Find The Solution Of This System Of Equations -3x+2y=-17 -3x-4y=11

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When faced with a system of equations such as
$-3x + 2y = -17$
$-3x - 4y = 11$,
understanding how to find the solution is essential in algebra. These types of problems involve determining the values of variables that satisfy all equations simultaneously. In this article, we will explore various methods to solve this system of equations, including substitution, elimination, and graphical approaches, ensuring you gain a comprehensive understanding of how to approach similar problems in mathematics.

Understanding the System of Equations

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

- Equation 1: $-3x + 2y = -17$
- Equation 2: $-3x - 4y = 11$

Notice that both equations contain the term $-3x$, which suggests that elimination might be an efficient approach. The goal is to find values of x and y that satisfy both equations simultaneously.

Methods to Solve the System of Equations

There are primarily three methods to solve systems of linear equations:

1. The Substitution Method

This method involves solving one of the equations for one variable and then substituting this expression into the other equation.

2. The Elimination Method

This approach aims to eliminate one variable by adding or subtracting the equations after adjusting coefficients.

3. Graphical Method

Plotting both equations on a graph and identifying their intersection point.

For this system, we will focus on the elimination method, as it appears most straightforward given the coefficients.

Step-by-Step Solution Using the Elimination Method

Let's proceed step-by-step:

Step 1: Write the equations clearly

Equation 1: $-3x + 2y = -17$
Equation 2: $-3x - 4y = 11$

Step 2: Subtract the second equation from the first to eliminate -3x

Subtract Equation 2 from Equation 1:

$(-3x + 2y) - (-3x - 4y) = -17 - 11$

Simplify:

$-3x + 2y + 3x + 4y = -28$

Combine like terms:

$(-3x + 3x) + (2y + 4y) = -28$

$0 + 6y = -28$

Step 3: Solve for y

$6y = -28$

$y = -28 / 6$

Simplify the fraction:

$y = -14 / 3$

Step 4: Substitute y back into one of the original equations to find x

Use Equation 1:

$-3x + 2y = -17$

Substitute $y = -14/3$:

$-3x + 2(-14/3) = -17$

Calculate:

$-3x - 28/3 = -17$

Step 5: Solve for x

Rewrite:

$-3x = -17 + 28/3$

Express -17 as a fraction with denominator 3:

$-17 = -51/3$

Now,

$-3x = -51/3 + 28/3 = (-51 + 28) / 3 = -23/3$

Divide both sides by -3:

$x = (-23/3) \div (-3) = (-23/3) (-1/3) = (23/3) (1/3) = 23/9$

Final Solution

The solution to the system of equations is:

- $x = 23/9$
- $y = -14/3$

Expressed as an ordered pair:

$(23/9, -14/3)$

Verification of the Solution

Always verify your solution by substituting the values into both original equations.

Check Equation 1:

$-3x + 2y = -17$

Substitute $x = 23/9$, $y = -14/3$:

$-3(23/9) + 2(-14/3) = ?$

Calculate:

$-3(23/9) = - (3 23) / 9 = -69/9 = -23/3$

$2(-14/3) = -28/3$

Sum:

$-23/3 - 28/3 = (-23 - 28)/3 = -51/3 = -17$

Matches the right side of Equation 1, confirming correctness.

Check Equation 2:

$-3x - 4y = 11$

Substitute the same values:

$-3(23/9) - 4(-14/3) = ?$

Calculate:

$-69/9 = -23/3$

$-4(-14/3) = +56/3$

Sum:

$-23/3 + 56/3 = (-23 + 56) / 3 = 33/3 = 11$

Matches the right side of Equation 2, confirming the solution is correct.

Additional Tips for Solving Systems of Equations

- Always check for the most straightforward method based on the coefficients.
- Use substitution if one variable has a coefficient of 1 or -1.
- Use elimination if coefficients are easily aligned for cancellation.
- Graphical solutions are useful for visual understanding but less precise for exact solutions.

Common Mistakes to Avoid

- Forgetting to simplify fractions.
- Mixing up signs when subtracting equations.
- Not verifying the solution in both equations.
- Assuming a system has a unique solution without checking for consistency or dependence.

Conclusion

Solving a system of equations like
$-3x + 2y = -17$
$-3x - 4y = 11$
requires understanding of algebraic techniques such as elimination. By carefully following the steps—subtracting equations to eliminate variables, solving for one variable, and substituting back—you can arrive at precise solutions efficiently. Remember to verify solutions to ensure accuracy. Mastering these methods will enhance your problem-solving skills in algebra and prepare you for more complex systems in mathematics.

FAQs

1. Can I use substitution instead of elimination for this system?

Yes, but since both equations contain -3x, elimination tends to be more straightforward here. Substitution involves solving one equation for a variable and substituting into the other, which is also a valid approach.

2. What if the system has no solution?

If the equations are inconsistent (e.g., represent parallel lines), no solution exists. This can often be seen if the equations reduce to a false statement after elimination.

3. How do I handle systems with infinitely many solutions?

If the equations are dependent (one is a multiple of the other), then infinitely many solutions exist along the line they represent.

4. Is graphical solution always accurate?

Graphical methods provide visual insight but may lack precision. For exact solutions, algebraic methods like substitution or elimination are preferred.

Final Thoughts

Mastering the solution of systems of equations is fundamental in algebra. Whether using substitution, elimination, or graphing, understanding each method's strengths ensures you can tackle various problems confidently. Practice with different systems to enhance your skills, and always verify your solutions for accuracy.

Frequently Asked Questions

What method can be used to solve the system of equations: -3x + 2y = -17 and -3x - 4y = 11?

You can use either substitution, elimination, or graphing methods to solve the system. In this case, elimination is efficient since the coefficients of x are the same.

How do you solve the system of equations: -3x + 2y = -17 and -3x - 4y = 11 by elimination?

Subtract the second equation from the first to eliminate -3x: (-3x + 2y) - (-3x - 4y) = -17 - 11. Simplify to get 6y = -28, then solve for y to find y = -14/3. Substitute y back into one of the original equations to find x.

What is the solution to the system of equations: -3x + 2y = -17 and -3x - 4y = 11?

First, subtract the second equation from the first to find y: 6y = -28, so y = -14/3. Substitute y into the first equation: -3x + 2(-14/3) = -17. Simplify to solve for x: -3x - 28/3 = -17, leading to x = 1.

Are the two equations in the system consistent and independent?

Yes, the equations are consistent and independent since they have a unique solution, which can be found through elimination or substitution.

What is the approximate solution for x and y in the system: -3x + 2y = -17 and -3x - 4y = 11?

The approximate solution is x = 1 and y = -14/3, which is approximately x = 1 and y ≈ -4.67.

Can the system of equations be solved graphically?

Yes, graphing both equations will show their intersection point, which represents the solution. The lines are not parallel, indicating a single unique solution.

What are the steps to verify the solution of the system?

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

Additional Resources

Find The Solution Of This System Of Equations -3x + 2y = -17 and -3x - 4y = 11 is a fundamental problem in algebra that exemplifies the process of solving systems of linear equations. Understanding how to find the values of variables that satisfy multiple equations simultaneously is essential in various fields, including engineering, economics, physics, and computer science. This particular system, consisting of two equations with two variables, is a perfect starting point for learners to grasp core concepts such as substitution, elimination, and graphical interpretation. The process involves applying algebraic techniques to isolate variables and determine their unique values, providing insight into the relationships between variables in real-world situations.

Understanding the System of Equations

Before diving into the solution, it is crucial to understand what the system of equations represents and the methods available for solving it.

Definition and Nature of the System

A system of equations is a set of two or more equations with the same variables. The solutions are the set of variable values that satisfy all equations simultaneously. In this case, the system is:

$-3x + 2y = -17$ ...(1)
$-3x - 4y = 11$ ...(2)

Both equations involve the variables x and y, and the goal is to find the pair (x, y) that makes both true.

Graphical Interpretation

Graphically, each equation represents a straight line in the xy-plane. The solution to the system is the point where these lines intersect. If the lines intersect at a single point, the system has a unique solution. Parallel lines indicate no solution, and coincident lines imply infinitely many solutions.

Methods for Solving the System

There are several techniques to solve such systems:

Substitution Method

Involves solving one equation for one variable and substituting into the other. Suitable when one equation is already solved for a variable or can easily be manipulated.

Elimination Method

Entails adding or subtracting the equations to eliminate one variable, making it straightforward to solve for the other.

Graphical Method

Plotting both equations and identifying the intersection point visually. Best for conceptual understanding but less precise for exact solutions.

Choosing the Best Method

Given the structure of the equations, the elimination method is often most straightforward here because the coefficients of x are the same, making elimination particularly simple.

Step-by-Step Solution Using the Elimination Method

Let's proceed with the elimination method to find the solution:

Step 1: Write down the equations

Equation (1): $-3x + 2y = -17$
Equation (2): $-3x - 4y = 11$

Step 2: Subtract equations to eliminate x

Subtract (2) from (1):

$(-3x + 2y) - (-3x - 4y) = -17 - 11$

Simplify:

$-3x + 2y + 3x + 4y = -28$

Combine like terms:

$(-3x + 3x) + (2y + 4y) = -28$
$0x + 6y = -28$

This simplifies to:

$6y = -28$

Step 3: Solve for y

Divide both sides by 6:

$y = -28 / 6 = -14 / 3$

So,

$y = -14/3$

Step 4: Substitute y back into one of the original equations to solve for x

Using Equation (1):

$-3x + 2y = -17$

Substitute $y = -14/3$:

$-3x + 2(-14/3) = -17$

Simplify:

$-3x - 28/3 = -17$

Multiply through by 3 to clear denominators:

$3(-3x) - 28 = 3(-17)$

$-9x - 28 = -51$

Now, solve for x:

$-9x = -51 + 28$
$-9x = -23$

Divide both sides by -9:

$x = -23 / -9 = 23 / 9$

$x = 23/9$

Final Solution and Verification

The solution to the system is:

x = 23/9 and y = -14/3

To verify, substitute these values into the second original equation:

-3x - 4y = 11

Calculate:

-3(23/9) - 4(-14/3) = ?

Simplify:

- (69/9) + (56/3)

Convert to common denominator 9:

- (69/9) + (56/3)(3/3) = - (69/9) + (168/9)

Add:

(-69 + 168) / 9 = 99 / 9 = 11

Since the left side equals the right side, the solution is verified.

Discussion on the Solution

Features and Significance

- The system has a unique solution, indicated by the intersection of two lines at a single point.
- The solution involves rational numbers, demonstrating that solutions are not always integers.
- The method used ensures precise answers that can be verified algebraically.

Pros of the Elimination Method

- Efficient for systems where coefficients align conveniently.
- Reduces the problem to solving a single-variable equation.
- Easy to verify solutions by substitution.

Cons of the Elimination Method

- Can become cumbersome if coefficients are complex or not aligned.
- Less intuitive graphically for visual understanding unless plotted carefully.

Alternative Approaches and Their Merits

Substitution Method

- Useful when one equation is already solved for a variable.
- Can be more straightforward if coefficients are awkward to eliminate.

Graphical Method

- Provides visual understanding of solution and system behavior.
- Less precise unless plotted with accuracy tools.

Matrix Methods (e.g., Cramer's Rule)

- Suitable for larger systems.
- Involves determinants and linear algebra concepts.

Practical Applications of Solving Such Systems

- Business and Economics: To optimize profit or cost functions.
- Physics: To determine intersection points of forces or trajectories.
- Engineering: For circuit analysis involving multiple equations.
- Computer Graphics: To find points of intersection in geometric modeling.

Conclusion

Finding the solution of the system of equations $-3x + 2y = -17$ and $-3x - 4y = 11$ demonstrates fundamental algebraic techniques essential for problem-solving across disciplines. The elimination method proved effective here, providing a clear and precise solution set: $x = 23/9$ and $y = -14/3$. This process underscores the importance of understanding different solution strategies, verifying results, and appreciating the graphical interpretation of systems. Mastery of such techniques forms a vital foundation for tackling more complex systems and enhances analytical thinking skills vital in academic and professional contexts. Whether approached algebraically or visually, solving systems of equations remains a core skill in mathematics education and real-world problem-solving.

Note: Practice with various systems helps develop intuition about their solutions, whether they intersect at a point, are parallel, or coincide. Regular practice ensures proficiency and prepares learners for advanced topics involving matrices and linear algebra.

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