Find The Solution To The System Of Equations: X + 3y = 7 And 2x + 4y = 8 1. Isolate X In The First Equation:

Find The Solution To The System Of Equations: X + 3y = 7 And 2x + 4y = 8 1. Isolate X In The First Equation:

When working with systems of equations, one common goal is to find the values of the variables that satisfy all equations simultaneously. In this article, we'll explore how to solve the system:

1. $x + 3y = 7$
2. $2x + 4y = 8$

Specifically, we'll focus on isolating x in the first equation as a crucial step toward solving the system effectively. Understanding how to manipulate equations to isolate a variable is foundational in algebra and essential for solving systems efficiently.

Understanding the System of Equations

Before diving into the steps to isolate x, it's important to understand the structure of the given system.

What Is a System of Equations?

A system of equations comprises two or more equations with the same variables. The solution to the system is the set of variable values that satisfy all equations simultaneously.

Methods for Solving Systems

Common methods include:

- **Graphing:** Plotting each equation and finding their intersection point.
- **Substitution:** Solving one equation for a variable and substituting into the other.
- **Elimination:** Adding or subtracting equations to eliminate a variable.

In this case, isolating x in the first equation sets the stage for substitution or elimination.

Step-by-Step: Isolating X in the First Equation

The first equation is:

$$ x + 3y = 7 $$

The goal is to express x explicitly in terms of y.

Step 1: Subtract $3y$ from Both Sides

To isolate x, move all other terms to the right side:

$$ x + 3y - 3y = 7 - 3y $$

which simplifies to:

$$ x = 7 - 3y $$

This is the key step that isolates x as a function of y.

Step 2: Express x in terms of y

Now that we've isolated x, the first equation becomes:

$$ x = 7 - 3y $$

This expression allows us to substitute x into the second equation, facilitating the process of solving for the variables.

Using the Isolated x to Solve the System

Having expressed x as $7 - 3y$, the next step involves substituting this into the second equation to find y.

Step 3: Substitute $x = 7 - 3y$ into the Second Equation

The second equation is:

$$ 2x + 4y = 8 $$

Substitute x:

$$ 2(7 - 3y) + 4y = 8 $$

Step 4: Simplify and Solve for y

Distribute the 2:

$$ 14 - 6y + 4y = 8 $$

Combine like terms:

$$ 14 - 2y = 8 $$

Subtract 14 from both sides:

$$ -2y = 8 - 14 $$

$$ -2y = -6 $$

Divide both sides by -2:

$$ y = \frac{-6}{-2} $$

$$ y = 3 $$

Find the Corresponding x Value

Now that $y = 3$, substitute back into the expression for x:

$$ x = 7 - 3(3) $$

$$ x = 7 - 9 $$

$$ x = -2 $$

Verify the Solution

It's important to verify the solution $(x, y) = (-2, 3)$ in both original equations.

Check in the First Equation:

$$ x + 3y = 7 $$

$$ -2 + 3(3) = 7 $$

$$ -2 + 9 = 7 $$

$$ 7 = 7 \quad \checkmark $$

Check in the Second Equation:

$$ 2x + 4y = 8 $$

$$ 2(-2) + 4(3) = 8 $$

$$ -4 + 12 = 8 $$

$$ 8 = 8 \quad \checkmark $$

Both equations are satisfied, confirming the solution.

Summary of the Solution Process

To find the solution to the system:

- Isolate x in the first equation: $x = 7 - 3y$
- Substitute this expression into the second equation
- Solve the resulting equation for y
- Use the value of y to find x
- Verify the solution in both original equations

This method demonstrates how isolating a variable in one equation simplifies the process of solving systems of equations.

Additional Tips for Solving Systems of Equations

- Always check your solutions by substituting back into original equations.
- When equations are in different forms, consider rewriting them into slope-intercept form (for linear equations).
- Use substitution when one equation easily isolates a variable.
- Use elimination when coefficients align for straightforward addition/subtraction.

Conclusion

Understanding how to isolate x in the first equation is a fundamental skill in solving systems of equations. By manipulating the equation $x + 3y = 7$ to express x as $7 - 3y$, you set up an efficient pathway toward solving for both variables systematically. Mastering this process not only helps in solving simple linear systems but also builds a solid foundation for tackling more complex algebraic problems. Whether you're preparing for exams or working through real-world applications, these techniques are invaluable tools in your mathematical toolkit.

Frequently Asked Questions

How do I isolate x in the first equation X + 3y = 7?

Subtract 3y from both sides to get x = 7 - 3y.

What is the value of x when y = 0 in the first equation?

Substitute y = 0 into x = 7 - 3y, resulting in x = 7 - 0 = 7.

How can I use the first equation to eliminate x in the system?

Isolate x in the first equation as x = 7 - 3y and substitute into the second equation to solve for y.

What is the next step after isolating x in the first equation?

Substitute x = 7 - 3y into the second equation 2x + 4y = 8 and solve for y.

How do I solve for y after substituting x in the second equation?

Replace x with 7 - 3y in the second equation: 2(7 - 3y) + 4y = 8, then solve for y.

What is the value of y after solving the second equation?

Simplify 14 - 6y + 4y = 8 to get 14 - 2y = 8, then solve for y: -2y = -6, so y = 3.

How do I find the corresponding value of x after determining y?

Substitute y = 3 into x = 7 - 3y, resulting in x = 7 - 3(3) = 7 - 9 = -2.

What is the solution to the system of equations?

The solution is x = -2 and y = 3.

Are the equations consistent and do they have a unique solution?

Yes, the equations are consistent and intersect at the point (-2, 3), giving a unique solution.

Can the method of isolating x in the first equation be used for similar systems?

Yes, isolating one variable in one equation and substituting into the other is a common method for solving linear systems.

Additional Resources

Find The Solution To The System Of Equations: X + 3Y = 7 And 2X + 4Y = 8

Mathematics, especially algebra, forms the backbone of critical thinking and problem-solving skills. Among the fundamental concepts in algebra is solving systems of equations—an essential skill for students, educators, and professionals alike. This article delves into a specific system of linear equations, focusing on the process of isolating X in the first equation and ultimately solving for both variables. Through a comprehensive, step-by-step exploration, we aim to clarify the methodology, principles, and applications of solving such systems.

Understanding the System of Equations

The system under consideration consists of two linear equations:

1. X + 3Y = 7
2. 2X + 4Y = 8

These equations are interconnected, and solving the system involves finding the values of X and Y that satisfy both simultaneously. Such solutions are called solutions to the system or point(s) of intersection when visualized graphically.

The Significance of Isolating X in the First Equation

Before tackling the entire system, isolating X in the first equation provides a foundation for substitution methods. This process involves expressing X explicitly in terms of Y, which can then be substituted into the second equation to find Y and subsequently X.

Isolating a variable simplifies the process of solving systems and enhances understanding of variable

relationships. It also exemplifies algebraic manipulation techniques, crucial for both academic pursuits and real-world applications such as engineering, economics, and data analysis.

Steps to Isolate X in the First Equation

Given the first equation:

X + 3Y = 7

To isolate X, follow these steps:

1. Subtract 3Y from both sides:

X = 7 - 3Y

This expression now explicitly states X in terms of Y. It is the first key step in the substitution method.

Applying the Substitution Method

With X expressed as 7 - 3Y, the next step involves substituting this into the second equation:

2X + 4Y = 8

Substitution Process

Replace X with 7 - 3Y:

2(7 - 3Y) + 4Y = 8

Now, expand and simplify:

(2 7) - (2 3Y) + 4Y = 8

14 - 6Y + 4Y = 8

Combine like terms:

14 - 2Y = 8

Solving for Y

Subtract 14 from both sides:

$-2Y = 8 - 14$

$-2Y = -6$

Divide both sides by -2:

$Y = (-6) / (-2) = 3$

With Y determined as 3, substitute back into the expression for X:

$X = 7 - 3Y = 7 - 3(3) = 7 - 9 = -2$

Solution: $X = -2$, $Y = 3$

Verification of the Solution

Verification ensures the solution satisfies both original equations.

1. Check $X + 3Y = 7$:

$-2 + 3(3) = -2 + 9 = 7 \rightarrow$ True

2. Check $2X + 4Y = 8$:

$2(-2) + 4(3) = -4 + 12 = 8 \rightarrow$ True

Since both equations are satisfied, the solution ($X = -2$, $Y = 3$) is valid.

Alternative Methods for Solving the System

While substitution is straightforward here, other methods include:

Graphical Method

Plotting both equations on a coordinate plane:

- X + 3Y = 7 rearranged as Y = (7 - X)/3
- 2X + 4Y = 8 rearranged as Y = (8 - 2X)/4 = (4 - X)/2

The intersection point of the lines corresponds to the solution.

Elimination Method

Multiply the first equation by 2:

2X + 6Y = 14

Subtract the second equation:

(2X + 6Y) - (2X + 4Y) = 14 - 8

(2X - 2X) + (6Y - 4Y) = 6

0 + 2Y = 6

Y = 3

Then, back-substitute into the first or second equation to find X.

Implications and Applications

Solving systems of equations is pervasive across various fields:

- Engineering: Analyzing circuit currents and voltages.
- Economics: Modeling supply and demand equilibrium.
- Computer Science: Algorithm optimization.
- Physics: Kinematic equations and force analysis.
- Data Science: Parameter estimation in regression models.

The direct approach of isolating variables simplifies complex problems, making solutions accessible and transparent.

Conclusion: Mastering the Art of Variable Isolation and System Solutions

The process of solving the system of equations:

- X + 3Y = 7
- 2X + 4Y = 8

demonstrates fundamental algebraic techniques, notably isolating variables and substitution. The explicit expression X = 7 - 3Y serves as an essential step, facilitating an efficient pathway to the solution (X = -2, Y = 3).

Beyond the specific problem, mastering these methods enhances analytical skills, critical thinking, and problem-solving capabilities. Whether in academic contexts, professional environments, or everyday decision-making, the ability to decode and solve systems of equations remains a vital intellectual tool.

In the broader scope, such exercises exemplify the power of algebraic manipulation—transforming complex, intertwined relationships into manageable, solvable components. As students and practitioners continue to refine these techniques, they unlock deeper insights into the interconnected systems that underpin our world.

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