraic Equations

When it comes to mastering algebra, solving for an unknown variable is one of the fundamental skills that every learner needs to develop. Among these, linear equations—those that involve variables to the first power—are the building blocks for more complex mathematics. One such example is the equation: $3(x + 1) = 2(x - 1)$. This equation offers a clear illustration of the process involved in isolating the variable, simplifying expressions, and ultimately finding the value of x .

In this comprehensive review, we'll explore the step-by-step solution to this equation, analyze each stage in detail, and provide expert insights into the techniques used. Whether you're a student brushing up on basics or a teacher seeking a clear explanation, this guide aims to demystify the process and reinforce foundational algebraic principles.

Understanding the Equation: $3(x + 1) = 2(x - 1)$

Before diving into the solution, it's essential to understand what the equation represents and the key components involved.

Breaking Down the Equation

The equation $3(x + 1) = 2(x - 1)$ is a linear equation with a single variable, x . The structure involves two expressions multiplied by constants: 3 and 2. These are then set equal to each other, forming a balanced equation.

- The left side: $3(x + 1)$, which signifies three times the quantity $x + 1$.
- The right side: $2(x - 1)$, indicating two times the quantity $x - 1$.

The goal is to find the value of x that makes this equality true.

Why Is Solving This Equation Important?

Solving for x in such equations is crucial because it demonstrates core algebraic skills: distributing, combining like terms, and isolating the variable. These skills are foundational for more advanced topics such as quadratic equations, systems of equations, and even real-world problem solving involving unknown quantities.

Step-by-Step Solution Process

Let's now explore the detailed steps to solve for x . Each step will be explained thoroughly to ensure clarity and understanding.

Step 1: Distribute the Constants

The first step involves applying the distributive property to remove parentheses. This property states that:

$$a(b + c) = ab + ac$$

Applying this to both sides:

- Left side: $3(x + 1) = 3x + 3 \cdot 1 = 3x + 3$

- Right side: $2(x - 1) = 2x - 2 \cdot 1 = 2x - 2$

Result after distribution:

$$3x + 3 = 2x - 2$$

Step 2: Bring Like Terms Together

The goal now is to isolate x on one side of the equation. To do this, we need to move all terms containing x to one side and constant terms to the other.

- Subtract $2x$ from both sides to get all x terms on the left:

$$3x - 2x + 3 = 2x - 2 - 2x$$

- Simplify both sides:

$$(3x - 2x) + 3 = 0 - 2$$

$$x + 3 = -2$$

- Alternatively, you could subtract 3 from both sides first, but the sequence doesn't matter as long as you're consistent.

Step 3: Isolate the Variable x

Now, subtract 3 from both sides to solve for x :

$$x + 3 - 3 = -2 - 3$$

which simplifies to:

$$x = -5$$

This is the solution: the value of x that satisfies the original equation.

Verification of the Solution

It's always good practice to verify your solution by substituting $x = -5$ back into the original equation.

Step 1: Substitute $x = -5$ into the original equation:

$$3(x + 1) = 2(x - 1)$$

becomes

$$3(-5 + 1) = 2(-5 - 1)$$

Step 2: Simplify both sides:

- Left side: $3(-4) = -12$

- Right side: $2(-6) = -12$

Since both sides equal -12, the solution $x = -5$ is verified as correct.

Key Takeaways and Expert Tips

1. Distributive Property is Fundamental

Applying the distributive property correctly simplifies the equation and prepares it for combining like terms. Always double-check your distribution to avoid common errors.

2. Maintain Balance in the Equation

Remember that whatever you do to one side, you must do to the other. This principle ensures the equation remains balanced and valid throughout the solving process.

3. Combine Like Terms Carefully

When moving variables and constants, combine like terms systematically to prevent mistakes. Keep your workspace organized to track each step clearly.

4. Verify Your Solution

Always substitute your answer back into the original equation to confirm accuracy. This step can catch errors early and reinforce understanding.

5. Practice with Variations

Try solving similar equations with different coefficients or additional steps (like fractions or parentheses) to build confidence and mastery.

Additional Insights and Applications

While solving for x in a simple linear equation may seem straightforward, the skills acquired are highly transferable. For instance:

- Real-World Problem Solving: Equations like this model situations such as budgeting, speed-distance calculations, or chemical mixtures.
- Foundation for Advanced Math: Mastery here paves the way for tackling quadratic equations, inequalities, and systems of equations.
- Analytical Thinking: Breaking down complex problems into manageable steps develops logical reasoning and problem-solving skills.

Furthermore, understanding how to manipulate algebraic expressions enhances computational fluency, which is crucial in fields like engineering, economics, physics, and computer science.

Conclusion

The journey to solve $3(x + 1) = 2(x - 1)$ exemplifies core algebraic principles and demonstrates the importance of methodical problem-solving. From distributing to combining like terms and verifying solutions, each step reinforces foundational skills that are essential across mathematics and beyond.

By carefully applying these techniques, learners can confidently approach similar equations, expanding their mathematical toolkit and developing a deeper appreciation for the elegance of algebra. Whether for academic success or practical application, mastering such problems is a key step toward analytical proficiency.

Remember: The process is as important as the answer. Practice, patience, and attention to detail will turn solving equations from a daunting task into an empowering skill.

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