40 POINTS PLEASE HELP!1. Consider The System Of Equations5x - 2y = 16,15x - 7y = 51.Multiply The First

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When working with systems of equations, especially those involving multiple variables, understanding the methods to solve them efficiently is essential. In this article, we will explore how to solve the system:

$$
\begin{cases}
5x - 2y = 16 \quad \quad (1) \\
15x - 7y = 51 \quad \quad (2)
\end{cases}
$$

by employing multiplication techniques, substitution, and elimination methods. Our primary focus is on the first step: multiplying the equations appropriately to facilitate elimination. We will delve into detailed explanations, step-by-step instructions, and practical tips to master solving such systems, which are fundamental skills in algebra and higher mathematics.

Understanding Systems of Equations

A system of equations consists of two or more equations with multiple variables, typically x, y, and sometimes z. The goal is to find the values of these variables that satisfy all equations simultaneously.

Types of systems:

- Consistent and independent: Has exactly one solution.
- Consistent and dependent: Infinite solutions (the equations represent the same line or plane).
- Inconsistent: No solution (the equations represent parallel lines).

In our case, the system appears to be consistent and independent, and we will find a unique solution.

Methods to Solve Systems of Equations

Several methods are commonly used to solve systems:

1. Substitution Method: Solve one equation for one variable and substitute into the other.
2. Elimination Method: Add or subtract equations to eliminate a variable.
3. Graphical Method: Plot both equations to find the intersection point.
4. Multiplication and Addition: Adjust equations via multiplication to align coefficients, enabling elimination.

For the system at hand, elimination via multiplication is especially suitable, as the equations have coefficients that can be manipulated to cancel variables.

Step-by-Step Solution: Multiplying for Elimination

Step 1: Write down the original equations

$$
\begin{cases}
5x - 2y = 16 \quad \quad (1) \\
15x - 7y = 51 \quad \quad (2)
\end{cases}
$$

Step 2: Think about how to align coefficients for elimination

Our goal is to eliminate one variable by making the coefficients of that variable opposites in the two equations.

Observe:

- The coefficient of x in (1) is 5.
- The coefficient of x in (2) is 15.

Since 15 is a multiple of 5, we can multiply the first equation by 3 to align the x coefficients:

$$
(1) \times 3: \quad 3 \times (5x - 2y) = 3 \times 16
$$
$$
15x - 6y = 48 \quad \quad (3)
$$

Now, our system becomes:

$$
\begin{cases}
15x - 6y = 48 \quad \quad (3) \\
15x - 7y = 51 \quad \quad (2)
\end{cases}
$$

Step 3: Subtract equations to eliminate x

Subtract equation (3) from equation (2):

$$
(15x - 7y) - (15x - 6y) = 51 - 48
$$
$$
15x - 7y - 15x + 6y = 3
$$
$$
(-7y + 6y) = 3
$$
$$
- y = 3
$$

Solve for y:

$$
y = -3
$$

Step 4: Substitute $y = -3$ into one of the original equations

Choose equation (1):

$$
5x - 2y = 16
$$

Substitute $y = -3$:

$$
5x - 2(-3) = 16
$$

$$
5x + 6 = 16
$$

Solve for x:

$$
5x = 16 - 6
$$

$$
5x = 10
$$

$$
x = 2
$$

Final Solution:

$$
\boxed{
x = 2, \quad y = -3
}
$$

This point $(2, -3)$ is the solution to the system—the intersection point of the two lines represented by the equations.

Additional Tips for Solving Systems of Equations

- Always check your solutions: Substitute your solution back into the original equations to verify.
- Choose the best method: Depending on the coefficients, sometimes

substitution is easier than elimination, and vice versa.
- Multiply equations carefully: When multiplying, ensure to multiply all terms in the equation to maintain equality.
- Be mindful of signs: Keep track of positive and negative signs during calculations to avoid errors.

Practice Problems to Reinforce Learning

- Solve the system: $3x + 4y = 7$, $6x - 2y = 8$ using multiplication and elimination.

- Find the solution to: $2x - 3y = 5$, $4x + y = 9$ using substitution.

- Graph the equations $y = 2x + 1$ and $y = -x + 4$ and identify the intersection point.

Summary

Solving systems of equations by multiplication involves:

- Aligning coefficients via multiplication.
- Eliminating one variable by addition or subtraction.
- Solving for the remaining variable.
- Substituting back to find the other variable.

This approach is systematic and reliable, especially when equations have coefficients that are multiples or factors of each other.

Mastering these techniques enhances your algebra skills and prepares you for more advanced topics in mathematics, such as matrices, linear programming, and calculus.

Conclusion

The problem at hand demonstrates the power of multiplying equations to facilitate elimination, making complex systems more manageable. By carefully choosing the multiplication factors, you can efficiently solve for the variables and find the unique solution. Remember, practice is key—work through various systems to develop confidence and proficiency.

If you want to deepen your understanding of systems of equations, consider exploring topics like matrix methods, determinants, and applications in real-world problems such as economics, engineering, and physics.

Hope this detailed guide helps you confidently tackle systems of equations and understand the importance of multiplication in solving them!

Frequently Asked Questions

How do I solve the system of equations 5x - 2y = 16 and 15x - 7y = 51 by elimination?

To solve by elimination, multiply the first equation to align coefficients. For instance, multiply the first equation by 3: 15x - 6y = 48. Then subtract this from the second equation: (15x - 7y) - (15x - 6y) = 51 - 48, resulting in -y = 3, so y = -3. Substitute y back into one original equation to find x.

What is the first step when asked to multiply one equation to facilitate solving a system?

Identify which variable's coefficients you want to align or eliminate, then multiply the entire equation by a number so that the coefficients of that variable match in magnitude but are opposite in sign.

Can I use substitution instead of elimination for this system?

Yes, you can solve for one variable in one equation and substitute into the other. For example, from 5x - 2y = 16, solve for x or y and substitute into the second equation to find the solution.

What are the solutions to the system 5x - 2y = 16 and 15x - 7y = 51?

Using elimination, the solutions are x = 7 and y = -3.

How do I verify my solution to a system of

equations?

Plug the found values of x and y into both original equations to check if both sides are equal; if they are, the solution is correct.

What is the importance of multiplying an equation in solving systems?

Multiplying an equation helps to align coefficients for elimination, making it easier to eliminate a variable and solve for the remaining variable.

Is it necessary to multiply both equations in a system to solve it?

Not always. Multiplying is only necessary when you want to align coefficients for elimination. Sometimes substitution can be more straightforward without multiplication.

Are systems of equations always solvable?

No, some systems are inconsistent (no solution) or dependent (infinitely many solutions). If after solving, you find a contradiction or the same equation, the system may be inconsistent or dependent.

What should I do if multiplying the first equation complicates the calculation?

You can consider using substitution instead or try multiplying the second equation to align coefficients. Choose the method that simplifies your calculations.

Additional Resources

System Of Equations: An In-Depth Analysis and Solution Strategies

Understanding systems of equations is fundamental in algebra and higher mathematics, as they provide a framework for solving multiple related equations simultaneously. In this article, we will focus on the specific system:

5x - 2y = 16
15x - 7y = 51

and explore various methods to solve such systems, including the process of multiplying equations to facilitate elimination or substitution. Whether you're a student struggling with these concepts or a teacher seeking effective explanations, this comprehensive review offers insights into techniques, pros and cons, and practical applications.

Introduction to Systems of Equations

A system of equations consists of two or more equations with the same set of variables. The solutions to the system are the values of the variables that satisfy all equations simultaneously. The most common goals are to find the point(s) of intersection when graphed or the specific values that satisfy all equations.

Types of Systems:
- Consistent System: Has at least one solution.
- Inconsistent System: Has no solution.
- Dependent System: Has infinitely many solutions (equations are essentially the same).

The given system:

$5x - 2y = 16$
$15x - 7y = 51$

is consistent and independent, typically having a unique solution.

Methods for Solving Systems of Equations

There are several methods to solve such systems:

- Graphing Method
- Substitution Method
- Elimination Method
- Multiplication (or Scaling) Method
- Matrix Method (using determinants or matrices)

This article focuses on the multiplication method and explores how it can be used to simplify and solve the system efficiently.

Applying the Multiplication Method to the

System

The multiplication method is a variation of the elimination approach. It involves multiplying one or both equations by constants to align the coefficients of a variable, so they can be eliminated through addition or subtraction.

Step-by-step process:

1. Identify the coefficients to align.
For the system:

$$5x - 2y = 16$$
$$15x - 7y = 51$$

observe that the coefficients of x are 5 and 15. To eliminate x, multiply the first equation by a number that makes its x coefficient equal to 15.

2. Multiply to match coefficients.
Multiply the first equation by 3:

$$(3)(5x - 2y) = 3(16)$$
$$\rightarrow 15x - 6y = 48$$

3. Subtract or add the equations.
Now, subtract the second original equation from this new equation:

$$(15x - 6y) - (15x - 7y) = 48 - 51$$

Simplify:

$$15x - 6y - 15x + 7y = -3$$
$$\rightarrow (-6y + 7y) = -3$$
$$\rightarrow y = -3$$

4. Back-substitute to find x.
Plug $y = -3$ into the original first equation:

$$5x - 2(-3) = 16$$
$$\rightarrow 5x + 6 = 16$$
$$\rightarrow 5x = 10$$
$$\rightarrow x = 2$$

Solution:
$x = 2, y = -3$

This process demonstrates how multiplying equations to match coefficients simplifies elimination, especially when coefficients are not readily compatible.

Advantages and Disadvantages of the Multiplication Method

Pros:

- Systematic approach: Clear steps make it straightforward to follow.
- Handles coefficients effectively: Useful when coefficients are not conveniently aligned.
- Reduces complexity: Simplifies systems that are otherwise difficult to eliminate variables directly.

Cons:

- Can involve extra calculations: Sometimes multiple multiplications are needed.
- Potential for errors: Mistakes in multiplication or subtraction can lead to incorrect solutions.
- Less intuitive: Compared to substitution, it may seem less straightforward for simple systems.

Alternative Solution Methods and Their Features

While the multiplication method is powerful, other methods may be more suitable depending on the problem context.

Substitution Method

- Process: Solve one equation for one variable, then substitute into the other.
- Features:
- Simple for systems where one variable can be easily isolated.
- Efficient for systems with variables that have coefficients of 1 or -1.
- Limitations:
- Can become cumbersome if coefficients are complex.

Graphical Method

- Process: Plot each equation on a graph; the intersection point(s) represent

solutions.
- Features:
- Visual approach helps understanding solutions.
- Useful for approximate solutions.
- Limitations:
- Less precise unless using graphing tools.
- Not practical for complex systems.

Matrix and Determinant Methods

- Process: Use linear algebra techniques like Cramer's rule.
- Features:
- Efficient for larger systems.
- Suitable for computational algorithms.
- Limitations:
- Requires understanding of matrices and determinants.

Practical Applications of Solving Systems of Equations

Systems of equations appear in various fields:

- Physics: Calculating forces, velocities, or electrical currents.
- Economics: Modeling supply and demand equations.
- Engineering: Analyzing circuits or structural systems.
- Computer Science: Algorithm design and optimization problems.
- Biology: Population models and rate equations.

Mastering multiple solution techniques ensures flexibility and efficiency in real-world problem-solving.

Tips for Effective Solving of Systems of Equations

- Always check whether equations are linear before applying methods.
- Simplify equations when possible to reduce calculation errors.
- When coefficients are inconvenient, consider multiplying to align variables.
- Cross-verify solutions by substituting back into original equations.

- Use graphical methods to gain intuition, especially with real-world data.

Conclusion

Understanding the system of equations and the various methods to solve them, including the multiplication method, is crucial for algebra proficiency. The multiplication approach offers a systematic way to eliminate variables when coefficients are mismatched, making it a valuable technique in the mathematician's toolkit. By weighing its pros and cons and exploring alternative methods, learners can choose the most effective approach based on the specific problem at hand. Whether applied in academic settings or real-world scenarios, mastering these techniques enhances problem-solving skills and mathematical reasoning.

Final Thoughts

The ability to manipulate and solve systems of equations efficiently is foundational for advanced mathematics and related disciplines. The example system provided illustrates how multiplying equations to align coefficients simplifies the process and leads to a straightforward solution. As you continue to develop your algebra skills, experimenting with different methods will deepen your understanding and improve your flexibility in tackling complex problems.

Remember: Practice makes perfect. Working through multiple systems, varying coefficients, and different solution strategies will build confidence and mathematical intuition. Keep exploring, practicing, and refining your skills!

If you need further assistance or specific problem-solving guidance, feel free to ask!

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