5x+3(x−1) = 8(x + 2) - 10

5x+3(x−1) = 8(x + 2) - 10 is a common algebraic equation that students encounter when learning how to simplify expressions and solve for an unknown variable. Understanding how to approach and solve this type of equation is fundamental to mastering algebra. In this article, we will explore the step-by-step process of solving the equation, discuss the underlying concepts involved, and provide tips to help you improve your algebra skills.

Understanding the Equation 5x + 3(x − 1) = 8(x + 2) - 10

Before jumping into solving the equation, it’s essential to understand what each part of the equation represents and how to interpret the algebraic expressions involved.

The Components of the Equation

The equation consists of:

- Terms involving the variable x (such as 5x, 3(x − 1), 8(x + 2))
- Constants (−10)
- Operations such as addition, subtraction, and multiplication

Goals in Solving

The primary goal is to isolate the variable x on one side of the equation to find its value. This involves:

- Expanding expressions
- Combining like terms
- Using inverse operations to isolate x

Step-by-Step Solution to the Equation

Let’s walk through solving the equation $5x + 3(x - 1) = 8(x + 2) - 10$.

Step 1: Expand the Parentheses

The first step is to expand all parentheses to remove grouping symbols.

- For $3(x - 1)$, distribute 3: $3 \times x = 3x$, $3 \times -1 = -3$
- For $8(x + 2)$, distribute 8: $8 \times x = 8x$, $8 \times 2 = 16$

This transforms the equation into:

$$
5x + 3x - 3 = 8x + 16 - 10
$$

Step 2: Simplify Both Sides

Combine like terms on each side:

- Left side: $5x + 3x = 8x$, so the left side becomes $8x - 3$
- Right side: $16 - 10 = 6$, so the right side becomes $8x + 6$

The simplified equation is:

$$
8x - 3 = 8x + 6
$$

Step 3: Subtract $8x$ from Both Sides

To isolate the variable, subtract $8x$ from both sides:

$$
8x - 8x - 3 = 8x - 8x + 6
$$

which simplifies to:

$$
-3 = 6
$$

Step 4: Analyze the Result

The resulting statement, $-3 = 6$, is false. This indicates that the original equation has no solution, meaning the equations are inconsistent and do not intersect at any point on the number line.

Understanding When Equations Have No Solution or Infinite Solutions

This particular example illustrates an important concept in algebra: equations can sometimes have:

No Solution

- When simplifying leads to a false statement like $-3 = 6$, which is impossible.

- Indicates that the lines represented by the equations are parallel and never intersect.

Infinite Solutions

- When the simplified form results in a true statement like $0 = 0$.
- Indicates the equations are equivalent, representing the same line.

Tips for Solving Similar Algebraic Equations

To effectively solve equations like $5x + 3(x-1) = 8(x + 2) - 10$, consider the following strategies:

1. Always Expand Parentheses First

Distribute any coefficients over parentheses to simplify the equation fully.

2. Combine Like Terms

Group similar variables and constants to reduce the equation to simpler form.

3. Maintain Balance

Perform the same operation on both sides of the equation to keep it balanced.

4. Isolate the Variable

Use addition or subtraction to move all variable terms to one side, then divide to solve for x.

5. Check Your Solution

Substitute your solution back into the original equation to verify correctness.

Practice Problems to Master Algebraic Equations

Strengthening your algebra skills involves practice. Here are some similar problems to try:

1. Solve for x: $2x + 4(x - 3) = 3(x + 2) - 5$
2. Find x: $7(x - 1) = 2(3x + 4) + 1$
3. Determine whether the equation $5x + 2 = 5x + 7$ has solutions, no solutions, or infinite solutions.

By working through these problems, you'll get more comfortable with the process of solving linear equations and understanding their solutions.

Conclusion

The equation **$5x + 3(x - 1) = 8(x + 2) - 10$** is an excellent example for illustrating key algebraic concepts such as expanding parentheses, combining like terms, and solving for an unknown. As demonstrated, the solution process involves systematically simplifying both sides of the equation and analyzing the resulting statements. Whether the equation has a unique solution, no solution, or infinitely many solutions, understanding the steps involved is crucial for mastering algebra.

Remember, practice makes perfect. Regularly working through similar problems will enhance your problem-solving skills and confidence in handling algebraic equations. Use the tips provided to approach equations methodically, and don't forget to verify your solutions for accuracy. With consistent effort, you'll find solving equations like this becomes second nature, paving the way for success in more advanced mathematics.

Frequently Asked Questions

How do I solve the equation $5x + 3(x - 1) = 8(x + 2) - 10$ for x?

First, distribute the coefficients: $5x + 3x - 3 = 8x + 16 - 10$. Combine like terms: $8x - 3 = 8x + 6$. Subtract 8x from both sides: $-3 = 6$. Since this is false, the equation has no solution.

What is the first step to simplify the equation $5x + 3(x - 1) = 8(x + 2) - 10$?

Distribute the coefficients in both parentheses: $5x + 3x - 3 = 8x + 16 - 10$.

Does the equation $5x + 3(x - 1) = 8(x + 2) - 10$ have a solution?

No, after simplifying, the equation reduces to a false statement ($-3 = 6$), indicating there is no solution.

How can I verify if an equation like $5x + 3(x - 1) = 8(x + 2) - 10$ has solutions?

Solve for x step-by-step; if you end up with a true statement, solutions exist. If you get a contradiction like a false statement, then no solutions exist.

What is the simplified form of 5x + 3(x - 1) = 8(x + 2) - 10?

After distribution and combining like terms, the simplified form is 8x - 3 = 8x + 6, which indicates no solution since it results in a contradiction.

Additional Resources

Mathematical Equations: Unlocking the Power of Algebraic Problem Solving

Mathematics often presents itself as a complex language, filled with symbols and equations that can seem daunting at first glance. However, with the right approach and understanding, these algebraic expressions become powerful tools for logical reasoning, problem-solving, and analytical thinking. Today, we delve into a classic linear equation: 5x + 3(x - 1) = 8(x + 2) - 10. This detailed exploration will not only solve the equation but also serve as a comprehensive guide to mastering similar algebraic challenges, much like how a well-designed product offers an intuitive user experience.

Understanding the Equation: Breaking Down the Components

Before diving into the steps to solve the equation, it’s crucial to understand its structure and the significance of each component.

The Equation:

$$ 5x + 3(x - 1) = 8(x + 2) - 10 $$

Key elements:

- Variables: The unknown x that we aim to determine.
- Constants: Numerical values like 5, 3, 8, and 10 that modify the variable expressions.
- Operations: Addition (+), subtraction (-), and multiplication implied by coefficients or parentheses.

Why is this important?
Understanding each part helps us identify the best strategies for simplification. Just as a product review dissects features to highlight benefits, analyzing each component of an equation reveals the most efficient pathway to a solution.

Step-by-Step Solution Approach

To systematically solve the equation, we will follow a structured process:

1. Expand parentheses

2. Combine like terms
3. Isolate the variable
4. Solve for x
5. Verify the solution

Each step builds upon the previous, ensuring clarity and accuracy.

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1. Expand Parentheses

Parentheses indicate that the terms within should be multiplied by the factors outside. This is akin to unboxing a product to see all features.

- Expand $3(x - 1)$:

$$3 \times x = 3x$$

$$3 \times -1 = -3$$

- Expand $8(x + 2)$:

$$8 \times x = 8x$$

$$8 \times 2 = 16$$

Rewriting the original equation with expanded terms:

$$5x + 3x - 3 = 8x + 16 - 10$$

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2. Combine Like Terms

Like terms are those that contain the same variables raised to the same power. Combining them simplifies the equation.

- On the left side:

$$5x + 3x = 8x$$

$$-3 \text{ remains as is}$$

So, left side becomes:

$$8x - 3$$

- On the right side:

$$8x + 16 - 10 = 8x + 6$$

Now, the simplified equation is:

$$8x - 3 = 8x + 6$$

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3. Isolate the Variable

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

Observe that both sides have $8x$. Subtract $8x$ from both sides to eliminate the variable term:

$$(8x - 8x) - 3 = (8x - 8x) + 6$$

Simplifies to:

$$-3 = 6$$

This indicates an inconsistency—a key step in understanding the nature of the equation.

Analyzing the Result: No Solution or Infinite Solutions?

The simplified step reveals:

$$-3 = 6$$

which is not true. This means the original equation has no solution.

What does this imply?
In algebraic terms, the equation is inconsistent; the two sides cannot be equal for any real value of x. This is akin to a product review revealing a product that doesn't function as advertised—the problem cannot be solved within the typical parameters.

Alternative Perspective: When Equations Have No Solution

- Inconsistent equations: No value of x satisfies the equation.
- Common causes:
- Contradictory statements within the equations.
- Errors in expansion or combination (not applicable here, as steps are verified).

Educational takeaway: Recognizing when an equation has no solution is as important as solving equations that do. It demonstrates critical thinking and an understanding of the equation's structure.

Special Case: When Equations Have Infinite Solutions

For completeness, if after simplifying both sides, you find an identity such as:

$$0 = 0$$

then the equation has infinite solutions—meaning any x satisfies it.

In our case, since the simplification resulted in a contradiction, the equation is unsolvable in real numbers.

Summary of the Solution Process and Key Lessons

Step	Action	Outcome	Key Takeaway
1. Expand parentheses	$3(x - 1) \to 3x - 3$, $8(x + 2) \to 8x + 16$	Equation becomes $5x + 3x - 3 = 8x + 16 - 10$	Expansion clears parentheses for easier manipulation
2. Combine like terms	$8x - 3 = 8x + 6$	Simplified to a direct comparison	Combining like terms reduces complexity
3. Isolate x	Subtract $8x$ from both sides	Contradiction $-3 = 6$	Recognize if the equation has solutions or not
4. Conclusion	No solution exists for x	Equation is inconsistent	Critical to identify when equations are unsolvable

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Practical Applications and Broader Context

While this equation might seem abstract, the skills used to analyze and simplify it are foundational in numerous fields:

- Engineering: Calculating forces, circuits, or system behaviors.
- Economics: Modeling supply and demand functions.
- Computer Science: Algorithm design involving algebraic logic.
- Data Science: Mathematical modeling and data fitting.

Understanding how to methodically approach and interpret algebraic equations enhances problem-solving skills across disciplines.

Final Thoughts: Mastering Algebraic Problem Solving

This detailed examination of $5x + 3(x - 1) = 8(x + 2) - 10$ exemplifies not just the mechanics of solving a linear equation but also highlights the importance of critical analysis. Recognizing when an equation has no solutions is as vital as finding solutions when they exist.

Much like evaluating a complex product, dissecting an algebraic equation involves understanding its components, simplifying systematically, and interpreting the results. Whether you're a student, educator, or professional, honing these skills empowers you to approach mathematical challenges with confidence and precision.

Remember, every problem is an opportunity to deepen your understanding—embrace the process, learn from each step, and see equations not just as symbols, but as tools for unlocking insights in the world around you.

5x 3 X 1 8 X 2 10

5x 3 X 1 8 X 2 10

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