

Consider The System Of Equations. $5x + 2y = 125$ $2x = 28$ What Is The Solution To The System Of Equations?

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Understanding systems of equations is fundamental in algebra, as it allows us to find values of variables that satisfy multiple conditions simultaneously. In this article, we will analyze the given system of equations:

1. $5x + 2y = 125$
2. $2x = 28$

Our goal is to determine the solution set for the variables x and y that satisfy both equations at the same time. We will explore various methods to solve the system, including substitution, elimination, and graphical interpretation, providing a comprehensive guide suitable for students and learners seeking clarity on solving such algebraic systems.

Understanding the System of Equations

Before diving into solving methods, let's understand what a system of equations entails.

Definition of a System of Equations

A system of equations is a collection of two or more equations with multiple variables. The solution to the system is the set of variable values that make all equations true simultaneously.

Types of Systems

- Consistent systems: Have at least one solution.
- Inconsistent systems: Have no solution.
- Dependent systems: Have infinitely many solutions.

Our focus is on solving a specific system with two equations, which are linear and thus form a linear system.

Analyzing the Given System

Let's examine the equations:

- Equation 1: $5x + 2y = 125$
- Equation 2: $2x = 28$

Notice that Equation 2 involves only x , making it straightforward to solve for x first.

Simplifying the Second Equation

Divide both sides of $2x = 28$ by 2:

$$\begin{aligned} 2x / 2 &= 28 / 2 \\ x &= 14 \end{aligned}$$

Having found x , we can substitute this value into Equation 1 to find y .

Solving the System Step-by-Step

1. **Find x from Equation 2:** $x = 14$
2. **Substitute x into Equation 1:** $5(14) + 2y = 125$
3. **Solve for y :** $70 + 2y = 125$
4. **Isolate y :** $2y = 125 - 70 = 55$
5. **Divide both sides by 2:** $y = 55 / 2 = 27.5$

Therefore, the solution to the system is:

$$x = 14, y = 27.5$$

This pair of values satisfies both equations simultaneously.

Verification of the Solution

To ensure the accuracy of our solution, let's verify it by substituting $x = 14$ and $y = 27.5$ back into both original equations.

Verification in Equation 1:

$$5x + 2y = 125$$

$$\begin{aligned}5(14) + 2(27.5) &= 125 \\70 + 55 &= 125 \\125 &= 125 \text{ (True)}\end{aligned}$$

Verification in Equation 2:

$$\begin{aligned}2x &= 28 \\2(14) &= 28 \\28 &= 28 \text{ (True)}\end{aligned}$$

Since both equations are satisfied, our solution is verified.

Graphical Interpretation of the System

Understanding the solution graphically can deepen comprehension.

Plotting Equation 1: $5x + 2y = 125$

- Rewrite in slope-intercept form:

$$\begin{aligned}2y &= 125 - 5x \\y &= (125 - 5x) / 2\end{aligned}$$

- This is a straight line with a slope of $-5/2$ and y-intercept at $125/2$.

Plotting Equation 2: $2x = 28$

- Simplify to $x = 14$
- This is a vertical line crossing the x-axis at $x = 14$.

The intersection point of these two lines is at $(14, 27.5)$, confirming our algebraic solution.

Methods for Solving Systems of Equations

While our example was straightforward, systems can sometimes be more complex. Here are common methods:

1. Substitution Method

- Solve one equation for one variable.
- Substitute into the other equation.
- Solve for the remaining variable.

2. Elimination Method

- Multiply equations to align coefficients.
- Add or subtract equations to eliminate a variable.
- Solve for the remaining variable.

3. Graphical Method

- Plot both equations on a coordinate plane.
- Identify the point(s) of intersection.

4. Matrix Method (for advanced learners)

- Use matrices and determinants (Cramer's rule) to solve systems.

Special Cases in Systems of Equations

While our example has a unique solution, it's useful to recognize other scenarios.

- **No solution:** The lines are parallel and do not intersect.
- **Infinite solutions:** The lines are coincident, representing the same line.

Practical Applications of Systems of Equations

Understanding how to solve systems of equations has real-world implications:

- Engineering: Calculating forces and loads.
- Economics: Finding equilibrium points.
- Physics: Solving for multiple variables in motion problems.
- Business: Optimizing profit and cost functions.

Conclusion

In summary, solving the system:

- $5x + 2y = 125$
- $2x = 28$

leads us to the solution $x = 14$ and $y = 27.5$. The process involved solving the simpler

equation for x , then substituting into the other to find y . Verification confirmed the accuracy of this solution. Understanding methods like substitution, elimination, and graphical interpretation enhances our ability to solve various systems effectively. Recognizing the nature of the solutions—whether unique, infinite, or nonexistent—also helps in analyzing systems for practical applications.

By mastering these techniques, students and professionals alike can confidently approach and solve complex systems of equations across different fields.

Frequently Asked Questions

What is the correct system of equations given in the problem?

The system of equations is $5x + 2y = 125$ and $2x + 2y = 28$.

How do I solve the system $5x + 2y = 125$ and $2x + 2y = 28$?

You can solve the system by using substitution or elimination methods. Subtract the second equation from the first to eliminate y and find x , then substitute back to find y .

What is the value of x in the system?

Subtract the second equation from the first: $(5x + 2y) - (2x + 2y) = 125 - 28$, which simplifies to $3x = 97$, so $x = 97/3$.

How do I find the value of y after finding x ?

Substitute $x = 97/3$ into either original equation, for example, $2x + 2y = 28$, then solve for y : $2(97/3) + 2y = 28$.

What is the value of y in the solution?

Plugging $x = 97/3$ into $2x + 2y = 28$: $2(97/3) + 2y = 28$, so $(194/3) + 2y = 28$. Convert 28 to thirds: $28 = 84/3$. Then, $2y = (84/3) - (194/3) = (-110/3)$, so $y = -55/3$.

What is the final solution to the system of equations?

The solution is $x = 97/3$ and $y = -55/3$.

Are there any other solutions to the system?

No, since the system consists of two linear equations with a unique intersection point, there is only one solution: $x = 97/3$ and $y = -55/3$.

How can I verify that the solution is correct?

Substitute $x = 97/3$ and $y = -55/3$ into both original equations to check if they hold true. If both equations are satisfied, the solution is correct.

Additional Resources

System of Equations: Unlocking Solutions Through Mathematical Precision

When tackling complex problems in mathematics, the concept of the system of equations stands as a fundamental pillar. Whether you're a student aiming to master algebra or a professional applying these principles in engineering or data analysis, understanding how to analyze and solve systems of equations is crucial. Today, we delve into a specific system:

$$\begin{aligned} 5x + 2y &= 12 \\ 2x &= 28 \end{aligned}$$

This seemingly straightforward pair of equations offers a rich opportunity to explore various solution methods, interpret results, and appreciate the elegance of algebraic problem-solving. Let's embark on this detailed journey, examining each element with the depth and clarity it deserves.

Understanding the System of Equations

At its core, a system of equations is a set of two or more equations with the same variables, which are to be solved simultaneously. The goal is to find the values of the variables that satisfy all equations at once.

In our case:

- Equation 1: $5x + 2y = 12$
- Equation 2: $2x = 28$

This system involves two variables, x and y , but only two equations, making it solvable with standard algebraic techniques.

Why is this important? Because solving such a system helps us understand relationships between variables, optimize solutions in real-world scenarios, and develop critical problem-solving skills that transcend basic mathematics.

Decoding the Equations: What Do They Mean?

Before diving into solving, it's wise to interpret what each equation represents:

- Equation 1: $5x + 2y = 12$

This is a linear equation in two variables. Geometrically, it represents a straight line on the Cartesian plane. The slope and intercepts provide insights into how x and y relate to each other.

- Equation 2: $2x = 28$

This is a simple linear equation in one variable. It indicates a direct relationship for x , independent of y , which simplifies the problem significantly.

Understanding the geometric and algebraic implications of these equations helps us anticipate the solution process.

Step-by-Step Solution Process

Let's explore how to find the solution(s) to this system. We'll focus on substitution, a straightforward method given the simplicity of the second equation.

Step 1: Solve the Simple Equation for One Variable

Starting with the second equation:

$$2x = 28$$

Divide both sides by 2:

$$x = 28 / 2 = 14$$

This immediately gives us the value of x :

$$x = 14$$

Expert Tip: When one equation is already solved for a variable, substitution becomes an effortless method to find the other variable.

Step 2: Substitute the Known Variable into the Other Equation

Now, substitute $x = 14$ into Equation 1:

$$5(14) + 2y = 12$$

Calculate:

$$70 + 2y = 12$$

Step 3: Solve for y

Subtract 70 from both sides:

$$2y = 12 - 70$$

$$2y = -58$$

Divide both sides by 2:

$$y = -58 / 2 = -29$$

Result: The solution is $x = 14$, $y = -29$.

Interpreting the Solution

The solution set for this system is a single point in the xy-plane:

(14, -29)

This point is the intersection of the line represented by the first equation and the vertical line (since x is fixed) from the second equation.

Graphical Perspective:

- The line $5x + 2y = 12$ crosses the plane at points satisfying the equation.
- The line $2x = 28$ is a vertical line at $x = 14$.
- The point (14, -29) is where these two lines intersect, confirming the solution.

Alternative Solution Methods

While substitution was straightforward here, understanding other approaches enriches your problem-solving toolkit:

1. Graphical Method

Plotting both equations on the Cartesian plane to visually identify the intersection point.

- For $5x + 2y = 12$, rearranged as $y = (12 - 5x) / 2$.
- For $2x = 28$, a vertical line at $x = 14$.

The intersection visually confirms (14, -29).

2. Elimination Method

Since one equation directly gives x , elimination isn't necessary here, but generally, you multiply equations to align coefficients and subtract.

3. Substitution Method

Already employed, substituting $x = 14$ into the first equation.

Implications and Applications of the Solution

Understanding and solving systems like this extend beyond academic exercises:

- Engineering: Calculating dimensions where constraints are modeled by equations.
- Economics: Finding equilibrium points where supply and demand equations intersect.
- Physics: Determining the point where two forces or motions meet or balance.

In real-world applications, systems of equations model complex relationships, and an accurate solution is vital for decision-making.

Potential Challenges and Common Mistakes

While this system was straightforward, students and practitioners often encounter pitfalls:

- Misreading equations: Confusing coefficients or signs can lead to incorrect solutions.
- Incorrect substitution: Forgetting to substitute the value correctly or substituting into the wrong equation.
- Arithmetic errors: Simple mistakes in calculation can derail the entire solution process.
- Overlooking extraneous solutions: In more complex systems involving nonlinear equations, some solutions may not satisfy all constraints.

Tip: Always double-check your work and verify solutions by plugging them back into the original equations.

Final Thoughts: The Power of Systematic Approach

The process of solving the given system— $5x + 2y = 12$ and $2x = 28$ —demonstrates the elegance of algebra. Starting from simple steps, we uncovered a unique solution that satisfies both equations simultaneously. This methodical approach exemplifies how complex problems become manageable when broken down into logical stages.

By mastering such techniques, you equip yourself with a powerful skill set applicable across scientific, engineering, economic, and mathematical disciplines. Whether dealing with linear systems or more advanced nonlinear equations, the core principles remain the same: understand the problem, choose the appropriate method, execute carefully, and interpret the results with insight.

In summary:

- The solution to the system is $x = 14$ and $y = -29$.
- The solution points to a specific intersection in the Cartesian plane, symbolizing the harmony between algebraic relationships.
- Building proficiency in solving systems enhances analytical thinking, problem-solving efficiency, and application versatility.

Embrace these methods, and you'll find that systems of equations are not just abstract mathematical constructs but powerful tools for understanding and solving real-world challenges.

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