

53 solving systems of linear equations by elimination answer key

5.3 Solving Systems of Linear Equations by Elimination: Answer Key and Comprehensive Guide

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Introduction: Mastering the Elimination Method for Solving Systems of Linear Equations

This comprehensive guide provides a detailed explanation of section 5.3, focusing on solving systems of linear equations using the elimination method. We will explore the fundamental principles, step-by-step procedures, and provide numerous examples, along with an answer key to solidify your understanding. The "5.3 solving systems of linear equations by elimination answer key" serves as a valuable resource for students seeking to master this crucial algebraic technique. This method, also known as the addition method, offers a powerful and efficient way to solve systems of two or more linear equations simultaneously. Understanding this method is critical for success in higher-level mathematics courses and applications in various fields, including science, engineering, and economics.

Understanding Systems of Linear Equations

Before diving into the elimination method, let's establish a clear understanding of what constitutes a system of linear equations. A system of linear equations involves two or more linear equations, each containing the same variables. A linear equation is an equation where the highest power of the variables is 1. For example:

$$2x + 3y = 7$$

$$x - y = 1$$

This represents a system of two linear equations with two variables (x and y). The goal is to find the values of x and y that simultaneously satisfy both equations. Geometrically, these equations represent lines, and the solution represents the point of intersection of those lines.

The Elimination Method: A Step-by-Step Approach

The elimination method for solving systems of linear equations involves manipulating the equations to eliminate one of the variables, allowing you to solve for the remaining variable. Here's a detailed step-by-step guide, accompanied by examples:

Step 1: Prepare the Equations

Ensure the equations are in standard form ($Ax + By = C$). If not, rearrange them accordingly.

Step 2: Choose a Variable to Eliminate

Select the variable you want to eliminate. Look for equations where the coefficients of one variable are opposites (e.g., $2x$ and $-2x$) or easily made opposites by multiplying one or both equations by a constant.

Step 3: Eliminate the Variable

Add the equations together. The chosen variable should cancel out, leaving you with a single equation in one variable.

Step 4: Solve for the Remaining Variable

Solve the resulting equation for the remaining variable.

Step 5: Substitute and Solve for the Other Variable

Substitute the value you found in Step 4 back into either of the original equations and solve for the other variable.

Step 6: Check Your Solution

Substitute both values back into both original equations to verify your solution satisfies both equations.

Examples with the 5.3 Solving Systems of Linear Equations by Elimination Answer Key

Example 1:

Solve the system:

$$2x + y = 7$$

$$x - y = 2$$

Solution:

1. Equations are already in standard form.
2. Choose to eliminate 'y'. The coefficients are already opposites (+y and -y).
3. Add the equations: $(2x + y) + (x - y) = 7 + 2 \Rightarrow 3x = 9 \Rightarrow x = 3$
4. Substitute $x = 3$ into the first equation: $2(3) + y = 7 \Rightarrow y = 1$
5. Check: $2(3) + 1 = 7$ (True); $3 - 1 = 2$ (True)

Answer: $x = 3, y = 1$

Example 2:

Solve the system:

$$3x + 2y = 11$$

$$x - y = 2$$

Solution:

1. Equations are in standard form.
2. Choose to eliminate 'y'. Multiply the second equation by 2: $2(x - y) = 2(2) \Rightarrow 2x - 2y = 4$
3. Add the modified second equation to the first equation: $(3x + 2y) + (2x - 2y) = 11 + 4 \Rightarrow 5x = 15 \Rightarrow x = 3$
4. Substitute $x = 3$ into the second equation: $3 - y = 2 \Rightarrow y = 1$
5. Check: $3(3) + 2(1) = 11$ (True); $3 - 1 = 2$ (True)

Answer: $x = 3, y = 1$

Example 3 (with inconsistent system):

Solve the system:

$$x + y = 3$$

$$x + y = 5$$

Solution:

1. Equations are in standard form.
2. Attempt to eliminate 'x' by subtracting the first equation from the second: $(x + y) - (x + y) = 5 - 3 \Rightarrow 0 = 2$
3. This is a contradiction. Therefore, there is no solution to this system of equations. The lines are parallel.

Example 4 (with dependent system):

Solve the system:

$$2x + 4y = 6$$

$$x + 2y = 3$$

Solution:

1. Equations are in standard form.
2. Multiply the second equation by 2: $2(x + 2y) = 2(3) \Rightarrow 2x + 4y = 6$
3. Subtract the first equation from the modified second equation: $(2x + 4y) - (2x + 4y) = 6 - 6 \Rightarrow 0 = 0$
4. This is an identity. The equations are equivalent. There are infinitely many solutions. The lines are coincident.

Advanced Applications of the Elimination Method: 5.3 Solving Systems of Linear Equations by Elimination Answer Key

The elimination method can be extended to solve systems of three or more linear equations. This involves strategically eliminating variables one at a time until a single equation in one variable remains. Gaussian elimination is a systematic approach to this process, often used in linear algebra.

Conclusion

Mastering the elimination method is crucial for solving systems of linear equations effectively. This method provides a systematic approach to finding solutions, which are essential in various mathematical and real-world applications. The provided examples and the "5.3 solving systems of linear equations by elimination answer key" serve as invaluable resources for understanding and practicing this fundamental algebraic concept. Remember to always check your solutions to ensure

accuracy.

FAQs

1. What if the coefficients aren't easily made opposites? You can multiply both equations by different constants to create opposite coefficients for one of the variables.
1. Can I use the elimination method for systems with more than two variables? Yes, the principles extend to larger systems; however, the process becomes more complex.
1. What if there's no solution to the system? You will end up with a contradiction (e.g., $0 = 2$).
1. What if there are infinitely many solutions? You'll get an identity (e.g., $0 = 0$).
1. Is the elimination method always the best method? No, substitution may be more efficient in certain cases. The best method depends on the specific system of equations.
1. How can I check my answer? Substitute the solution back into the original equations. If both equations are true, your solution is correct.
1. What are some real-world applications of solving systems of linear equations? They're used in various fields, such as circuit analysis, mixture problems, and economic modeling.
1. What is the difference between elimination and substitution methods? Elimination involves eliminating a variable by adding or subtracting equations, while substitution involves solving for one variable in terms of the other and substituting it into the other equation.
1. Where can I find more practice problems? Numerous online resources and textbooks offer

practice problems on solving systems of linear equations.

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