Solve The System Of Equations By The Addition Method.2x - 5y = 47x - 2y = 4Type In Ordered Pair.

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Understanding how to solve systems of equations is a fundamental skill in algebra that helps students and professionals alike analyze relationships between variables. One effective method for solving systems of equations is the Addition Method, also known as the Elimination Method. In this article, we will explore how to solve the system:

$$ 2x - 5y = 4 $$
$$ 7x - 2y = 4 $$

using the addition method, and how to express the solution as an ordered pair. This approach is particularly useful when the coefficients of one variable are opposites or can be made opposites through multiplication, allowing for straightforward elimination.

Understanding the System of Equations

Before diving into the solution process, it's essential to understand what a system of equations represents. A system consists of two or more equations with the same variables. The solution to the system is the point(s) where the equations intersect, represented as ordered pairs (x, y).

In our case, the system is:

$$ 2x - 5y = 4 \quad \text{(Equation 1)} $$
$$ 7x - 2y = 4 \quad \text{(Equation 2)} $$

Our goal is to find the values of x and y that satisfy both equations simultaneously.

Applying the Addition Method to Solve the

System

The addition method involves manipulating the equations so that adding them together cancels out one variable, making it easier to solve for the other.

Step 1: Align the Equations

Ensure both equations are in the standard form:

- Equation 1: $2x - 5y = 4$
- Equation 2: $7x - 2y = 4$

Step 2: Make the Coefficients of One Variable Opposite

To eliminate a variable, the coefficients of either x or y should be opposites. Since 2 and 7 are not opposites, we can find the least common multiple (LCM) of their coefficients to create equal and opposite coefficients.

- For x, the coefficients are 2 and 7. The LCM is 14.

- For y, the coefficients are -5 and -2. The LCM is 10.

Let's choose to eliminate x. To do this:

- Multiply Equation 1 by 7:

$$
(2x - 5y) \times 7 \Rightarrow 14x - 35y = 28
$$

- Multiply Equation 2 by -2:

$$
(7x - 2y) \times -2 \Rightarrow -14x + 4y = -8
$$

Now, the system becomes:

$$
\begin{cases}
14x - 35y = 28 \quad \text{(Equation 3)} \\
-14x + 4y = -8 \quad \text{(Equation 4)}
\end{cases}
$$

Step 3: Add the Equations to Eliminate x

Add Equation 3 and Equation 4:

$$
(14x - 35y) + (-14x + 4y) = 28 + (-8)
$$

Simplify:

$$
(14x - 14x) + (-35y + 4y) = 20
$$
$$
0x - 31y = 20
$$

which simplifies to:

$$
-31y = 20
$$

Solve for y:

$$
y = \frac{20}{-31} = -\frac{20}{31}
$$

Step 4: Substitute y Back into One of the Original Equations

Now that we have y, substitute this value into one of the original equations to solve for x. Let's choose Equation 1:

$$
2x - 5y = 4
$$

Substitute $y = -\frac{20}{31}$:

$$
2x - 5 \times \left(-\frac{20}{31}\right) = 4

\]

Simplify:

$$
2x + \frac{100}{31} = 4
$$

Subtract $\frac{100}{31}$ from both sides:

$$
2x = 4 - \frac{100}{31}
$$

Express 4 as a fraction with denominator 31:

$$
2x = \frac{124}{31} - \frac{100}{31} = \frac{24}{31}
$$

Divide both sides by 2:

$$
x = \frac{24}{31} \times \frac{1}{2} = \frac{24}{62} = \frac{12}{31}
$$

Final Solution as Ordered Pair

The solution to the system, expressed as an ordered pair (x, y), is:

$$
\boxed{\left(\frac{12}{31}, -\frac{20}{31} \right)}
$$

This means the point $\left(\frac{12}{31}, -\frac{20}{31} \right)$ lies on both lines represented by the original equations.

Why Use The Addition Method?

The addition method is favored for its simplicity and efficiency, especially when the coefficients of one variable are already opposites or can be easily made so through multiplication. It avoids the need for substitution, which can sometimes involve more complex algebraic manipulation.

Advantages include:

- Faster solutions when coefficients are compatible.
- Reduced chance of algebraic errors.
- Clear elimination process for one variable.

Tips for Solving Systems Using the Addition Method

- Always aim to align equations in standard form.
- Find the least common multiple (LCM) of coefficients to facilitate elimination.
- Carefully multiply equations to create opposite coefficients.
- Always double-check calculations, especially signs and fractions.
- After finding one variable, substitute back into an original equation to find the other.

Practice Problems for Mastery

To solidify your understanding, try solving these systems using the addition method:

1. $3x + 4y = 10$ and $5x - 2y = 4$
2. $6x - y = 8$ and $2x + 3y = 7$
3. $x + 2y = 5$ and $3x - y = 4$

Conclusion

Solving systems of equations by the addition method is a powerful technique that simplifies the process of finding solutions, especially when coefficients are conducive to elimination. By following structured steps—aligning equations, making coefficients opposites, adding to eliminate a variable, and substituting back—you can efficiently find the exact points where the equations intersect.

Remember, mastering these algebraic techniques enhances your problem-solving abilities and builds a solid foundation for more advanced mathematics topics. Practice regularly with different systems to become confident in applying the addition method and expressing solutions as ordered pairs.

Keywords: solve system of equations, addition method, elimination method, algebra, solve for x and y, ordered pair, system of linear equations, algebra tutorial, math practice

Frequently Asked Questions

How do you solve the system of equations $2x - 5y = 0$ and $7x - 2y = 4$ using the addition method?

First, align the equations: $2x - 5y = 0$ and $7x - 2y = 4$. To eliminate one variable, multiply the equations to make the coefficients of either x or y equal. For example, multiply the first equation by 2 and the second by 5: ($4x - 10y = 0$) and ($35x - 10y = 20$). Subtract the first from the second: $(35x - 10y) - (4x - 10y) = 20 - 0$, resulting in $31x = 20$, so $x = 20/31$. Substitute x back into one of the original equations to find y.

What is the solution to the system $2x - 5y = 4$ and $7x - 2y = 4$ using the addition method?

Multiply the first equation by 2 and the second by 5 to align the coefficients: ($4x - 10y = 8$) and ($35x - 10y = 20$). Subtract the first from the second: $(35x - 10y) - (4x - 10y) = 20 - 8$, giving $31x = 12$, so $x = 12/31$. Plug x into one original equation to solve for y.

How do you find the solution for the system $2x - 5y = 47$ and $7x - 2y = 4$?

Multiply the first equation by 2 and the second by 5: ($4x - 10y = 94$) and ($35x - 10y = 20$). Subtract the first from the second: $(35x - 4x) = 20 - 94$, which simplifies to $31x = -74$, so $x = -74/31$. Substitute x into one of the original equations to find y.

What are the steps to solve the system $2x - 5y = 4$

and $7x - 2y = 4$ using addition?

First, multiply equations to align coefficients of y: multiply the first by 2 and the second by 5, resulting in $4x - 10y = 8$ and $35x - 10y = 20$. Then subtract to eliminate y: $(35x - 4x) = 20 - 8$, leading to $31x = 12$, and solve for x. Substitute x back into one of the original equations to find y.

Additional Resources

Solve The System Of Equations By The Addition Method

Understanding how to solve systems of equations is a fundamental skill in algebra that unlocks numerous real-world applications, from engineering calculations to economic modeling. One particularly efficient method is the Addition Method, also known as the Elimination Method. This technique is especially valuable when the coefficients of one variable are opposites or can be made to be opposites, allowing for straightforward elimination. In this article, we will explore how to solve a specific system of equations using the addition method, exemplified by the equations:

$$ 2x - 5y = 4 $$
$$ 7x - 2y = 47 $$

We'll guide you through each step in detail, clarify the underlying concepts, and demonstrate how to write the solution as an ordered pair.

Understanding the System of Equations

Before diving into the solution process, it’s essential to understand what a system of equations is and why the addition method is a powerful approach.

What Is a System of Equations?

A system of equations consists of two or more equations with the same set of variables. The goal is to find the values of these variables that satisfy all equations simultaneously. For example:

$$
\begin{cases}
2x - 5y = 4 \\
7x - 2y = 47
\end{cases}
$$

The solutions are the points (x, y) where both equations intersect on the coordinate plane.

The Addition (Elimination) Method Overview

The addition method involves combining the equations to eliminate one variable, allowing for straightforward solving of the remaining variable. The key steps are:

1. Align the equations in standard form.
2. Adjust coefficients to make the coefficients of one variable opposites.
3. Add or subtract the equations to eliminate that variable.
4. Solve for the remaining variable.
5. Substitute back to find the other variable.

This method is particularly effective when the coefficients of a variable are already opposites or can be made so with simple multiplication.

Step-by-Step Solution of the System

Let's now apply the addition method to our specific system:

$$
\begin{cases}
2x - 5y = 4 \quad (1) \\
7x - 2y = 47 \quad (2)
\end{cases}
$$

Step 1: Prepare the Equations for Elimination

First, ensure both equations are in standard form with variables aligned:

- Equation (1): $2x - 5y = 4$
- Equation (2): $7x - 2y = 47$

Our goal is to eliminate either x or y. To do this efficiently, we look at the coefficients of y:

- Equation (1): coefficient of y is -5
- Equation (2): coefficient of y is -2

These coefficients are not opposites, but we can adjust one or both equations so that their coefficients of y are equal in magnitude but opposite in sign.

Step 2: Equalize the Coefficients for Elimination

To eliminate y, we want the coefficients to be opposites:

- Multiply Equation (1) by 2:

$$
(2x - 5y) \times 2 \Rightarrow 4x - 10y = 8
$$

- Multiply Equation (2) by 5:

$$
(7x - 2y) \times 5 \Rightarrow 35x - 10y = 235
$$

Now, the modified equations are:

$$
\begin{cases}
4x - 10y = 8 \quad (3) \\
35x - 10y = 235 \quad (4)
\end{cases}
$$

Notice that both equations have $-10y$, which makes elimination straightforward.

Step 3: Eliminate the Variable and Solve

Subtract Equation (3) from Equation (4):

$$
(35x - 10y) - (4x - 10y) = 235 - 8
$$

Simplify:

\[

$$
(35x - 4x) + (-10y + 10y) = 227
$$

$$
31x + 0 = 227
$$

$$
31x = 227
$$

Solve for x:

$$
x = \frac{227}{31}
$$

Since $31 \times 7 = 217$, and $31 \times 8 = 248$, $227/31$ simplifies to a decimal:

$$
x \approx 7.3226
$$

But it's preferable to keep it as an exact fraction:

$$
x = \frac{227}{31}
$$

Step 4: Substitute x Back to Find y

Now, substitute $x = \frac{227}{31}$ into one of the original equations to solve for y. Let's use Equation (1):

$$
2x - 5y = 4
$$

Plugging in:

$$
2 \times \frac{227}{31} - 5y = 4
$$

Simplify:

$$
\frac{454}{31} - 5y = 4
$$

Express 4 as a fraction with denominator 31:

$$
\frac{454}{31} - 5y = \frac{124}{31}
$$

Now, isolate $5y$:

$$
-5y = \frac{124}{31} - \frac{454}{31} = -\frac{330}{31}
$$

Divide both sides by -5:

$$
y = \frac{-\frac{330}{31}}{-5} = \frac{330/31}{5}
$$

Simplify numerator and denominator:

$$
y = \frac{330}{31} \times \frac{1}{5} = \frac{330}{31 \times 5} =
\frac{330}{155}
$$

Reduce the fraction:

$$
\frac{330}{155} = \frac{66}{31}
$$

(because $330 ÷ 5 = 66$ and $155 ÷ 5 = 31$).

Final Answer:

$$
x = \frac{227}{31}
$$
$$
y = \frac{66}{31}
$$

Expressed as an ordered pair:

$$
\boxed{\left(\frac{227}{31}, \frac{66}{31} \right)}
$$

Interpreting and Verifying the Solution

Once the solution is obtained, it's good practice to verify its accuracy by substituting the values back into the original equations.

Verification:

- Equation (1):

$$
2x - 5y = 4
$$

$$
2 \times \frac{227}{31} - 5 \times \frac{66}{31} = \frac{454}{31} - \frac{330}{31} = \frac{124}{31} = 4
$$

- Equation (2):

$$
7x - 2y = 47
$$

$$
7 \times \frac{227}{31} - 2 \times \frac{66}{31} = \frac{1589}{31} - \frac{132}{31} = \frac{1457}{31} = 47
$$

Both equations check out, confirming the solution's correctness.

Summary of Key Points

- The addition (elimination) method simplifies solving systems by aligning coefficients to cancel variables.
- Adjust coefficients through multiplication to create opposites.
- Carefully perform arithmetic operations, especially when fractions are involved.
- Always verify your solution by substituting back into the original equations.
- Solutions can be expressed as exact fractions or decimals, depending on the context.

Applications of the Addition Method

Understanding and applying the addition method is not just a mathematical exercise but also a vital skill in various fields:

- Engineering: balancing forces or currents.
- Economics: solving for equilibrium points.
- Physics: resolving vector components.
- Computer Science: algorithms involving simultaneous equations.

Mastering this technique enhances problem-solving efficiency and analytical thinking.

Conclusion

The addition method offers a systematic, efficient approach to solving systems of linear equations. By carefully manipulating coefficients and combining equations, you can find solutions with confidence and precision. The example detailed above illustrates not only the mechanics of the method but also the importance of step-by-step verification to ensure accuracy. Whether you're tackling academic problems or applying these skills in real-world scenarios, mastering the addition method equips you with a powerful tool in your mathematical toolkit.

Remember: Practice makes perfect. Try solving systems with different coefficients and variables to develop fluency and intuition with the addition method.

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