Solve The Inequality For X:2 (2x - 3) < 4x - 6

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Understanding how to solve inequalities like 2(2x - 3) < 4x - 6 is essential in algebra. These inequalities are fundamental for students and professionals dealing with mathematical problems, data analysis, and various scientific calculations. This comprehensive guide will walk you through the step-by-step process to solve this particular inequality, explain the concepts involved, and provide practical tips to master similar problems.

Introduction to Inequalities in Algebra

Before diving into solving the specific inequality, it is important to understand what inequalities are and how they differ from equations.

What Is an Inequality?

An inequality is a mathematical statement that compares two expressions using symbols such as:

- < (less than)
- > (greater than)
- ≤ (less than or equal to)
- ≥ (greater than or equal to)

The inequality 2(2x - 3) < 4x - 6 indicates that the expression on the left is less than the expression on the right.

Why Are Inequalities Important?

Inequalities are widely used in real-world scenarios, including:

- Determining acceptable ranges for variables
- Optimization problems
- Economic modeling
- Engineering constraints

Step-by-Step Solution to the Inequality 2(2x - 3) < 4x - 6

Let's now analyze and solve the inequality:

$2(2x - 3) < 4x - 6$

Step 1: Expand the Left Side

Distribute the 2 across the parentheses:

$2\ 2x = 4x$

$2\ (-3) = -6$

So, the inequality becomes:

$4x - 6 < 4x - 6$

Step 2: Simplify Both Sides

The left side is already simplified: $4x - 6$

The right side is also simplified: $4x - 6$

Now, the inequality is:

$4x - 6 < 4x - 6$

Step 3: Subtract 4x from Both Sides

To isolate the variable, subtract 4x from both sides:

$(4x - 6) - 4x < (4x - 6) - 4x$

Simplifies to:

$-6 < -6$

Step 4: Interpret the Result

The inequality now reads:

-6 < -6

This statement is false because -6 is equal to -6, not less than -6.

Therefore, the original inequality simplifies to a statement that is never true.

Conclusion: The Solution Set

Since the simplified form leads to a false statement, it means that there are no solutions to the inequality.

Final answer:

- The inequality 2(2x - 3) < 4x - 6 has no solution.

Understanding Why There Are No Solutions

This example illustrates an important concept: sometimes, inequalities simplify to a false statement, indicating that the original inequality is never true, regardless of the value of x.

In this case:

- The original inequality reduces to an identity that is false, meaning the set of solutions is empty.

Additional Tips for Solving Similar

Inequalities

To approach other inequalities effectively, consider the following:

1. Always Expand and Simplify

- Distribute any coefficients
- Combine like terms to simplify the inequality

2. Isolate the Variable

- Use addition or subtraction to gather all variable terms on one side
- Use multiplication or division to solve for the variable

3. Be Careful When Multiplying or Dividing by Negative Numbers

- Remember to reverse the inequality sign when multiplying or dividing both sides by a negative number

4. Analyze the Final Simplified Statement

- Determine whether the simplified inequality has solutions or none
- Check for identities, contradictions, or infinite solutions

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Practice Problems for Mastery

Try solving these inequalities to reinforce your understanding:

1. Solve for x: $3(2x + 4) \geq 2(x + 5)$
2. Solve for x: $-5x + 7 < 2x - 3$
3. Find the solution set for: $4x - 2 > 2(2x - 1)$

Solutions:

- For problem 1, expand and simplify, then isolate x.
- For problem 2, combine like terms and solve step-by-step.
- For problem 3, expand the right side and solve for x.

Summary

In this guide, we explored the process of solving the inequality $2(2x - 3) < 4x - 6$. The key steps included expanding, simplifying, and analyzing the resulting statement. The ultimate conclusion was that the inequality has no solution because it simplifies to a false statement ($-6 < -6$). Understanding this process enhances your ability to tackle similar algebraic inequalities confidently.

Whether you're a student preparing for exams or a professional dealing with mathematical models, mastering the art of solving inequalities is invaluable. Keep practicing with different problems, and you'll develop strong analytical skills that apply across various fields.

Remember:

- Always verify your solutions
- Pay attention to sign changes when multiplying or dividing by negatives
- Recognize when an inequality has no solutions or infinite solutions

With consistent practice, solving inequalities like $2(2x - 3) < 4x - 6$ will become second nature, empowering you to handle complex mathematical challenges with confidence.

Frequently Asked Questions

How do I start solving the inequality $2(2x - 3) < 4x - 6$?

Begin by expanding the left side to get $4x - 6$, then compare it to the right side, and proceed to isolate x accordingly.

What is the first step in solving $2(2x - 3) < 4x - 6$?

Expand the left side: $4x - 6$, and then write the inequality as $4x - 6 < 4x - 6$.

Does solving $2(2x - 3) < 4x - 6$ lead to any

contradictions?

Yes, after simplifying, you'll find that the inequality reduces to a statement like 0 < 0, which is false, indicating no solution exists.

Are there any solutions for the inequality 2(2x - 3) < 4x - 6?

No, because simplifying the inequality shows it's always false, so there are no values of x that satisfy it.

What is the simplified form of the inequality 2(2x - 3) < 4x - 6?

The inequality simplifies to 4x - 6 < 4x - 6, which is never true, indicating no solution.

Additional Resources

Solve the Inequality for X: 2(2x - 3) < 4x - 6

Introduction

Mathematics, especially algebra, forms the backbone of logical reasoning and problem-solving skills. One of the fundamental concepts in algebra involves solving inequalities, which are mathematical statements that compare two expressions using inequality symbols such as `<`, `>`, `≤`, or `≥`. These inequalities are crucial in various applications, including real-world scenarios like budgeting, optimization, and scientific measurements.

Today, we focus on solving a specific linear inequality:

\[2(2x - 3) < 4x - 6 \]

This problem appears straightforward but requires a methodical approach to ensure an accurate solution. Throughout this detailed review, we will dissect the process step-by-step, covering the foundational principles, solving strategies, common pitfalls, and interpretation of the solution set.

Understanding the Inequality

Before jumping into solving, it’s essential to understand the structure of the inequality:

$$ 2(2x - 3) < 4x - 6 $$

- The left side involves a multiplicative factor of 2 applied to a binomial expression $(2x - 3)$.
- The right side is a linear expression $4x - 6$.

This inequality is linear in x, which generally implies the solution will be an interval or a set of values satisfying the inequality.

Step-by-Step Approach to Solving the Inequality

Step 1: Expand and Simplify Both Sides

The first step in solving any inequality involving parentheses is to expand the expressions:

- Distribute the 2 across $(2x - 3)$:

$$
2 \times 2x = 4x \\
2 \times (-3) = -6
$$

So, the left side becomes:

$$
4x - 6
$$

Now, the inequality is:

$$
4x - 6 < 4x - 6
$$

Step 2: Analyze the Simplified Inequality

After simplification, the inequality reduces to:

$$
4x - 6 < 4x - 6
$$

This is a critical step because the inequality now compares two identical expressions.

Step 3: Interpret the Result

The simplified inequality:

$$
4x - 6 < 4x - 6
$$

has the form:

$$
A < A
$$

which is never true because a number cannot be less than itself. This indicates that:

- For all real values of x, the expressions are equal.
- Therefore, the inequality has no solution because the strict inequality (less than `<`) cannot be satisfied when both sides are equal.

Special Consideration: Is it an Equality?

If the inequality were:

$$
2(2x - 3) \leq 4x - 6
$$

or with a different inequality symbol, the solution set might differ.

In our case, since the inequality is strict (`<`), and both sides are identical after simplification, the solution set is empty.

Summary of the Solution

Given the original inequality:

$$
2(2x - 3) < 4x - 6
$$

The solution set is:

$$
\boxed{\text{No real solutions}}
$$

because the simplified form reveals an impossibility for the inequality to hold true.

Deep Dive: Why Does This Happen?

This situation is a classic example illustrating the importance of algebraic simplification:

- When both sides simplify to the same expression, the inequality reduces to $A < A$, which is always false.
- This indicates the original inequality is never true for any real x.

Additional Explorations

To deepen understanding, let's consider related inequalities:

1. Change the inequality to a non-strict form:

$$2(2x - 3) \leq 4x - 6$$

After simplification:

$$4x - 6 \leq 4x - 6$$

which simplifies to:

$$0 \leq 0$$

This is always true, meaning:

- The solution set for this inequality is all real numbers x.

2. What if the inequality were reversed?

$$2(2x - 3) > 4x - 6$$

which simplifies to:

$$4x - 6 > 4x - 6$$

or

$$0 > 0$$

which is never true. Therefore, the set of solutions is empty.

Graphical Interpretation

Graphing the two expressions:

- The left side: $y = 2(2x - 3)$
- The right side: $y = 4x - 6$

Since both are linear:

- $y = 4x - 6$
- $y = 4x - 6$

They are the same line. The inequality:

$$2(2x - 3) < 4x - 6$$

translates graphically to:

- The region below the line $y = 4x - 6$, but since the two expressions are identical, the inequality compares a value to itself.

The key takeaway:

- Any point (x, y) on the line satisfies $y = 4x - 6$
- The inequality $y < y$ is impossible; thus, no points satisfy the inequality.

Common Mistakes and Misconceptions

When solving inequalities, students often make some typical errors:

- Not distributing correctly: forgetting to distribute the multiplier across each term.
- Ignoring the direction of the inequality when multiplying or dividing by negative numbers.
- Overlooking the simplification step: failing to reduce expressions to their simplest form before concluding.
- Misinterpreting the solution set: assuming solutions exist when algebraic simplification shows none.

In our specific problem, the key mistake would be to stop after the expansion and not recognize that both sides are identical, leading to an incorrect conclusion that multiple solutions exist.

Practical Implications and Applications

Understanding the nature of inequalities like this one is vital in real-world contexts:

- Feasibility analysis: Determining whether a certain condition can ever be satisfied.
- Optimization problems: Recognizing when constraints are inconsistent.
- Decision-making: Identifying impossible scenarios.

In this particular case, the inequality indicates a condition that is never satisfied, which could inform decisions in engineering, economics, or data analysis where such constraints arise.

Summary and Final Thoughts

- The original inequality simplifies to an equality, revealing that it has no solutions.
- When solving inequalities, always aim to simplify expressions thoroughly.
- Recognize when the simplified form indicates an impossible situation, thereby saving time and effort.
- Remember the importance of understanding the difference between strict (`<`, `>`) and non-strict (`≤`, `≥`) inequalities, as it impacts the solution sets.

Mastering the process of solving inequalities like this deepens your algebraic intuition and prepares you for tackling more complex problems involving inequalities, systems, and real-world applications.

Concluding Remarks

The journey of solving the inequality $2(2x - 3) < 4x - 6$ underscores the importance of meticulous algebraic manipulation and critical thinking. Often, the process reveals more about the nature of the inequality than just the solution—highlighting the importance of simplification, interpretation, and understanding the implications of the algebraic results.

In this case, the key lesson is that sometimes, inequalities reduce to identities or contradictions, providing insight into the inherent properties of the expressions involved. Whether in pure mathematics or applied scenarios, these skills are invaluable for rigorous problem-solving and logical analysis.

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