

6-2

Class Notes

Solving Systems Using Substitution

You can solve a system of equations by *substituting* an equivalent expression for one variable.

Problem

Solve and check the following system:

$$x + 2y = 4$$

$$2x - y = 3$$

Solution

$$x + 2y = 4$$

$$x = 4 - 2y$$

$$2(4 - 2y) - y = 3$$

$$8 - 4y - y = 3$$

$$8 - 5y = 3$$

$$8 - 8 - 5y = 3 - 8$$

$$-5y = -5$$

$$y = 1$$

$$x + 2(1) = 4$$

$$x + 2 - 2 = 4 - 2$$

$$x = 2$$

The first equation is easiest to solve in terms of one variable.

Get x to one side by subtracting $2y$.

Substitute $4 - 2y$ for x in the second equation.

Distribute.

Simplify.

Subtract 8 from both sides.

Divide both sides by 25.

You have the solution for y . Solve for x .

Substitute in 1 for y in the first equation.

Subtract 2 from both sides.

The solution is $(2, 1)$.

Check

Substitute your solution into either (or both) of the given linear equations.

$$x + 2y = 4$$

$$2 + 2(1) \stackrel{?}{=} 4$$

$$4 = 4 \checkmark$$

Substitute $(2, 1)$ into the first equation.

You check the second equation.

Solve each system using substitution. Check your answer.

1. $x + y = 3$

$$2x - y = 0$$

$$(1, 2)$$

2. $x - 3y = -14$

$$x - y = -2$$

$$(4, 6)$$

[Video Solutions are available online](#)

$$\begin{aligned} 3. \quad 2x - 2y &= 10 \\ 4. \quad 4x + y &= 8 \\ x + 2y &= 5 \end{aligned}$$

$$\begin{aligned} 4. \quad 4x + y &= 8 \\ x + 2y &= 5 \end{aligned}$$

infinitely many solutions

$$\left(\frac{11}{7}, \frac{12}{7}\right)$$

Solve each system using substitution. Check your answer.

$$\begin{aligned} 5. \quad & -2x + y = 8 \\ & 3x + y = -2 \end{aligned}$$

$$(-2, 4)$$

$$\begin{aligned} 6. \quad & 3x - 4y = 8 \\ & 2x + y = 9 \end{aligned}$$

$$(4, 1)$$

$$7. 3x + 2y = 25$$

$$2x + 3y = -6$$

The solution to the system is

$$(17\frac{2}{5}, -13\frac{3}{5})$$

$$8. 6x - 5y = 3$$

$$x - 9y = 25$$

Solve for x in the second equation:

$$x = 9y + 25$$

substitute $(9y + 25)$ for x in the first equation:

$$6x - 5y = 3$$

$$6(9y + 25) - 5y = 3$$

$$54y + 150 - 5y = 3$$

$$49y = -147$$

$$y = -3$$

Use either equation to substitute -3 for y , solve for x :

$$x - 9y = 25$$

$$x - 9(-3) = 25$$

$$x + 27 = 25$$

$$x = -2$$

The solution to the system is

$$(-2, -3)$$