

$56x + 40 = 48x + 104$

$56x + 40 = 48x + 104$ is a fundamental algebraic equation that can serve as an excellent example to understand how to solve for an unknown variable. Equations like this are common in mathematics and are often encountered in various fields such as engineering, physics, economics, and everyday problem-solving. In this article, we will explore the step-by-step process to solve this equation, discuss related concepts, and provide tips for mastering similar algebraic problems.

Understanding the Equation $56x + 40 = 48x + 104$

Before diving into the solution, it's essential to understand the structure of the equation and what it represents.

What Does the Equation Represent?

This linear equation involves a variable, x , with coefficients and constants on both sides. It states that the expression $56x + 40$ is equal to $48x + 104$. The goal is to find the value of x that makes this statement true.

Key Components of the Equation

- **Variable term:** $56x$ on the left and $48x$ on the right.
- **Constants:** 40 on the left and 104 on the right.

Understanding how these components interact is crucial for solving the equation effectively.

Step-by-Step Solution to $56x + 40 = 48x + 104$

Solving this type of linear equation involves isolating the variable x on one side of the equation. Let's walk through the process systematically.

Step 1: Subtract $48x$ from Both Sides

The first step simplifies the equation by getting all variable terms on one side:

$$56x + 40 - 48x = 48x + 104 - 48x$$

This simplifies to:

$$(56x - 48x) + 40 = 104$$

which further simplifies to:

$$8x + 40 = 104$$

Step 2: Subtract 40 from Both Sides

Next, eliminate the constant term on the left:

$$8x + 40 - 40 = 104 - 40$$

Simplifies to:

$$8x = 64$$

Step 3: Divide Both Sides by 8

Now, solve for x by dividing both sides by the coefficient of x:

$$x = 64 / 8$$

which results in:

$$x = 8$$

Solution Summary

The solution to the equation $56x + 40 = 48x + 104$ is:

- $x = 8$

This value of x satisfies the original equation.

Verifying the Solution

Always verify your solution by substituting the value back into the original equation:

$$56(8) + 40 = 48(8) + 104$$

Calculate each side:

- Left side: $56 \cdot 8 + 40 = 448 + 40 = 488$
- Right side: $48 \cdot 8 + 104 = 384 + 104 = 488$

Since both sides equal 488, the solution $x = 8$ is correct.

Additional Tips for Solving Similar Equations

Mastering the process used here can help you efficiently solve similar algebraic equations. Here are some tips:

1. Always Simplify First

- Combine like terms on each side before moving variables around.
- Simplify constants and coefficients to make the equation easier to work with.

2. Use Addition or Subtraction to Isolate Variables

- To gather variable terms on one side, add or subtract the same term from both sides.
- This maintains the equality while simplifying the equation.

3. Use Division or Multiplication to Solve for the Variable

- Once the variable is isolated with a coefficient, divide or multiply both sides accordingly.

4. Check Your Solution

- Always substitute your solution back into the original equation to verify correctness.
- This step helps prevent errors and confirms your understanding.

Common Mistakes to Avoid

While solving equations like $56x + 40 = 48x + 104$, some common pitfalls include:

- **Incorrectly combining like terms:** Ensure that only like terms are combined.
- **Forgetting to perform the same operation on both sides:** Maintaining equality requires symmetrical operations.
- **Dividing by zero:** Always check that the coefficient of the variable is not zero before dividing.
- **Neglecting to verify the solution:** Always substitute back to confirm your answer.

Real-World Applications of Solving Equations Like $56x + 40 = 48x + 104$

Equations similar to $56x + 40 = 48x + 104$ are used in various practical scenarios:

1. Financial Calculations

- Determining break-even points where costs equal revenues.
- Calculating unknown quantities in budgeting problems.

2. Physics and Engineering

- Solving for unknown forces or velocities.
- Analyzing electrical circuits with algebraic relationships.

3. Business and Economics

- Optimizing profit functions.
- Equating supply and demand equations to find equilibrium prices.

Conclusion

Understanding how to solve an equation like $56x + 40 = 48x + 104$ is fundamental in algebra. The process involves isolating the variable through addition, subtraction, and division, followed by verification. Mastery of these steps enables you to approach more complex equations and real-life problems with confidence. Remember to simplify first, perform operations symmetrically, and verify your solutions to ensure accuracy. Whether in academics, professional work, or everyday life, the skills learned from solving such equations are invaluable tools in your mathematical toolkit.

Frequently Asked Questions

What is the first step to solve the equation $56x + 40 = 48x + 104$?

The first step is to get all the variable terms on one side and constants on the other. You can subtract $48x$ from both sides to start.

How do I isolate the variable x in the equation $56x + 40 = 48x + 104$?

Subtract $48x$ from both sides to get $(56x - 48x) + 40 = 104$, which simplifies to $8x + 40 = 104$.

What is the value of x in the equation $56x + 40 = 48x + 104$?

First, subtract 40 from both sides: $8x = 64$. Then, divide both sides by 8: $x = 8$.

Is the solution $x=8$ valid for the equation $56x + 40 = 48x + 104$?

Yes, substituting $x=8$ back into the original equation confirms both sides are equal: $56(8)+40 = 448+40=488$ and $48(8)+104=384+104=488$.

What does solving the equation $56x + 40 = 48x + 104$ tell us about the relationship between the terms?

It shows how the variable x affects the balance between the two sides of the equation, revealing the specific value of x that makes both sides equal.

Can this equation have more than one solution?

No, since it is a linear equation with one variable, it has a unique solution, which is $x=8$.

How can I check my solution for correctness in this equation?

Substitute $x=8$ into the original equation and verify that both sides are equal, which confirms the solution is correct.

What are common mistakes to avoid when solving equations like $56x + 40 = 48x + 104$?

Common mistakes include forgetting to perform the same operation on both sides, mixing up subtraction and addition, or incorrectly dividing to solve for x . Always double-check each step.

Additional Resources

Investigation into the Equation $56x + 40 = 48x + 104$: A Mathematical Breakdown

Mathematics often presents us with equations that, at first glance, seem straightforward but can reveal deeper insights upon closer examination. The equation $56x + 40 = 48x + 104$ is one such example—simple in appearance but rich in instructional value. This comprehensive analysis aims to dissect the problem step by step, explore its implications, and contextualize its significance within algebra and problem-solving methodologies.

Understanding the Equation: Context and Significance

At its core, the equation $56x + 40 = 48x + 104$ is a linear equation involving one variable, x . Solving such an equation is foundational in algebra, serving as a building block for more complex mathematical concepts. Its structure embodies common themes in algebraic manipulation: combining like terms, isolating variables, and understanding constants.

This equation is representative of real-world problems where different linear relationships intersect. For example, it could model scenarios such as comparing two different rates or costs, where x might represent quantity, time, or other measurable factors. Understanding how to solve and interpret such an equation provides crucial skills for applied mathematics, economics, engineering, and beyond.

Step-by-Step Solution Strategy

To decode the equation, we need to follow a systematic approach. Let's break down the solution process into clear, meticulous steps.

Step 1: Write down the original equation

$$56x + 40 = 48x + 104$$

This is the starting point, with variables and constants on both sides.

Step 2: Gather like terms

Our goal: isolate x on one side. To do this, we can move the variable terms to one side and constants to the other.

- Subtract $48x$ from both sides:

$$56x - 48x + 40 = 48x - 48x + 104$$

which simplifies to:

$$8x + 40 = 104$$

- Next, subtract 40 from both sides to isolate the term with x :

$$8x + 40 - 40 = 104 - 40$$

resulting in:

$$8x = 64$$

Step 3: Solve for x

Divide both sides by 8:

$$x = 64 / 8$$

which yields:

$$x = 8$$

This straightforward process demonstrates the importance of systematic algebraic manipulation.

Interpreting the Solution: What Does $x=8$ Mean?

The solution $x=8$ tells us that when x equals 8, both sides of the original equation are equal. But beyond the numerical solution, it's instructive to understand what this value signifies within the context of the problem.

Suppose the equation models a real-world scenario, such as:

- Scenario A: Two companies offering discounts based on quantity (x). Company A's total cost is $56x + 40$, while Company B's is $48x + 104$. Finding $x=8$ indicates the quantity at which both costs are equal.
- Scenario B: A distance or rate problem where x represents time, and the constants are fixed costs or rates.

In either case, the solution pinpoints a critical intersection—where the two linear relationships are equivalent.

Deeper Analysis: Verifying and Validating the Solution

Ensuring the correctness of the solution is paramount in mathematical investigations.

Verification of $x=8$

Substitute $x=8$ back into the original equation:

- Left side:

$$56(8) + 40 = 448 + 40 = 488$$

- Right side:

$$48(8) + 104 = 384 + 104 = 488$$

Since both sides equal 488, the solution $x=8$ is confirmed as valid.

Exploring Variations and Related Equations

The initial problem provides a foundation to examine related equations and their solutions, broadening understanding.

1. Variations with Different Coefficients

Consider equations like:

$$- a x + b = c x + d$$

where a, b, c, d are constants. The solution process remains similar:

- Move variables to one side:

$$(a - c) x = d - b$$

- Solve for x :

$$x = (d - b) / (a - c)$$

This general formula underscores the importance of coefficient differences in determining unique solutions.

2. Special Cases

- If $a = c$ and $b \neq d$, the equation has no solution (parallel lines in graph terms).
- If $a = c$ and $b = d$, the equation has infinitely many solutions.

These cases highlight the necessity of understanding the coefficient relationships.

Graphical Interpretation

Plotting the lines $y = 56x + 40$ and $y = 48x + 104$ provides visual insight.

- Both are straight lines with different slopes and intercepts.
- The solution $x=8$ corresponds to the x-coordinate of their intersection point.

Graphically, this point demonstrates where the two relationships are equal, reinforcing the algebraic solution's validity.

Applications in Real-World Contexts

Linear equations like $56x + 40 = 48x + 104$ often model practical situations:

- Cost analysis: Comparing two pricing models.
- Physics: Equating different linear motion equations.
- Economics: Balancing supply and demand curves.
- Business: Determining break-even points.

Understanding how to solve and interpret these equations enables decision-making based on quantitative data.

Educational Implications and Pedagogical Insights

This particular equation serves as an excellent teaching tool for:

- Reinforcing algebraic manipulation skills.
- Demonstrating the importance of systematic problem-solving.
- Developing understanding of solution validation.
- Connecting algebra to graphical representations.

Educators can use this example to build foundational competencies in students, emphasizing clarity, verification, and contextual understanding.

Conclusion: The Broader Significance of Equation Analysis

The investigation into $56x + 40 = 48x + 104$ reveals more than just a numerical solution; it illustrates the core principles of algebraic reasoning, problem-solving strategies, and real-world modeling. The process exemplifies how systematic manipulation, verification, and interpretation are integral to mathematics education and application.

By dissecting this seemingly simple equation, learners gain valuable insights into the mechanics of linear equations, the importance of logical reasoning, and the relevance of mathematical models across disciplines. Mastery of such problems lays the groundwork for tackling more complex mathematical challenges, fostering analytical skills essential in an increasingly data-driven world.

In summary, the solution $x=8$ emerges from careful algebraic steps, validated through substitution and graphical interpretation. This exercise exemplifies core mathematical techniques and underscores the importance of detailed analysis in understanding and applying equations effectively.

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