

The Substitution Method

CW due for a grade

Another way to solve systems of equations is to use the **substitution method**.

This method substitutes for one variable in terms of the other variable.

Solve: $x + 2y = 7$
 $3x + y = 11$

Step 1:

Solve for x in terms of y in either equation.

$$\begin{aligned} x + 2y &= 7 \\ x + 2y - 2y &= 7 - 2y \\ x &= 7 - 2y \end{aligned}$$

Step 2:

Substitute $7 - 2y$ for x in the second equation.

$$\begin{aligned} 3x + y &= 11 \\ 3(7 - 2y) + y &= 11 \\ 21 - 6y + y &= 11 \\ -5y &= -10 \\ y &= 2 \end{aligned}$$

Step 3:

Substitute 2 for y in either equation.

$$\begin{aligned} x + 2(2) &= 7 \\ x &= 3 \end{aligned}$$

Check:

$$\begin{aligned} x + 2y &= 7 \\ 3 + 2(2) &= 7 \\ \text{and} \\ 3x + y &= 11 \\ 3(3) + 2 &= 11 \end{aligned}$$

The solution is (3, 2).

Use the substitution method to solve each system of equations. Write the answer as an ordered pair.

1. $x + 4y = 12$
 $2x - y = 6$

2. $x - y = 1$
 $5x + 3y = 45$

3. $3x + 2y = 13$
 $x + y = 5$

4. $x + y = 4$
 $x + 3y = 10$

5. $x - y = 2$
 $4x + y = 23$

6. $2x + 3y = 9$
 $x - 2y = 1$

7. $x + 2y = 9$
 $x - y = 3$

8. $x + 3y = 10$
 $x + y = 6$

9. $x + 3y = 11$
 $x + y = 7$

10. $x + 5y = 10$
 $x - 2y = 3$

11. $2x + y = 8$
 $x + 2y = 7$

12. $3x - y = 9$
 $2x + y = 11$

Systems of Equations

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Systems of equations are two or more equations that are solved together or at the same time. Sometimes there is a solution that satisfies both equations.

Suppose you have two linear equations for lines that intersect. Each equation has 2 variables, x and y . Since both sides of an equation have the same value, you can create a new equation by adding the two equations together or by subtracting one equation from the other. The goal of combining equations in this way is to eliminate one of the variables in order to solve for the other variable. The solution to both equations will be a single ordered pair.

Solve: $x + y = 13$

$$x - y = 1$$

Add. $x + y = 13$

$$\underline{x - y = 1}$$

$$2x + 0 = 14$$

$$x = 7$$

Substitute the value of x into one of the original equations and solve for y .

$$7 + y = 13$$

$$y = 6$$

Check: Substitute the values of x and y into the original equations.

$$x + y = 13 \quad x - y = 1$$

$$7 + 6 = 13 \quad 7 - 6 = 1$$

The solution to the system of equations is $(7, 6)$.

Solve each system of equations. Check by substitution.

1. $a + b = 15$

$$a - b = 5$$

2. $a + b = 13$

$$a - b = 5$$

3. $a + b = 14$

$$a - b = 6$$

4. $x + y = 17$

$$x - y = 7$$

5. $m + n = 27$

$$m - n = 17$$

6. $d + e = 51$

$$d - e = 9$$

7. $x + y = 37$

$$x - y = 7$$

8. $b + c = -55$

$$b - c = 17$$

9. $a + b = 23$

$$a - b = 9$$

10. $m + n = 35$

$$m - n = 15$$

11. $a + b = -44$

$$a - b = 10$$

12. $x + y = 25$

$$x - y = 15$$