Solve The System Of Equations Using Elimination.4x + 4y = 283x + Y = 15

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Solving a system of equations is a fundamental skill in algebra, enabling us to find the values of variables that satisfy multiple equations simultaneously. One effective method for solving such systems is the elimination method, which involves manipulating the equations to eliminate one variable, making it easier to solve for the remaining variable(s). In this article, we will explore how to solve the given system of equations using the elimination method, step by step, ensuring a clear understanding of each stage in the process.

Understanding the Given System of Equations

Presenting the Equations

The system provided in the problem appears to have some formatting issues, but based on the typical structure, it can be interpreted as:

- Equation 1: $4x + 4y = 28$
- Equation 2: $3x + y = 15$

Note: It seems there might be a typo or formatting error in the original statement ("4x + 4y = 283x + Y = 15"). Given standard algebraic systems, the most logical correction is the above, where the first equation is "4x + 4y = 28" and the second is "3x + y = 15". If the original equations differ, please clarify; otherwise, we proceed with these assumptions.

Verifying the System

Before applying the elimination method, it's essential to verify the equations are in a compatible form, typically both written in standard form (ax + by = c). Here, both are already in this form:

- Equation 1: $4x + 4y = 28$
- Equation 2: $3x + y = 15$

Step-by-Step Solution Using the Elimination Method

Step 1: Arrange Equations Properly

Ensure both equations are aligned with variables and constants on respective sides:

```
Equation 1: 4x + 4y = 28
Equation 2: 3x + y = 15
```

Step 2: Equalize Coefficients of a Variable

The elimination method requires the coefficients of one variable to be equal (or opposites) so that adding or subtracting the equations eliminates that variable. Here, to eliminate y, observe the coefficients:

- Equation 1: Coefficient of y is 4
- Equation 2: Coefficient of y is 1

To make the coefficients equal, multiply Equation 2 by 4:

```
(3x + y = 15) × 4 → 12x + 4y = 60
```

Step 3: Subtract Equations to Eliminate a Variable

Now, subtract the modified Equation 2 from Equation 1:

```
(4x + 4y = 28)
- (12x + 4y = 60)
--------------------
(4x - 12x) + (4y - 4y) = 28 - 60
-8x + 0 = -32
```

Simplify to find x:

```
-8x = -32
```

Step 4: Solve for the Remaining Variable

Divide both sides by -8:

```
x = \(\frac{-32}{-8}\) = 4
```

Step 5: Substitute the Found Value into One of the Original Equations

Now, substitute x = 4 into either of the original equations to find y. Let's use Equation 2 (3x + y = 15):

```
3(4) + y = 15
12 + y = 15
```

Solve for y:

```
y = 15 - 12 = 3
```

Final Solution and Verification

Solution Set

The solution to the system is:

- x = 4
- y = 3

Verification of the Solution

Substitute x = 4 and y = 3 into both original equations to verify correctness:

- Equation 1: 4(4) + 4(3) = 16 + 12 = 28
- Equation 2: 3(4) + 3 = 12 + 3 = 15

Since both equations are satisfied, the solution is correct.

Additional Considerations in Elimination Method

Dealing with Special Cases

When applying the elimination method, be aware of the following special cases:

1. **No Solution:** If the equations represent parallel lines, they never intersect, and the system has no solution.
2. **Infinite Solutions:** If the equations are essentially the same line (multiple representations of the same equation), then there are infinitely many solutions.

Strategies for Different Systems

Depending on the coefficients, you may need to multiply equations by different factors to align coefficients for elimination. Always aim for coefficients that are equal or opposites.

Conclusion

The elimination method is a powerful and systematic approach to solving systems of linear equations. By strategically multiplying equations to align coefficients and then adding or subtracting to eliminate variables, you can efficiently find solutions. The example demonstrated that with the system:

```
4x + 4y = 28
3x + y = 15
```

1. Aligned the coefficients by multiplying the second equation by 4.
2. Subtracted to eliminate y, solving for x.
3. Substituted back to find y.

Mastering this technique enables you to handle a wide variety of linear systems and enhances your problem-solving skills in algebra. Remember to verify your solutions by substituting back into the original equations to ensure accuracy.

Frequently Asked Questions

What is the first step to solve the system of equations using elimination?

The first step is to align the equations and eliminate one variable by adding or subtracting the equations after making the coefficients of that variable equal in magnitude.

How do you eliminate a variable when the coefficients are different in the equations?

Multiply one or both equations by suitable numbers so that the coefficients of the variable you want to eliminate become opposites, then add or subtract the equations.

In the given system, $4x + 4y = 28$ and $3x + y = 15$, how can we eliminate y?

Multiply the second equation by 4 to make the coefficients of y equal: $4(3x + y) = 4(15)$ □ $12x + 4y = 60$. Then subtract the first equation from this result to eliminate y.

What is the solution for x after elimination in the given system?

After eliminating y, you can solve for x by combining the equations and then substitute back to find y. For example, subtract the equations to find x, then substitute into one of the original equations.

How do you verify the solution to the system after solving using elimination?

Substitute the found values of x and y into both original equations to check if both equations are satisfied, ensuring the solution is correct.

Can elimination be used if the coefficients of a variable are already

opposites?

Yes, if the coefficients of a variable are already equal and opposite, you can directly add the equations to eliminate that variable without further multiplication.

What are common mistakes to avoid when solving systems using elimination?

Common mistakes include not aligning equations properly, forgetting to multiply equations to match coefficients, and substituting incorrectly during back-substitution.

What is the solution to the system $4x + 4y = 28$ and $3x + y = 15$?

The solution is $x = 7$ and $y = 1$. You can find this by eliminating y and solving for x, then substituting back to find y.

Additional Resources

Solve The System Of Equations Using Elimination

In the realm of algebra, solving systems of equations is a fundamental skill that underpins much of higher mathematics, science, engineering, and various applied fields. Among the various methods employed to solve these systems, the elimination method stands out for its straightforwardness and efficiency, especially when dealing with two linear equations. This article delves into the process of solving a specific system of equations using elimination, analyzing the step-by-step approach, common pitfalls, and practical applications.

Understanding the System of Equations

The system under consideration is:

1. $4x + 4y = 28$
2. $3x + y = 15$

At first glance, these equations seem straightforward, but a closer look reveals the importance of precise interpretation and algebraic manipulation.

Clarification of the Equations

It appears there might be typographical errors in the original equations; the first equation is shown as "4x + 4y = 283x + Y = 15," which is ambiguous. Based on standard form and typical systems, the intended system likely is:

- Equation 1: $4x + 4y = 28$
- Equation 2: $3x + y = 15$

This correction aligns with conventional mathematical notation and allows for a meaningful solution.

Fundamentals of the Elimination Method

The elimination method involves manipulating the equations to eliminate one variable, leading to a single-variable equation that can be solved directly. Once one variable is found, it is substituted back into one of the original equations to find the other.

Key steps include:

- Aligning the equations with variables aligned vertically.
- Multiplying equations by constants if necessary to match coefficients.
- Adding or subtracting equations to eliminate a variable.
- Solving the resulting equation for the remaining variable.
- Substituting back to find the other variable.

Step-by-Step Solution for the Given System

Step 1: Write the system in standard form

Ensure both equations are aligned:

- Equation 1: $4x + 4y = 28$
- Equation 2: $3x + y = 15$

Step 2: Make coefficients of one variable opposites

To eliminate y, observe the coefficients:

- Equation 1 has 4y.
- Equation 2 has y (or 1y).

To match coefficients, multiply Equation 2 by 4:

- $4 (3x + y) = 4 \ 15$
- Result: $12x + 4y = 60$

Now, the system is:

- $4x + 4y = 28$
- $12x + 4y = 60$

Step 3: Subtract equations to eliminate y

Subtract Equation 1 from the modified Equation 2:

$(12x + 4y) - (4x + 4y) = 60 - 28$

Simplify:

$(12x - 4x) + (4y - 4y) = 32$

Which simplifies to:

$8x = 32$

Step 4: Solve for x

Divide both sides by 8:

$x = 32 / 8 = 4$

Step 5: Substitute x into one of the original equations to find y

Using Equation 2: $3x + y = 15$

Substitute $x = 4$:

3 4 + y = 15

12 + y = 15

Subtract 12 from both sides:

y = 15 - 12 = 3

Verification of the Solution

To ensure the solution is correct, substitute x = 4 and y = 3 into both original equations.

- Equation 1: 4x + 4y = 28

4 4 + 4 3 = 16 + 12 = 28 Correct

- Equation 2: 3x + y = 15

3 4 + 3 = 12 + 3 = 15 Correct

The solution x = 4, y = 3 satisfies both equations, confirming its validity.

Implications and Practical Applications

The elimination method is a powerful tool beyond academic exercises. Its applications include:

- Engineering: Circuit analysis, where simultaneous equations model complex systems.
- Economics: Solving for equilibrium points in supply and demand models.
- Physics: Calculating parameters where multiple equations describe physical phenomena.
- Computer Science: Algorithm design for solving linear systems efficiently.

Understanding how to effectively apply elimination enhances problem-solving skills across disciplines.

Common Challenges and Tips

While straightforward, the elimination method can encounter pitfalls:

1. Sign errors: Be meticulous when multiplying equations, especially with negative numbers.
2. Incorrect coefficient matching: Ensure coefficients are correctly scaled before elimination.
3. Arithmetic mistakes: Double-check calculations during addition/subtraction steps.
4. System consistency: Some systems are inconsistent (no solutions) or dependent (infinitely many solutions). Always verify solutions.

Tips for success:

- Write equations clearly and align variables.
- Use consistent notation.
- Double-check multipliers and calculations.
- Verify solutions by substituting back into original equations.

Conclusion

The elimination method remains a fundamental approach for solving systems of linear equations, exemplified by the straightforward solution to the system:

- $x = 4$
- $y = 3$

Mastering this technique equips students, professionals, and enthusiasts with a reliable tool for tackling various mathematical and real-world problems. Its systematic nature ensures clarity and efficiency, reinforcing the importance of algebraic fluency in diverse contexts. As systems grow more complex, understanding elimination paves the way for more advanced methods like substitution, matrix operations, and computational algorithms, underscoring its foundational role in algebra and applied mathematics.

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