62 solving systems by substitution worksheet answers

62 solving systems by substitution worksheet answers is a crucial topic in algebra that helps students understand how to solve systems of equations effectively. The substitution method is one of the most popular techniques for finding the solution to a system of linear equations, where you express one variable in terms of the other and substitute it back into the equation. This article will delve into the intricacies of solving systems by substitution, provide detailed examples, and present answers to common worksheet problems to enhance understanding.

Understanding Systems of Equations

Systems of equations are collections of two or more equations with the same set of variables. When graphed, these equations can intersect at one point, multiple points, or not at all. The solution to the system is the point(s) where the equations intersect, representing the values of the variables that satisfy all equations in the system.

Types of Systems of Equations

1. Consistent and Independent: The system has exactly one solution. The lines intersect at a single point.
2. Consistent and Dependent: The system has infinitely many solutions. The lines are the same.
3. Inconsistent: The system has no solution. The lines are parallel and never intersect.

The Substitution Method Explained

The substitution method involves three main steps:

1. Isolate one variable: Solve one of the equations for one variable in terms of the other.
2. Substitute: Replace the isolated variable in the other equation with the expression obtained.
3. Solve: Simplify and solve the resulting equation for the remaining variable.

Step-by-Step Example

Let's illustrate the substitution method with a detailed example.

Consider the following system of equations:

1. $y = 2x + 3$
2. $3x + y = 9$

Step 1: Isolate a Variable

In this case, the first equation already expresses y in terms of x.

Step 2: Substitute

Now, substitute y in the second equation:

$$
3x + (2x + 3) = 9
$$

Step 3: Solve

Combine like terms:

$$
5x + 3 = 9
$$

Subtract 3 from both sides:

$$
5x = 6
$$

Divide by 5:

$$
x = \frac{6}{5}
$$

Now, substitute x back into the first equation to find y:

$$
y = 2\left(\frac{6}{5}\right) + 3 = \frac{12}{5} + \frac{15}{5} = \frac{27}{5}
$$

Thus, the solution to the system is:

$$
\left(\frac{6}{5}, \frac{27}{5} \right)
$$

Worksheet Problems and Solutions

Now that we understand the substitution method, let’s explore some common problems one might find on a worksheet, including their answers.

Problem Set:

1. $x + y = 10$
$2x - y = 1$

2. $3x + 4y = 24$
$x - 2y = -3$

3. $5x + 2y = 20$
$3x - y = 5$

4. $y = -x + 4$
$2x + y = 10$

5. $4x + y = 8$
$3x - 2y = 6$

Solutions:

1. For $x + y = 10$ and $2x - y = 1$:

- From the first equation: $y = 10 - x$
- Substitute into the second equation:
$$
2x - (10 - x) = 1 \implies 3x - 10 = 1 \implies 3x = 11 \implies x = \frac{11}{3}
$$
- Substitute back to find y:
$$
y = 10 - \frac{11}{3} = \frac{30}{3} - \frac{11}{3} = \frac{19}{3}
$$
- Solution: $\left(\frac{11}{3}, \frac{19}{3} \right)$

2. For $3x + 4y = 24$ and $x - 2y = -3$:

- From the second equation: $x = 2y - 3$
- Substitute into the first equation:
$$
3(2y - 3) + 4y = 24 \implies 6y - 9 + 4y = 24 \implies 10y - 9 = 24
$$
- Solve for y:
$$
10y = 33 \implies y = \frac{33}{10}
$$
- Substitute back to find x:
$$
x = 2\left(\frac{33}{10}\right) - 3 = \frac{66}{10} - \frac{30}{10} = \frac{36}{10} = \frac{18}{5}
$$
- Solution: $\left(\frac{18}{5}, \frac{33}{10} \right)$

3. For $5x + 2y = 20$ and $3x - y = 5$:

- From the second equation: $y = 3x - 5$
- Substitute into the first equation:

$$
5x + 2(3x - 5) = 20 \implies 5x + 6x - 10 = 20
$$

- Solve for x:

$$
11x - 10 = 20 \implies 11x = 30 \implies x = \frac{30}{11}
$$

- Substitute back to find y:

$$
y = 3\left(\frac{30}{11}\right) - 5 = \frac{90}{11} - \frac{55}{11} = \frac{35}{11}
$$

- Solution: $\left(\frac{30}{11}, \frac{35}{11} \right)$

4. For $y = -x + 4$ and $2x + y = 10$:

- Substitute y in the second equation:

$$
2x + (-x + 4) = 10 \implies 2x - x + 4 = 10
$$

- Solve for x:

$$
x + 4 = 10 \implies x = 6
$$

- Substitute back to find y:

$$
y = -6 + 4 = -2
$$

- Solution: $(6, -2)$

5. For $4x + y = 8$ and $3x - 2y = 6$:

- From the first equation: $y = 8 - 4x$
- Substitute into the second equation:

$$
3x - 2(8 - 4x) = 6 \implies 3x - 16 + 8x = 6
$$

- Solve for x:

$$
11x - 16 = 6 \implies 11x = 22 \implies x = 2
$$

- Substitute back to find y:

$$
y = 8 - 4(2) = 8 - 8 = 0
$$

- Solution: $(2, 0)$

Conclusion

Understanding the 62 solving systems by substitution worksheet answers provides a strong foundation for students tackling algebraic equations. The substitution method not only simplifies the process of finding solutions but also enhances problem-solving skills crucial for higher-level mathematics. By practicing various systems of equations, students can gain confidence and improve their ability to solve complex problems effectively. Remember, the key to mastery is practice, so keep working through these types of problems to reinforce your understanding!

Frequently Asked Questions

What is the substitution method for solving systems of equations?

The substitution method involves solving one of the equations for one variable and then substituting that expression into the other equation.

How do you check your answers after using the substitution method?

To check your answers, substitute the values of the variables back into the original equations to ensure both equations are satisfied.

What types of systems are best solved using the substitution method?

The substitution method is best used for systems where one equation is easily solvable for one variable, particularly when the coefficients are simple.

What should you do if you end up with a false statement when solving a system by substitution?

If you get a false statement, it indicates that the system has no solution, meaning the lines represented by the equations are parallel.

Can you provide an example of a system of equations solved using substitution?

Sure! For the system $y = 2x + 3$ and $3x + y = 12$, substitute y in the second equation: $3x + (2x + 3) = 12$, then solve for x and find y.

What are common mistakes to avoid when solving systems by

substitution?

Common mistakes include miscalculating when substituting, forgetting to distribute correctly, and not simplifying equations fully before solving.

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