

$$-8 + 2x - 9 + 3x - 10 = 21$$

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Solving algebraic equations like $-8 + 2x - 9 + 3x - 10 = 21$ is a fundamental skill in mathematics that forms the basis for more advanced topics. Whether you're a student brushing up on algebra or someone interested in understanding how to manipulate equations, this article offers a comprehensive guide to solving such equations efficiently. We'll explore the step-by-step process, explain relevant concepts, and provide tips to master similar algebraic problems.

Understanding the Equation: Breaking Down the Components

Before diving into solving the equation, it's essential to understand its components:

- Constants: Numbers without variables, such as -8, -9, and -10.
- Variables: Symbols representing unknown quantities, in this case, x .
- Coefficients: Numbers multiplying variables, like 2 and 3 in $2x$ and $3x$.

The given equation:

$$\begin{aligned} & \backslash[\\ & -8 + 2x - 9 + 3x - 10 = 21 \\ & \backslash] \end{aligned}$$

contains multiple constants and variables. To solve it, we aim to isolate x on one side of the equation.

Step-by-Step Solution Process

The process involves several systematic steps:

1. Combine like terms on the left side.
2. Simplify the equation to isolate the term with x .
3. Solve for the variable x .
4. Verify the solution by substituting back into the original equation.

Let's proceed with these steps in detail.

Step 1: Combine Like Terms

The left side contains constants: -8, -9, and -10, and variables: 2x and 3x.

- Constants: $(-8 - 9 - 10)$
- Variables: $(2x + 3x)$

Calculating:

- Constants: $(-8 - 9 = -17)$; then $(-17 - 10 = -27)$
- Variables: $(2x + 3x = 5x)$

Now, the equation simplifies to:

$$\begin{aligned} &[-27 + 5x = 21] \end{aligned}$$

Step 2: Isolate the Variable Term

To solve for x, first move the constant term to the other side:

$$\begin{aligned} &[5x = 21 + 27] \end{aligned}$$

Adding (27) to both sides:

$$\begin{aligned} &[5x = 48] \end{aligned}$$

Step 3: Solve for x

Divide both sides by the coefficient of x, which is 5:

$$\begin{aligned} &[x = \frac{48}{5}] \end{aligned}$$

Expressed as a mixed number or decimal:

- As a decimal: $(x = 9.6)$
- As a fraction: $(\frac{48}{5})$

Step 4: Verify the Solution

Substitute $(x = \frac{48}{5})$ back into the original equation:

$$\begin{aligned} & \backslash[\\ & -8 + 2x - 9 + 3x - 10 = 21 \\ & \backslash] \end{aligned}$$

Calculate each term:

$$\begin{aligned} & - \backslash(2x = 2 \times \frac{48}{5} = \frac{96}{5}\backslash) \\ & - \backslash(3x = 3 \times \frac{48}{5} = \frac{144}{5}\backslash) \end{aligned}$$

Rewrite the entire equation with common denominators:

$$\begin{aligned} & \backslash[\\ & -8 - 9 - 10 + \frac{96}{5} + \frac{144}{5} = 21 \\ & \backslash] \end{aligned}$$

Express constants as fractions with denominator 5:

$$\begin{aligned} & \backslash[\\ & -8 = -\frac{40}{5} \\ & \backslash] \\ & \backslash[\\ & -9 = -\frac{45}{5} \\ & \backslash] \\ & \backslash[\\ & -10 = -\frac{50}{5} \\ & \backslash] \end{aligned}$$

Sum constants:

$$\begin{aligned} & \backslash[\\ & -\frac{40}{5} - \frac{45}{5} - \frac{50}{5} = -\frac{135}{5} = -27 \\ & \backslash] \end{aligned}$$

Sum variable terms:

$$\begin{aligned} & \backslash[\\ & \frac{96}{5} + \frac{144}{5} = \frac{240}{5} = 48 \\ & \backslash] \end{aligned}$$

Now, sum all:

$$\begin{aligned} & \backslash[\\ & -27 + 48 = 21 \\ & \backslash] \end{aligned}$$

Since the left side equals 21, which matches the right side, the solution is confirmed.

Additional Tips for Solving Similar Equations

- Combine like terms early: Always simplify constants and variables first to make the equation easier to work with.
- Maintain balance: Whatever operation you perform on one side, do the same on the other.
- Check your work: Substituting your solution back into the original equation

can prevent errors.

- Practice with different equations: The more you practice, the more intuitive algebra becomes.

Common Mistakes to Avoid

- Ignoring signs: Be careful with negative signs when combining terms.
- Forgetting to distribute: When equations involve parentheses, distribute correctly before simplifying.
- Incorrectly combining like terms: Only combine terms with the same variable and degree.
- Overlooking the solution verification: Always verify your answer to confirm accuracy.

Real-World Applications of Solving Equations

Algebraic equations like the one discussed are not just mathematical exercises—they have real-world applications:

- Finance: Calculating interest, loans, and investments.
- Science: Determining unknown quantities in experiments.
- Engineering: Designing systems based on variable relationships.
- Computer Programming: Solving for unknowns in algorithms and data analysis.

Understanding how to manipulate and solve equations enhances problem-solving skills applicable across various fields.

Summary

In summary, solving the equation $-8 + 2x - 9 + 3x - 10 = 21$ involves:

- Combining like terms to simplify the equation.
- Isolating the variable by performing inverse operations.
- Calculating the value of x .
- Verifying the solution to ensure correctness.

The final answer, $x = \frac{48}{5}$ or 9.6, demonstrates the power of algebraic techniques to find unknown quantities systematically.

Further Practice Problems

To strengthen your algebra skills, try solving these similar equations:

1. $3x + 7 - 2x = 10$
2. $-5 + 4x - 3 + 2x = 9$
3. $2(3x - 4) = 14$
4. $6x + 3 = 2x + 15$
5. $-8 + 2x - 9 + 3x - 10 = 21$ (the original problem)

Practicing these problems will help you become more comfortable with algebraic manipulation and problem-solving.

In conclusion, mastering the process of solving equations like $-8 + 2x - 9 + 3x - 10 = 21$ is vital for progressing in mathematics. By understanding each step, practicing regularly, and verifying solutions, you can confidently tackle a wide range of algebraic problems.

Frequently Asked Questions

How do I simplify the equation $-8 + 2x - 9 + 3x - 10 = 21$?

Combine like terms: $(-8 - 9 - 10) + (2x + 3x) = 21$, which simplifies to $-27 + 5x = 21$.

What is the first step to solve for x in the equation $-8 + 2x - 9 + 3x - 10 = 21$?

The first step is to combine all the constant terms and all the variable terms: $-8 - 9 - 10$ and $2x + 3x$.

What is the simplified form of the given equation?

The simplified form is $-27 + 5x = 21$.

How do I isolate x in the equation $-27 + 5x = 21$?

Add 27 to both sides to get $5x = 48$, then divide both sides by 5 to find x .

What is the solution for x in the equation $-8 + 2x - 9 + 3x - 10 = 21$?

$x = 48/5$ or $x = 9.6$.

Are there any alternative methods to solve this linear equation?

Yes, you can also use substitution or graphing methods, but combining like terms and isolating x is most straightforward here.

What does the solution $x = 9.6$ tell us about the original equation?

It satisfies the original equation, meaning substituting $x = 9.6$ makes both sides equal.

How can I verify my solution for the equation?

Substitute $x = 9.6$ back into the original equation and check if both sides are equal to 21.

Additional Resources

$$-8 + 2x - 9 + 3x - 10 = 21$$

Mathematics often appears as an abstract language, but behind every equation lies a story of logic, problem-solving, and critical thinking. One such example that exemplifies these qualities is the algebraic equation: $-8 + 2x - 9 + 3x - 10 = 21$. While it may seem simple at first glance, this expression provides a valuable window into the foundational principles of algebra, demonstrating how to manipulate variables, combine like terms, and ultimately solve for an unknown. In this article, we'll dissect this equation step-by-step, exploring the methods and reasoning that enable us to find the value of x , and in doing so, deepen our understanding of algebraic problem-solving.

Understanding the Equation: Breaking It Down

Before delving into the solution, it's essential to understand the structure of the equation:

$$-8 + 2x - 9 + 3x - 10 = 21$$

At first glance, it looks like a collection of numbers and variables combined through addition and subtraction. The goal here is to isolate the variable x on one side of the equation to find its value. But to do that efficiently, we need to process the equation systematically.

Key steps to consider:

- Recognize like terms (constants and terms with x)
- Combine constants to simplify
- Combine coefficients of x
- Isolate the variable term
- Solve for x

This approach ensures clarity and minimizes errors.

Step 1: Grouping Like Terms

The first step involves rearranging the equation to group similar terms together. Constants (numbers without variables) and variable terms should be grouped separately:

- Constants: -8, -9, -10
- Variable terms: 2x, 3x

The equation can be rewritten as:

$$(-8 - 9 - 10) + (2x + 3x) = 21$$

This organization helps to simplify the process, as constants and coefficients are easier to handle separately.

Step 2: Combining Constants and Coefficients

Next, combine the constants:

$$-8 - 9 - 10 = (-8 - 9) - 10 = (-17) - 10 = -27$$

Similarly, combine the coefficients of x:

$$2x + 3x = (2 + 3)x = 5x$$

Now, the equation becomes:

$$-27 + 5x = 21$$

This simplified form is much easier to work with.

Step 3: Isolate the Variable Term

To solve for x, the goal is to get the term containing x alone on one side of the equation. Currently, we have:

$$-27 + 5x = 21$$

Add 27 to both sides to move constants to the right:

$$-27 + 5x + 27 = 21 + 27$$

Simplifies to:

$$5x = 48$$

This step relies on the principle of equality—whatever you do to one side, you must do to the other.

Step 4: Solving for x

Now, dividing both sides by 5 isolates x:

$$x = 48 / 5$$

Expressed as a mixed number or decimal, this is:

$$x = 9.6$$

Thus, the solution to the original equation is:

$$x = 9.6$$

Validating the Solution

It's good practice to verify the solution by substituting x back into the original equation:

Original equation:

$$-8 + 2x - 9 + 3x - 10 = 21$$

Substitute $x = 9.6$:

$$-8 + 2(9.6) - 9 + 3(9.6) - 10$$

Calculate each term:

$$-8 + 19.2 - 9 + 28.8 - 10$$

Now, combine step-by-step:

$$(-8 - 9 - 10) + (19.2 + 28.8)$$

Sum constants:

$$-8 - 9 - 10 = -27$$

Sum variable terms:

$$19.2 + 28.8 = 48$$

Add these results:

$$-27 + 48 = 21$$

The left side equals the right side (21), confirming that $x = 9.6$ is indeed the correct solution.

The Significance of Solving Such Equations

While this particular equation may seem straightforward, the process exemplifies fundamental algebraic skills that are vital across various fields—science, engineering, economics, and beyond. Mastery over combining like terms, isolating variables, and verifying solutions builds a strong foundation for tackling more complex problems involving systems of equations, inequalities, and functions.

Moreover, understanding this process cultivates logical thinking and patience—traits essential in research, data analysis, and problem-solving scenarios.

Broader Applications of Algebraic Problem Solving

The principles demonstrated here extend well beyond classroom exercises:

- Engineering: Calculating parameters in circuit design or structural analysis often begins with similar algebraic manipulations.
- Economics: Equations model supply and demand, profit maximization, or cost analysis, requiring solving for unknown variables.
- Computer Science: Algorithms frequently rely on algebraic logic to optimize performance or solve for variables within code.
- Data Science: Regression models and statistical analyses utilize algebraic equations to interpret data.

In each case, the ability to manipulate and solve equations ensures accurate modeling and decision-making.

Common Pitfalls and Tips for Success

While solving equations like $-8 + 2x - 9 + 3x - 10 = 21$ is straightforward with practice, learners should be aware of common errors:

- Ignoring the order of operations: Always handle addition/subtraction carefully.
- Misgrouping terms: Keep constants and variables distinct to avoid mistakes.
- Incorrectly combining like terms: Remember that coefficients of x add algebraically.
- Neglecting to perform the same operation on both sides: Maintain equality throughout.

Tips for success:

- Write out each step clearly.
- Double-check each arithmetic operation.
- Verify your solution by substitution.
- Practice with varied problems to build confidence.

Final Thoughts

Equations like $-8 + 2x - 9 + 3x - 10 = 21$ serve as gateways to understanding the logic and structure of algebra. Through systematic grouping, combining like terms, and careful manipulation, we can unravel the mystery of the unknown variable x . The skills developed extend beyond mathematics, fostering critical thinking and problem-solving abilities applicable across disciplines.

In the broader context, mastering such foundational equations empowers students, professionals, and enthusiasts to approach complex challenges with confidence and clarity. Whether in academic pursuits or real-world applications, the journey from an equation to its solution exemplifies the

power of logical reasoning—a testament to the enduring relevance of algebra in our increasingly data-driven world.

8 2x 9 3x 10 21

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