Solve By Using Multiplication With The Addition-or-subtraction Method. 4x - 5y = 08x + 5y = -6

Solve By Using Multiplication With The Addition-or-subtraction Method. 4x - 5y = 0, 8x + 5y = -6

The method of solving systems of equations by using multiplication combined with addition or subtraction is a powerful technique, especially when the coefficients of one variable are opposites or can be made opposites through multiplication. In this article, we will explore how to apply this method to the following system of equations:

$4x - 5y = 0$

$8x + 5y = -6$

Our goal is to find the values of x and y that satisfy both equations simultaneously. To do this effectively, we'll analyze the structure of the equations, determine appropriate multipliers, and then utilize addition or subtraction to eliminate one variable, simplifying the process of solving for the other.

Understanding the System of Equations

Examining the Given Equations

- Equation 1: $4x - 5y = 0$
- Equation 2: $8x + 5y = -6$

Notice that the coefficients of y in both equations are opposites: -5 and +5. This is a key insight because it suggests that adding the two equations will eliminate y directly. However, let's verify this and see how multiplication can assist in the process if needed.

Initial Observations

- The coefficients of x are 4 and 8, which are multiples of each other. This means that multiplying the first equation by 2 will align the x coefficients, allowing for elimination through subtraction.

- The coefficients of y are already opposites, so addition will eliminate y without further multiplication.

Step-by-Step Solution Using Multiplication and Addition or Subtraction

Step 1: Preparing the Equations for Elimination

Since the coefficients of y are already opposites, our best approach is to add the equations directly to eliminate y. However, to eliminate x instead, or to confirm the solution, we can consider multiplying equations to align coefficients.

Step 2: Multiplying Equations to Align Coefficients

1. To eliminate y, proceed without multiplication because coefficients are already opposites:

2. Adding the equations:

Equation 1 + Equation 2:

$(4x - 5y) + (8x + 5y) = 0 + (-6)$

$(4x + 8x) + (-5y + 5y) = -6$

$12x + 0 = -6$

Step 3: Solving for x

From the simplified equation:

$12x = -6$

Divide both sides by 12:

$x = -6 / 12 = -1/2$

Step 4: Substituting x Back to Find y

Use either original equation to solve for y. Let's substitute into Equation 1:

$4x - 5y = 0$

$4(-1/2) - 5y = 0$

$-2 - 5y = 0$

$-5y = 2$

$y = 2 / -5 = -2/5$

Final Solution

Therefore, the solution to the system is:

- $x = -1/2$
- $y = -2/5$

Alternative Approach: Eliminating x Using Multiplication

Preparing Equations for x-Elimination

- Our goal is to align the coefficients of x for elimination.
- Equation 1 has 4x; Equation 2 has 8x.

Multiplying Equations for Equal Coefficients

1. Multiply Equation 1 by 2 to match the coefficient of 8x:

$$2(4x - 5y) = 2(0)$$

$$8x - 10y = 0$$

2. Now, with the modified Equation 1 and Equation 2:

$$8x - 10y = 0$$
$$8x + 5y = -6$$

Subtracting to Eliminate x

$$(8x - 10y) - (8x + 5y) = 0 - (-6)$$

$$8x - 8x - 10y - 5y = 6$$

$$0 - 15y = 6$$

$$-15y = 6$$

$$y = 6 / -15 = -2/5$$

Finding x Using y

Substitute y = -2/5 into Equation 2:

$8x + 5(-2/5) = -6$

$8x - 2 = -6$

$8x = -6 + 2 = -4$

$x = -4 / 8 = -1/2$

Summary of the Method

The process of solving systems using multiplication combined with addition or subtraction involves these key steps:

1. Identify which variable to eliminate by addition or subtraction.
2. Determine if multiplying one or both equations is necessary to align coefficients.
3. Multiply the equations accordingly to create coefficients that cancel out when added or subtracted.
4. Perform the addition or subtraction to eliminate one variable.
5. Solve for the remaining variable.
6. Substitute back into one of the original equations to find the other variable.

Conclusion

The addition-or-subtraction method combined with multiplication is an efficient way to solve systems of linear equations, especially when coefficients are already opposites or can be made so through multiplication. In the example provided, we demonstrated two approaches: adding directly because the y coefficients were opposites and multiplying to align x coefficients for elimination. Both methods led to the same solution: $x = -1/2$ and $y = -2/5$. Mastering these techniques enhances problem-solving skills and provides a systematic approach to tackling systems of equations in algebra.

Frequently Asked Questions

How can I use the addition or subtraction method to solve the system 4x - 5y = 0 and 8x + 5y = -6?

First, add the two equations to eliminate y: (4x - 5y) + (8x + 5y) = 0 + (-6), which simplifies to 12x = -6. Then, solve for x: x = -6/12 = -1/2. Next, substitute x = -1/2 into one of the original equations to find y.

What is the value of y when solving the system 4x - 5y = 0 and 8x + 5y = -6 using the addition method?

After finding x = -1/2, substitute into the first equation: 4(-1/2) - 5y = 0, simplifying to -2 - 5y = 0. Then, 5y = -2, so y = -2/5.

Why does adding the two equations in this system help to eliminate the variable y?

Because the coefficients of y are opposites (−5 and +5), adding the equations cancels out y, making it easier to solve for x directly.

Can you explain step-by-step how to solve 4x - 5y = 0 and 8x + 5y = -6 using the addition/subtraction method?

Yes. First, add the two equations to eliminate y: 12x = -6, so x = -1/2. Then, substitute x into either original equation, for example, into 4x - 5y = 0: 4(-1/2) - 5y = 0, resulting in -2 - 5y = 0, so y = -2/5.

What should I do if adding the equations does not eliminate a variable in a similar system?

If adding the equations doesn't eliminate a variable, try multiplying one or both equations by a constant to make the coefficients of that variable opposites, then add or subtract to eliminate it.

Additional Resources

Solve By Using Multiplication With The Addition-or-Subtraction Method is a fundamental technique in algebra that simplifies solving systems of linear equations. This method, often referred to as the elimination method, enables students and mathematicians alike to find solutions efficiently by manipulating equations to eliminate one variable, thereby reducing the system to a single-variable equation. When applied correctly, especially with the strategic use of multiplication, it can be a powerful tool for solving more complex systems. In this article, we will explore how to solve the specific system of equations:

$$
4x - 5y = 0
$$
$$
8x + 5y = -6
$$

using the multiplication with the addition or subtraction method, analyze each step in detail, and discuss general strategies, advantages, and limitations of this approach.

Understanding the System of Equations

Before diving into the solution process, it’s crucial to understand what the system entails. The two equations in question are:

1. $4x - 5y = 0$
2. $8x + 5y = -6$

Both are linear equations in two variables, x and y. The goal is to find the pair (x, y) that satisfies both equations simultaneously. This involves finding a common solution at the intersection point of the lines represented by each equation.

Principles of the Addition-Subtraction Method with Multiplication

The addition or subtraction method relies on manipulating equations so that when they are added or subtracted, one variable cancels out, leaving an equation with only one variable. To do this effectively, the coefficients of the targeted variable should be opposites or equal in magnitude but opposite in sign.

Key principles include:

- Matching coefficients: Adjust the equations so that the coefficients of the variable to eliminate are equal in magnitude but opposite in sign.
- Multiplication: Multiply entire equations by constants to achieve the desired coefficients.

- Addition or subtraction: Add or subtract the equations to eliminate one variable, then solve for the remaining variable.
- Back-substitution: Use the found value to determine the other variable.

Step-by-Step Solution Using Multiplication and Addition/Subtraction

Applying the method to our specific system:

$$
4x - 5y = 0 \quad (1)
$$
$$
8x + 5y = -6 \quad (2)
$$

Step 1: Identify coefficients of the variable to eliminate

Notice that the coefficients of y are -5 and 5, which are already opposites. This suggests that adding equations directly will eliminate y.

Step 2: Add the equations

$$
(4x - 5y) + (8x + 5y) = 0 + (-6)
$$

$$
(4x + 8x) + (-5y + 5y) = -6
$$

$$
12x + 0 = -6
$$

$$
12x = -6
$$

Step 3: Solve for x

$$
x = \frac{-6}{12} = -\frac{1}{2}
$$

Step 4: Substitute $x = -\frac{1}{2}$ into one of the original equations

Using equation (1):

$$
4x - 5y = 0
$$

$$
4 \times \left(-\frac{1}{2}\right) - 5y = 0
$$

$$
-2 - 5y = 0
$$

$$
-5y = 2
$$

$$
y = -\frac{2}{5}
$$

Final solution:

$$
x = -\frac{1}{2}, \quad y = -\frac{2}{5}
$$

Verification of the Solution

To ensure accuracy, substitute the solutions back into the second original equation:

$$
8x + 5y = -6
$$

$$
8 \times \left(-\frac{1}{2}\right) + 5 \times \left(-\frac{2}{5}\right) = -6
$$

$$
-4 - 2 = -6
$$

$$
-6 = -6
$$

\]

The solutions satisfy both equations, confirming their correctness.

General Features and Tips for Using the Multiplication Addition-Subtraction Method

Features:

- Efficient for systems where coefficients are already opposites or can be easily made so through multiplication.
- Eliminates one variable quickly, reducing the problem to a single-variable equation.
- Suitable for systems with coefficients that are multiples or factors of each other.

Tips:

- Always examine the coefficients to decide whether direct addition or subtraction will eliminate a variable.
- Use multiplication strategically to match coefficients if they are not already opposites.
- Be careful with signs during multiplication and addition to avoid errors.
- After finding one variable, substitute back to find the other.

Pros and Cons of the Multiplication With Addition-or-Subtraction Method

Pros:

- Speed: Often faster than substitution when coefficients align conveniently.
- Clarity: Provides a straightforward path to solution with fewer algebraic manipulations.
- Versatility: Effective for larger systems or those with coefficients that can be easily matched.

Cons:

- Preliminary work: Sometimes requires multiple steps of multiplication to align coefficients.
- Limited applicability: Not always straightforward if coefficients don’t

lend themselves to easy elimination.
- Potential for errors: Sign mistakes or incorrect multipliers can lead to wrong solutions; careful attention is needed.

Extensions and Variations of the Method

While the current example was straightforward due to the coefficients being already opposites, in more complex systems, the method may involve:

- Multiplying equations by different constants to align coefficients.
- Combining this method with substitution if elimination becomes cumbersome.
- Using matrix methods or graphing for systems with more variables or equations.

Conclusion

The Solve By Using Multiplication With The Addition-or-Subtraction Method is an essential skill in algebra that simplifies solving systems of equations. Its efficiency hinges on strategic multiplication to align coefficients, enabling straightforward elimination. The example provided demonstrates the method's power: by recognizing that the coefficients of y are already opposites, we directly added the equations, quickly deriving the solution $(x, y) = \left(-\frac{1}{2}, -\frac{2}{5}\right)$. Mastering this technique involves understanding when and how to apply multiplication, maintaining careful attention to signs, and verifying solutions. With practice, this method becomes an invaluable tool for solving systems quickly and accurately, laying a solid foundation for tackling more advanced algebraic problems and systems.

Features Summary:

- Strengths: Fast, clear, effective for suitable systems.
- Limitations: May require additional steps if coefficients are not aligned.
- Best suited for: Systems with coefficients that are multiples or can be easily manipulated to cancel variables.

By honing skills in this method, students can approach linear systems with confidence, fostering a deeper understanding of algebraic relationships and problem-solving strategies.

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