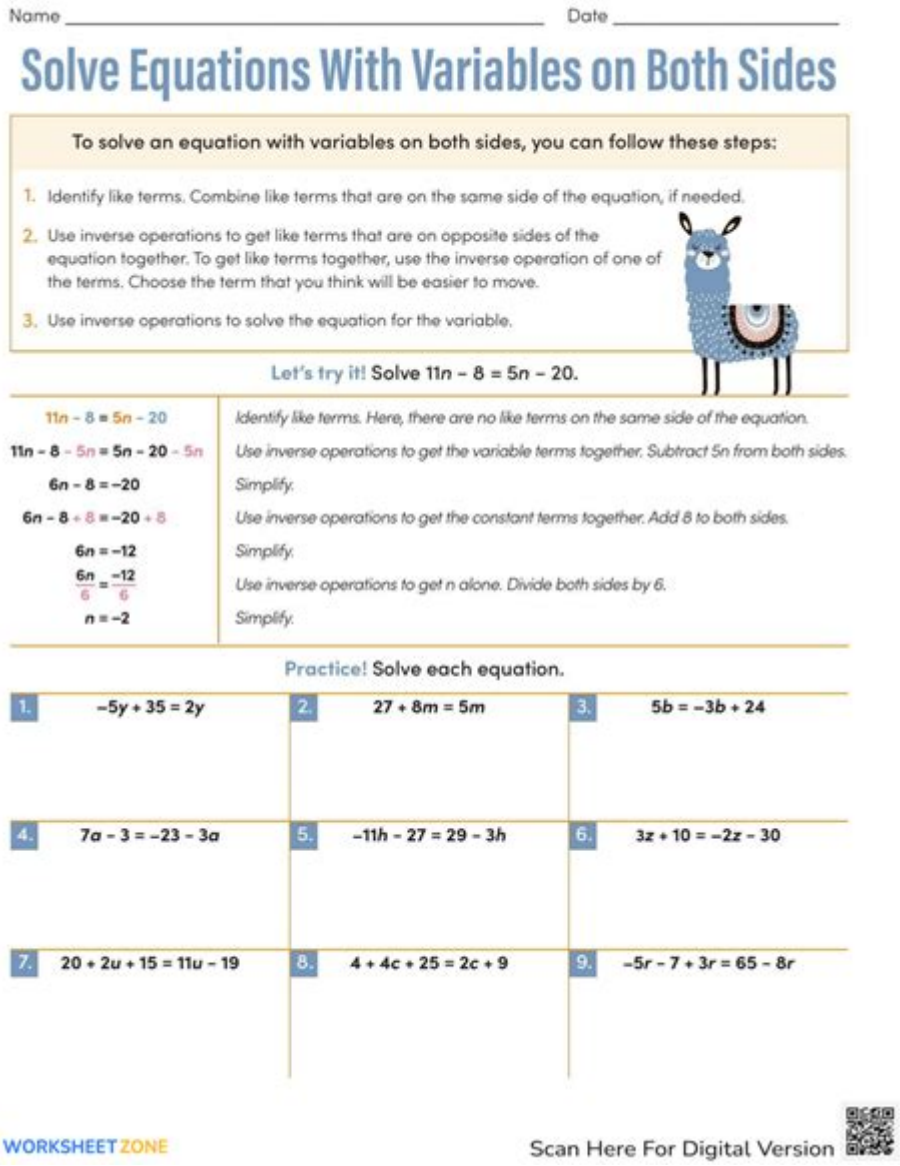
Algebra Solving Equations With Variables On Both Sides



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Solve Equations With Variables on Both Sides

To solve an equation with variables on both sides, you can follow these steps:

1. Identify like terms. Combine like terms that are on the same side of the equation, if needed.
2. Use inverse operations to get like terms that are on opposite sides of the equation together. To get like terms together, use the inverse operation of one of the terms. Choose the term that you think will be easier to move.
3. Use inverse operations to solve the equation for the variable.

Let's try it! Solve $11n - 8 = 5n - 20$.

$11n - 8 = 5n - 20$	*Identify like terms. Here, there are no like terms on the same side of the equation.*
$11n - 8 - 5n = 5n - 20 - 5n$	*Use inverse operations to get the variable terms together. Subtract 5n from both sides.*
$6n - 8 = -20$	*Simplify.*
$6n - 8 + 8 = -20 + 8$	*Use inverse operations to get the constant terms together. Add 8 to both sides.*
$6n = -12$	*Simplify.*
$\frac{6n}{6} = \frac{-12}{6}$	*Use inverse operations to get n alone. Divide both sides by 6.*
$n = -2$	*Simplify.*

Practice! Solve each equation.

1. $-5y + 35 = 2y$	2. $27 + 8m = 5m$	3. $5b = -3b + 24$
4. $7a - 3 = -23 - 3a$	5. $-11h - 27 = 29 - 3h$	6. $3z + 10 = -2z - 30$
7. $20 + 2u + 15 = 11u - 19$	8. $4 + 4c + 25 = 2c + 9$	9. $-5r - 7 + 3r = 65 - 8r$

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Algebra solving equations with variables on both sides is a fundamental concept that students encounter in their mathematics journey. This topic not only enhances one's problem-solving skills but also lays the groundwork for more advanced topics in algebra and calculus. In this article, we will explore the steps to solve equations with variables on both sides, provide examples for better understanding, and offer tips to avoid common pitfalls.

Understanding Equations with Variables on Both Sides

Before diving into the solving process, it's essential to grasp what it means to have variables on both sides of an equation. An equation typically consists of two expressions separated by an equal sign.

When both sides contain variables, the goal is to isolate the variable, allowing you to find its value.

For example, consider the equation:

$$ 3x + 5 = 2x + 10 $$

In this case, both sides of the equation contain the variable x, and our task is to manipulate the equation to solve for x.

Steps to Solve Equations with Variables on Both Sides

Solving equations with variables on both sides can be accomplished through a series of clear steps. Here's a structured approach to follow:

Step 1: Simplify Both Sides of the Equation

Start by simplifying each side of the equation as much as possible. This includes:

- Combining like terms
- Distributing any constants or coefficients
- Eliminating parentheses

For instance, if you have an equation like:

$$ 2(3x + 4) = x + 10 $$

You would first distribute the 2:

$$ 6x + 8 = x + 10 $$

Step 2: Move Variables to One Side

After simplifying, the next step is to get all instances of the variable on one side of the equation. You can accomplish this by:

- Subtracting or adding the variable from both sides

Continuing with our example:

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

This simplifies to:

$$ 5x + 8 = 10 $$

Step 3: Isolate the Variable

Once the variable is on one side, you need to isolate it by:

- Subtracting or adding constant terms from both sides
- Dividing or multiplying by coefficients if necessary

In our example, we would subtract 8 from both sides:

$$ 5x = 10 - 8 $$

Which simplifies to:

$$ 5x = 2 $$

Now, divide both sides by 5:

$$ x = \frac{2}{5} $$

Step 4: Verify Your Solution

It’s crucial to check your solution by substituting it back into the original equation. For our example with $x = \frac{2}{5}$:

$$ 3\left(\frac{2}{5}\right) + 5 \stackrel{?}{=} 2\left(\frac{2}{5}\right) + 10 $$

Calculating both sides gives:

$$ \frac{6}{5} + 5 = \frac{6}{5} + 10 $$

Converting 5 and 10 to fractions:

$$ \frac{6}{5} + \frac{25}{5} = \frac{6}{5} + \frac{50}{5} $$

This results in:

$$ \frac{31}{5} = \frac{56}{5} $$

Since both sides are indeed equal, our solution is verified.

Examples of Solving Equations with Variables on Both Sides

Let’s look at a couple more examples to solidify our understanding.

Example 1:

Solve the equation:

$$ 4x - 3 = 2x + 5 $$

1. Simplify both sides (no simplification needed here).
2. Move variables to one side:

$$ 4x - 2x = 5 + 3 $$

Which simplifies to:

$$ 2x = 8 $$

3. Isolate the variable by dividing by 2:

$$ x = 4 $$

4. Verify the solution:

$$ 4(4) - 3 = 2(4) + 5 $$

Which results in:

$$ 16 - 3 = 8 + 5 $$

Thus, $13 = 13$ confirms the solution is correct.

Example 2:

Solve the equation:

$$ 5(x - 2) = 3x + 4 $$

1. Distribute on the left side:

$$ 5x - 10 = 3x + 4 $$

2. Move variables to one side:

$$ 5x - 3x = 4 + 10 $$

Simplifying gives:

$$ 2x = 14 $$

3. Isolate the variable:

$$ x = 7 $$

4. Verify the solution:

$$ 5(7 - 2) = 3(7) + 4 $$

Simplifying both sides:

$$ 25 = 21 + 4 $$

Thus, $25 = 25$ confirms the solution is valid.

Common Mistakes to Avoid

While solving equations with variables on both sides, students often make mistakes. Here are some common pitfalls to watch out for:

- Forgetting to distribute: Ensure you distribute coefficients to all terms inside parentheses.
- Not combining like terms: Always look for opportunities to simplify expressions before moving to isolate variables.
- Incorrectly moving terms: When moving terms from one side to the other, remember to change their signs.
- Neglecting to verify: Always substitute your solution back into the original equation to confirm its accuracy.

Conclusion

Algebra solving equations with variables on both sides is an essential skill that requires practice and attention to detail. By following the structured steps outlined in this article—simplifying both sides, moving variables, isolating the variable, and verifying your solution—you can master this topic. With practice, solving these equations will become a straightforward task, paving the way for further success in algebra and beyond.

Frequently Asked Questions

What is the first step to solve an equation with variables on both sides?

The first step is to isolate the variable by moving all terms containing the variable to one side of the equation and constant terms to the other side.

How do I combine like terms when solving equations with

variables on both sides?

You combine like terms by adding or subtracting the coefficients of the variable terms and constant terms on each side of the equation.

What should I do if I have fractions in my equation?

If there are fractions, you can eliminate them by multiplying the entire equation by the least common denominator (LCD) before proceeding to isolate the variable.

Can you provide an example of solving an equation with variables on both sides?

Sure! For the equation 3x + 2 = 2x + 5, you would first subtract 2x from both sides to get x + 2 = 5, then subtract 2 from both sides to find x = 3.

What mistakes should I avoid when solving these types of equations?

Common mistakes include forgetting to perform the same operation on both sides of the equation, miscalculating when combining like terms, or incorrectly moving variables or constants.

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