Solve The Following System Using Substitution, Showing All Work.-3x + 2y = 162x + Y = 1Note: Failure

Solve The Following System Using Substitution, Showing All Work.-3x + 2y = 16 2x + y = 1Note: Failure

When approaching systems of linear equations, one of the most effective methods is substitution. This method involves solving one of the equations for one variable and then substituting that expression into the other equation to find the remaining variable. In this article, we will walk through the detailed steps to solve the following system:

-3x + 2y = 16
2x + y = 1

Failure to properly apply substitution can lead to incorrect solutions, so it’s important to follow each step carefully. We aim to demonstrate the process thoroughly, providing clarity for learners seeking a comprehensive understanding of the substitution method.

Understanding the System of Equations

Before diving into solving the system, let's analyze the equations:

1. Equation 1: -3x + 2y = 16
2. Equation 2: 2x + y = 1

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

Step 1: Solve One Equation for One Variable

The first step in the substitution method is to solve one of the equations for either x or y. Because Equation 2 is simpler and contains only y with a coefficient of 1, it’s advantageous to solve Equation 2 for y:

2x + y = 1

Rearranged for y:

y = 1 - 2x

This expression for y can now be substituted into Equation 1.

Step 2: Substitute into the Other Equation

Substituting y = 1 - 2x into Equation 1:

-3x + 2(1 - 2x) = 16

Now, expand and simplify:

-3x + 2 1 - 2 2x = 16

-3x + 2 - 4x = 16

Combine like terms:

(-3x - 4x) + 2 = 16

-7x + 2 = 16

Step 3: Solve for the Remaining Variable (x)

Subtract 2 from both sides:

-7x = 16 - 2

-7x = 14

Divide both sides by -7:

x = 14 / -7

x = -2

Solution so far:

x = -2

Step 4: Substitute x Back into the Expressed Equation for y

Recall that y = 1 - 2x, so substitute x = -2:

y = 1 - 2(-2)

y = 1 + 4

y = 5

Solution:

x = -2
y = 5

Step 5: Verify the Solution

It’s always important to verify the solutions by plugging x and y back into the original equations:

Equation 1: -3x + 2y = 16

-3(-2) + 2(5) = 16

6 + 10 = 16

16 = 16 (True)

Equation 2: 2x + y = 1

2(-2) + 5 = 1

-4 + 5 = 1

1 = 1 (True)

Since both equations are satisfied, the solution is correct.

Summary of the Steps in Solving Using Substitution

To summarize, the process involves:

1. Choosing an equation to solve for one variable (preferably the simplest).
2. Expressing that variable in terms of the other variable.
3. Substituting this expression into the other equation.
4. Solving the resulting equation for one variable.

5. Back-substituting to find the other variable.
6. Verifying the solution by substituting both variables into the original equations.

Common Mistakes to Avoid

When solving systems using substitution, students often make errors that can lead to failure or incorrect solutions. Here are some pitfalls and tips to avoid them:

- **Forgetting to distribute properly:** When substituting, ensure that multiplication distributes correctly over parentheses.
- **Incorrect algebraic manipulation:** Double-check addition, subtraction, and division steps to prevent sign errors or arithmetic mistakes.
- **Not verifying solutions:** Always substitute your answers back into the original equations to confirm their accuracy.
- **Choosing the wrong equation to solve:** Often, it's easier to solve the equation with a variable having a coefficient of 1 or a simple coefficient to minimize errors.

Additional Tips for Solving Systems Using Substitution

- Select the easiest equation: When choosing which equation to solve for a variable, pick the one that simplifies calculations, such as an equation with a variable with coefficient 1.

- Be meticulous with algebra: Carefully expand, combine like terms, and keep track of signs.

- Use substitution consistently: Once you have an expression for one variable, substitute it precisely without skipping steps.

- Check your solution: Always verify by plugging values back into the original system to ensure correctness.

Conclusion

The substitution method is a powerful and systematic approach to solving systems of linear equations. By following the steps—solving one equation for a variable, substituting into the other, solving for the remaining variable, and verifying—you can reliably find solutions to such systems. The example demonstrated here, solving the system:

$$-3x + 2y = 16$$
$$2x + y = 1$$

results in the solution $x = -2$ and $y = 5$, which satisfies both equations.

Mastering this method enhances problem-solving skills in algebra and prepares learners for more complex systems and applications in mathematics, science, and engineering. Practice solving various systems using substitution to build confidence and proficiency.

Remember: Careful work, verification, and understanding each step are key to success in solving systems with substitution.

Frequently Asked Questions

How do you solve the system of equations using substitution for -3x + 2y = 16 and 2x + y = 1?

First, solve the second equation for y: $y = 1 - 2x$. Substitute this into the first equation: $-3x + 2(1 - 2x) = 16$. Simplify: $-3x + 2 - 4x = 16$, then combine like terms: $-7x + 2 = 16$. Subtract 2: $-7x = 14$. Divide both sides by -7: $x = -2$. Then, substitute $x = -2$ into $y = 1 - 2x$: $y = 1 - 2(-2) = 1 + 4 = 5$. Solution: $x = -2$, $y = 5$.

What is the importance of showing all work step-by-step when solving systems using substitution?

Showing all work step-by-step ensures clarity in the solution process, helps identify any errors, and demonstrates understanding of the method. It also makes it easier for others to follow your reasoning and verify your solution.

In the system -3x + 2y = 16 and 2x + y = 1, what errors should be avoided during substitution?

Avoid errors such as incorrectly solving for y, substituting the wrong expression into the first equation, forgetting to distribute or combine like terms properly, and arithmetic mistakes during simplification. Double-check each step to prevent these errors.

Can substitution be used if one of the equations is not solved for a variable? How?

Yes, but it is easier if one equation is already solved for a variable. If not, choose one equation and solve for a variable first, then substitute into the other. For example, solve 2x + y = 1 for y: y = 1 - 2x, then substitute into the other equation.

What does the note 'Failure' imply in the context of solving the system, and how can it be avoided?

The note 'Failure' suggests possible errors or incomplete work in solving the system. To avoid failure, carefully follow each step, check your algebra, verify substitutions, and confirm the solution satisfies both equations.

What is the solution to the system -3x + 2y = 16 and 2x + y = 1 after applying substitution?

The solution is x = -2 and y = 5, obtained by solving for y in the second equation (y = 1 - 2x), substituting into the first, simplifying, and solving for x, then back-substituting to find y.

Additional Resources

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Introduction

Mathematics, especially algebra, often presents students and professionals alike with systems of equations that must be solved to find specific values of variables. These systems can be linear, nonlinear, or a combination of both, and solving them accurately is fundamental in fields ranging from engineering to economics. One of the most effective methods for solving certain systems — especially when variables are easily isolated — is substitution. This technique involves solving one equation for one variable and then substituting that expression into the other equation to find the remaining variable(s).

In this article, we will explore how to solve a particular system of equations using the substitution method. The given system is:

-3x + 2y = 16
2x + y = 1

While the phrase "Failure" appears in the prompt, it seems to be either an

error or a misstatement. Our objective here is to demonstrate the correct approach for solving this system step-by-step, emphasizing clarity and thoroughness to aid understanding for learners and practitioners alike.

Understanding the System of Equations

Before diving into the solution, it’s crucial to understand what the system represents and the nature of the equations:

1. Equation 1: -3x + 2y = 16
2. Equation 2: 2x + y = 1

These are both linear equations in two variables, x and y. The goal is to find the specific values of x and y that satisfy both equations simultaneously.

Step 1: Isolate one variable in one of the equations

The substitution method begins with solving one of the equations for one variable in terms of the other. Typically, choosing the equation that makes the algebra easier is best.

Looking at Equation 2:

2x + y = 1

We can solve for y:

y = 1 - 2x

This expression for y in terms of x will be substituted into the other equation.

Why choose this equation?
Because y is already isolated, which simplifies substitution.

Step 2: Substitute the expression into the other equation

Next, replace y in Equation 1 with the expression derived from Equation 2:

Equation 1: -3x + 2y = 16

Substituting y = 1 - 2x:

-3x + 2(1 - 2x) = 16

Now, expand the parentheses:

-3x + 2 1 - 2 2x = 16
-3x + 2 - 4x = 16

Combine like terms:

(-3x - 4x) + 2 = 16
-7x + 2 = 16

Step 3: Solve for the remaining variable

Now, isolate x:

-7x = 16 - 2
-7x = 14

Divide both sides by -7:

x = 14 / -7
x = -2

Result:
x = -2

Step 4: Find the corresponding y value

Recall the expression for y:

y = 1 - 2x

Substitute x = -2:

y = 1 - 2 (-2)
y = 1 + 4
y = 5

Result:
y = 5

Step 5: Verify the solution

Verifying the solution involves substituting x = -2 and y = 5 back into both original equations to ensure they are satisfied.

Equation 1: -3x + 2y = 16

-3 (-2) + 2 5 = 16
6 + 10 = 16
16 = 16 ✔

Equation 2: 2x + y = 1

2 (-2) + 5 = 1
-4 + 5 = 1
1 = 1 ✔

Both equations are satisfied, confirming the solution is correct.

Summary of the Solution

The system of equations:

-3x + 2y = 16
2x + y = 1

has the unique solution:

x = -2, y = 5

Common Challenges and Troubleshooting

While the process may seem straightforward, several challenges can arise:

- Choosing the wrong equation to isolate a variable:
Always select the equation that makes algebra simpler, ideally with a coefficient of 1 or that allows for easy rearrangement.

- Arithmetic errors:
Carefully perform algebraic manipulations and double-check calculations.

- No solution or infinitely many solutions:
If, upon substitution, you arrive at a contradiction (e.g., 0 = 5), the system has no solutions (inconsistent). If both equations become identical after manipulation, the system has infinitely many solutions.

The Importance of the Substitution Method

The substitution method is particularly effective for solving systems where one variable can be easily isolated, especially when equations are in forms

that lend themselves to straightforward substitution. Its step-by-step approach provides clarity and helps avoid common pitfalls associated with other methods like elimination or graphing.

Practical Applications

Understanding how to solve systems using substitution has real-world relevance:

- Economics: Finding equilibrium points where supply equals demand.
- Engineering: Solving circuit equations to determine current and voltage.
- Physics: Calculating intersection points of trajectories or forces.
- Computer Science: Algorithm development involving systems of equations.

Final Thoughts

Mastering the substitution method equips learners with a powerful tool for solving linear systems efficiently and accurately. It underscores the importance of strategic algebraic manipulation and reinforces foundational concepts in mathematics. With practice, identifying the optimal variable to isolate and executing the substitution seamlessly becomes second nature, paving the way for tackling more complex problems.

Remember, meticulousness in each step ensures correctness and builds confidence in solving diverse systems of equations. Whether in academic settings or real-world applications, these skills are essential for analytical reasoning and problem-solving success.

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