4r 4s + 4t=-44r +5 - 2t = 5-3r - 3s 4t=-16Use Elimination Or Substitution To Solve The Systems.(1,-3,-1)(1,3,1)(-1,3,1)

4r 4s + 4t = -44r + 5 - 2t = 5 - 3r - 3s 4t = -16 Use Elimination Or Substitution To Solve The Systems. (1, -3, -1) (1, 3, 1) (-1, 3, 1)

Introduction to Solving Systems of Equations

Understanding how to solve systems of equations is a fundamental skill in algebra that finds applications across various fields, including engineering, economics, physics, and computer science. A system of equations consists of multiple equations with shared variables, and solving the system means finding the values of these variables that satisfy all equations simultaneously.

In this article, we will explore the process of solving a particular system of equations using two effective methods: elimination and substitution. These methods are essential tools for algebra students and professionals alike, providing systematic approaches to find solutions efficiently.

The specific system under consideration involves three variables, commonly denoted as r, s, and t, and includes complex relationships such as:

- $4r + 4s + 4t = -44$
- $-44r + 5 - 2t = 5$
- $-3r - 3s + 4t = -16$

Additionally, the system references three potential solutions represented as ordered triples: $(1, -3, -1)$, $(1, 3, 1)$, and $(-1, 3, 1)$, which we will analyze to determine their validity.

Understanding the System of Equations

Before delving into solving techniques, it’s crucial to interpret the given equations accurately:

1. Equation 1: $4r + 4s + 4t = -44$

2. Equation 2: $-44r + 5 - 2t = 5$

3. Equation 3: $-3r - 3s + 4t = -16$

The goal is to find the values of r, s, and t that satisfy all three equations simultaneously.

Rearranging and Simplifying Equations

Effective problem-solving often begins with rewriting equations in a more manageable form:

Equation 1:
$$4r + 4s + 4t = -44$$
Divide both sides by 4 to simplify:
$$r + s + t = -11$$
Simplified Equation 1: $r + s + t = -11$

Equation 2:
$$-44r + 5 - 2t = 5$$
Subtract 5 from both sides:
$$-44r - 2t = 0$$
Divide through by -2:
$$22r + t = 0$$
Simplified Equation 2: $22r + t = 0$

Equation 3:
$$-3r - 3s + 4t = -16$$
This equation is already simplified, but for clarity:
$$-3r - 3s + 4t = -16$$

Now, the system is:

1. $r + s + t = -11$
2. $22r + t = 0$
3. $-3r - 3s + 4t = -16$

Using Substitution Method

The substitution method involves solving one equation for a variable and substituting that into the other equations. It’s particularly useful when one variable can be easily isolated.

Step 1: Solve Equation 2 for t:

From $22r + t = 0$:
$$ t = -22r $$

Step 2: Substitute $t = -22r$ into Equations 1 and 3:

- Equation 1:
$$ r + s + t = -11 $$
$$ r + s - 22r = -11 $$
$$ -21r + s = -11 $$
Solve for s:
$$ s = -11 + 21r $$

- Equation 3:
$$ -3r - 3s + 4t = -16 $$
Substitute $s = -11 + 21r$ and $t = -22r$:
$$ -3r - 3(-11 + 21r) + 4(-22r) = -16 $$
Simplify step by step:

- Expand:
$$ -3r + 33 - 63r - 88r = -16 $$

- Combine like terms:
$$ (-3r - 63r - 88r) + 33 = -16 $$
$$ (-154r) + 33 = -16 $$

- Isolate r:
$$ -154r = -16 - 33 $$
$$ -154r = -49 $$
$$ r = \frac{-49}{-154} = \frac{49}{154} $$
Simplify the fraction:
$$ r = \frac{7}{22} $$

Step 3: Find s and t:

- $s = -11 + 21r$
$$ s = -11 + 21 \times \frac{7}{22} $$
$$ s = -11 + \frac{147}{22} $$
Express -11 as a fraction with denominator 22:
$$ -11 = -\frac{242}{22} $$
Add:
$$ s = -\frac{242}{22} + \frac{147}{22} = -\frac{95}{22} $$

- $t = -22r$
$$ t = -22 \times \frac{7}{22} = -7 $$

Solution:
$$
\boxed{
r = \frac{7}{22}, \quad s = -\frac{95}{22}, \quad t = -7
}
$$

This set of values satisfies all three equations, confirming it as the unique solution to the system.

Using Elimination Method

The elimination method involves adding or subtracting equations to eliminate one variable, simplifying the system step-by-step.

Step 1: Use the simplified equations:

- $r + s + t = -11$ (Equation 1)
- $22r + t = 0$ (Equation 2)
- $-3r - 3s + 4t = -16$ (Equation 3)

Step 2: Eliminate t:

From Equation 2:
$$t = -22r$$

Substitute into Equation 1:
$$r + s - 22r = -11$$
$$-21r + s = -11$$
Solve for s:
$$s = -11 + 21r$$

Substitute $t = -22r$ and s into Equation 3:
$$-3r - 3(-11 + 21r) + 4(-22r) = -16$$
Same steps as before, leading to the same solution for r, s, and t.

Validating the Solutions: Comparing With Given Triples

The problem references three potential solutions: $(1, -3, -1)$, $(1, 3, 1)$, and $(-1, 3, 1)$. Let's see if any of these match our derived solution or satisfy the original equations.

Check $(1, -3, -1)$:

- Equation 1:
$$4(1) + 4(-3) + 4(-1) = 4 - 12 - 4 = -12 \neq -44$$
Fails to satisfy Equation 1.

Check $(1, 3, 1)$:

- Equation 1:
$$ 4(1) + 4(3) + 4(1) = 4 + 12 + 4 = 20 \neq -44 $$
Fails.

Check $(-1, 3, 1)$:

- Equation 1:
$$ 4(-1) + 4(3) + 4(1) = -4 + 12 + 4 = 12 \neq -44 $$
Fails.

None of these solutions satisfy the first equation, indicating that they are not solutions to the system as given. Instead, the solution derived via substitution and elimination is:

$$
r = \frac{7}{22} \approx 0.318, \quad s = -\frac{95}{22} \approx -4.318, \quad t = -7
$$

which does not match any of the provided triples but is consistent with the simplified equations.

Conclusion and Key Takeaways

- System of equations can be approached systematically using substitution or elimination methods.
- Simplifying equations before solving helps reduce errors and clarifies relationships among variables.
- Substitution is effective when a variable can be easily isolated, as demonstrated by solving for t in this problem.
- Elimination involves adding or subtract

Frequently Asked Questions

How can I use substitution to solve the system of equations involving variables r, s, and t?

To use substitution, solve one of the equations for one variable in terms of the others, then substitute this expression into the remaining equations to reduce the system step by step until all variables are found.

What is the first step in applying elimination to the system of equations involving 4r 4s + 4t = -44, -2t = 5 - 3r - 3s, and 4t = -16?

A good first step is to rewrite the equations clearly and look for equations that can be combined to eliminate one variable, such as using the equations for t to eliminate t first.

Are the solutions (1, -3, -1), (1, 3, 1), and (-1, 3, 1) valid for the system? How can I verify this?

Yes, these are potential solutions. To verify, substitute each set of values into all three equations and check if all equations hold true. If they do, the solution is valid.

What challenges might I face when solving this system of equations, and how can I overcome them?

Challenges include handling multiple variables and equations. To overcome this, use substitution or elimination systematically, verify each step, and double-check calculations to avoid errors.

How do I determine which method (elimination or substitution) is best for solving this system?

Choose substitution if one equation is easily solved for a variable, and elimination if coefficients align for direct cancellation. In this case, substitution might be easier due to the form of the equations involving t.

What is the final solution to the system of equations, and how does it relate to the given options?

The solution set is (1, -3, -1), which matches one of the provided options. Confirm by substituting into all equations to verify all are satisfied.

Additional Resources

4r 4s + 4t=-44r +5 - 2t = 5-3r - 3s 4t=-16Use Elimination Or Substitution To Solve The Systems.(1,-3,-1)(1,3,1)(-1,3,1)

In the realm of algebra, systems of equations serve as foundational tools for modeling real-world phenomena, from engineering challenges to economic forecasts. One common task is to find the values of variables that satisfy multiple equations simultaneously. Today, we explore a complex system involving three variables—r, s, and t—and demonstrate how to unravel its solutions using two classic algebraic methods: substitution and elimination. The goal is to identify which of the provided triplets—(1, -3, -1), (1, 3, 1), or (-1, 3, 1)—are solutions to the system, and to illustrate the step-by-step process that leads us there.

Understanding the System of Equations

The system in question is as follows:

1. $4r + 4s + 4t = -44$
2. $-4r + 5 - 2t = 5$
3. $-3r - 3s + 4t = -16$

At first glance, the system appears intricate due to the multiple variables and the mixture of constants and coefficients. Our task is to determine the values of r, s, and t that satisfy all three equations simultaneously.

Step 1: Simplify the Equations

Before applying substitution or elimination, it's beneficial to simplify the equations where possible.

Equation 1:

$4r + 4s + 4t = -44$

Divide through by 4 to simplify:

$r + s + t = -11$

Equation 2:

$-4r + 5 - 2t = 5$

Subtract 5 from both sides:

$-4r - 2t = 0$

Or:

$-4r - 2t = 0$

Divide through by -2:

$2r + t = 0$

Equation 3:

$-3r - 3s + 4t = -16$

This is already simplified, but no common factors can be extracted easily.

Now, our simplified system is:

(1) $r + s + t = -11$

(2) $2r + t = 0$

(3) $-3r - 3s + 4t = -16$

Step 2: Express Variables Using Substitution

Given the simpler form, substitution seems most straightforward. From Equation (2):

$2r + t = 0$

Solve for t:

$t = -2r$

Now, we can substitute $t = -2r$ into the other equations to reduce the system to two variables.

Step 3: Substitute t into Equations (1) and (3)

Substituting into Equation (1):

$r + s + t = -11$

Replace t with -2r:

$r + s - 2r = -11$

Simplify:

$- r + s = -11$

Express s:

$s = -11 + r$

Substituting into Equation (3):

$$-3r - 3s + 4t = -16$$

Replace s with $-11 + r$, and t with $-2r$:

$$-3r - 3(-11 + r) + 4(-2r) = -16$$

Simplify each term:

$$-3r + 33 - 3r - 8r = -16$$

Combine like terms:

$$(-3r - 3r - 8r) + 33 = -16$$

$$(-14r) + 33 = -16$$

Subtract 33 from both sides:

$$-14r = -49$$

Divide both sides by -14:

$$r = 3.5$$

Now that we have r, find s and t.

Step 4: Find s and t

Recall:

$$s = -11 + r = -11 + 3.5 = -7.5$$

$$t = -2r = -2\ 3.5 = -7$$

Solution:

$$r = 3.5$$

$$s = -7.5$$

$$t = -7$$

Step 5: Verify the Solution Against Given Triplets

The problem provides three candidate solutions:

- (1, -3, -1)

- (1, 3, 1)
- (-1, 3, 1)

Our derived solution is (r, s, t) = (3.5, -7.5, -7). None of these match directly, indicating that none of the candidate triplets are solutions to the system. To confirm, we can substitute each candidate into the original equations.

Check (1, -3, -1):

Equation 1:

4(1) + 4(-3) + 4(-1) = 4 - 12 - 4 = -12

Expected: -44

Not matching.

Equation 2:

-4(1) + 5 - 2(-1) = -4 + 5 + 2 = 3

Expected: 5

Not matching.

Equation 3:

-3(1) - 3(-3) + 4(-1) = -3 + 9 - 4 = 2

Expected: -16

No match.

Check (1, 3, 1):

Equation 1:

4(1) + 4(3) + 4(1) = 4 + 12 + 4 = 20

Expected: -44

No match.

Equation 2:

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

Expected: 5

No match.

Equation 3:

-3(1) - 3(3) + 4(1) = -3 - 9 + 4 = -8

Expected: -16

No match.

Check (-1, 3, 1):

Equation 1:

4(-1) + 4(3) + 4(1) = -4 + 12 + 4 = 12

Expected: -44

No match.

Equation 2:

-4(-1) + 5 - 2(1) = 4 + 5 - 2 = 7

Expected: 5

Close but not exact.

Equation 3:

-3(-1) - 3(3) + 4(1) = 3 - 9 + 4 = -2

Expected: -16

No match.

Conclusion:

Our detailed algebraic solution indicates that the actual solution to the system is approximately (r, s, t) = (3.5, -7.5, -7), which does not match any of the provided triplets. Therefore, none of the candidate solutions listed satisfy the entire system exactly.

Insights and Applications

This exercise highlights several important concepts in algebra:

- Simplifying equations can make the solving process more manageable.
- Substitution is effective when one variable can be expressed directly in

terms of others.
- Elimination involves combining equations to eliminate variables systematically.
- Verification against candidate solutions is essential to confirm correctness.

In real-world scenarios, systems of equations often model complex relationships—such as physical systems, economic models, or data analyses. Mastering methods like substitution and elimination equips students and professionals to analyze and solve these models efficiently.

Final Thoughts

While the specific triplets provided did not solve the system, the process of algebraic manipulation demonstrated here is foundational for tackling more complex problems. Whether dealing with engineering calculations, financial projections, or scientific data, understanding how to manipulate and solve systems of equations is a vital skill. As with any mathematical endeavor, patience, attention to detail, and verification are key to arriving at accurate solutions.

4r 4s 4t 44r 5 2t 5 3r 3s 4t 16use Elimination Or Substitution To Solve The Systems 1 3 1 1 3 1 1 3 1

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