

Solving Linear Systems by Substitution

To solve a linear system by substitution means to substitute one equation into the other equation in order to solve for one of the variables.

Steps to Solve a Linear System by Substitution

1. Rearrange one equation to isolate x or y. Label this equation #1 and label the other equation #2.
2. Substitute equation #1 into equation #2.
3. Solve for the unknown variable.
4. Substitute this solution into equation #1 to solve for the other variable.
5. State the point of intersection.

Example – Solve the following linear system by substitution.

$$3x - 5y = 21 \quad \text{and} \quad y = 4x - 11$$

Example – Solve each of the following linear systems by substitution.

a)
$$\begin{aligned}x + 4y &= 7 \\ 2x + 5y + 10 &= 0\end{aligned}$$

b)
$$\begin{aligned}x + 4y - 1 &= 0 \\ 3x + 2y + 12 &= 0\end{aligned}$$

Example – Solve the linear system below by substitution. Then check the solution.

$$8x - 5y = 16 \quad \text{and} \quad 4x - y = 5$$

Homework – Please complete questions # 1 – 3 below and questions #1ac (no check), 3, 4ac, 5ce and 13 on page 26.

1. Solve each of the following linear systems by substitution.

a)
$$\begin{aligned} 4x + 9y - 17 &= 0 \\ x - 7y + 42 &= 0 \end{aligned}$$

b)
$$\begin{aligned} y &= -2x - 3 \\ 6x - 5y - 8 &= 0 \end{aligned}$$

2. Solve each of the following linear systems by substitution.

a)
$$\begin{aligned} 3x + y &= 23 \\ 8x - 8y + 24 &= 0 \end{aligned}$$

b)
$$\begin{aligned} x + 3y - 18 &= 0 \\ 7x - 4y - 36 &= 0 \end{aligned}$$

3. Solve the linear system below by substitution. Then check the solution.

$$21x - 30y = 94 \quad \text{and} \quad 6x - y = -11$$

Answers:

1. a) The solution is $(x, y) = (-7, 5)$.

b) The solution is $(x, y) = \left(-\frac{7}{16}, -\frac{17}{8}\right)$.

2. a) The solution is $(x, y) = (5, 8)$.

b) The solution is $(x, y) = \left(\frac{36}{5}, \frac{18}{5}\right)$.

3. The solution is $(x, y) = \left(-\frac{8}{3}, -5\right)$.