

## Lesson 10: Solving Systems of Linear Equations by Substitution

CC attribute: *Beginning and Intermediate Algebra* by T. Wallace.



**Objective:** Solve linear systems by substitution.

**Students will be able to:**

- Identify a lone variable.
- Solve linear systems by substitution.
- Write system solutions as ordered pairs in the form  $(x, y)$ .
- Verify the accuracy of a solution by plugging it into each equation in the system.

**Prerequisite Knowledge:**

- Solving a linear equation.
- Applying the distributive property.
- Combining like terms.

---

**Lesson:**

**I - Motivating Example(s):**

We present the steps for solving a system of linear equations by substitution alongside an example.

Steps for Substitution	System: $\begin{cases} 4x - 2y = 2 \\ 2x + y = -5 \end{cases}$
1. Identify a lone variable.	The lone variable is $y$ , in the second equation: $2x + \boxed{y} = -5$
2. Solve for the lone variable.	Subtract $2x$ from both sides. $y = -5 - 2x$
3. Substitute into the untouched equation.	$4x - 2(-5 - 2x) = 2$
4. Solve for the remaining variable.	$\begin{array}{r} 4x + 10 + 4x = 2 \\ 8x + 10 = 2 \\ \underline{-10 \quad -10} \\ 8x = -8 \\ \underline{\quad 8 \quad 8} \\ x = -1 \end{array}$
5. Plug into lone variable equation and evaluate.	$\begin{array}{l} y = -5 - 2(-1) \\ y = -5 + 2 \\ y = -3 \end{array}$
Our solution, as a coordinate pair.	$(x, y) = (-1, -3)$

## II - Demo/Discussion Problems:

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

$$1. \begin{cases} 2x - 3y = 7 \\ y = 3x - 7 \end{cases}$$

$$2. \begin{cases} 3x + 2y = 1 \\ x - 5y = 6 \end{cases}$$

$$3. \begin{cases} x - y = 2 \\ 8x - 3y = 16 \end{cases}$$

## III - Practice Problems:

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

$$1. \begin{cases} y = -3x \\ y = 6x - 9 \end{cases}$$

$$12. \begin{cases} y = 7x - 24 \\ y = -3x + 16 \end{cases}$$

$$23. \begin{cases} y = -8x + 19 \\ -x + 6y = 16 \end{cases}$$

$$2. \begin{cases} y = 6x + 4 \\ y = -3x - 5 \end{cases}$$

$$13. \begin{cases} 6x - 4y = -8 \\ y = -6x + 2 \end{cases}$$

$$24. \begin{cases} x - 5y = 7 \\ 2x + 7y = -20 \end{cases}$$

$$3. \begin{cases} y = 2x - 3 \\ y = -2x + 9 \end{cases}$$

$$14. \begin{cases} y = x + 4 \\ 3x - 4y = -19 \end{cases}$$

$$25. \begin{cases} -6x + y = 20 \\ -3x - 3y = -18 \end{cases}$$

$$4. \begin{cases} y = -6 \\ 3x - 6y = 30 \end{cases}$$

$$15. \begin{cases} x - 2y = -13 \\ 4x + 2y = 18 \end{cases}$$

$$26. \begin{cases} 2x + y = 2 \\ 3x + 7y = 14 \end{cases}$$

$$5. \begin{cases} -2x + 2y = 18 \\ y = 7x + 15 \end{cases}$$

$$16. \begin{cases} 6x + 4y = 16 \\ -2x + y = -3 \end{cases}$$

$$27. \begin{cases} -2x + 4y = -16 \\ y = -2 \end{cases}$$

$$6. \begin{cases} 7x - 2y = -7 \\ y = 7 \end{cases}$$

$$17. \begin{cases} -5x - 5y = -20 \\ -2x + y = 7 \end{cases}$$

$$28. \begin{cases} y = -6x + 3 \\ y = 6x + 3 \end{cases}$$

$$7. \begin{cases} -2x - y = -5 \\ x - 8y = -23 \end{cases}$$

$$18. \begin{cases} 2x + 3y = -10 \\ 7x + y = 3 \end{cases}$$

$$29. \begin{cases} y = -2x - 9 \\ y = -5x - 21 \end{cases}$$

$$8. \begin{cases} 3x + y = 9 \\ 2x + 8y = -16 \end{cases}$$

$$19. \begin{cases} y = -2x - 9 \\ y = 2x - 1 \end{cases}$$

$$30. \begin{cases} -x + 3y = 12 \\ y = 6x + 21 \end{cases}$$

$$9. \begin{cases} x + 5y = 15 \\ -3x + 2y = 6 \end{cases}$$

$$20. \begin{cases} y = 3x + 2 \\ y = -3x + 8 \end{cases}$$

$$31. \begin{cases} 7x + 2y = -7 \\ y = 5x + 5 \end{cases}$$

$$10. \begin{cases} y = x + 5 \\ y = -2x - 4 \end{cases}$$

$$21. \begin{cases} y = 6x - 6 \\ -3x - 3y = -24 \end{cases}$$

$$32. \begin{cases} y = -2x + 8 \\ -7x - 6y = -8 \end{cases}$$

$$11. \begin{cases} y = 3x + 13 \\ y = -2x - 22 \end{cases}$$

$$22. \begin{cases} y = -5 \\ 3x + 4y = -17 \end{cases}$$

$$33. \begin{cases} 3x - 4y = 15 \\ 7x + y = 4 \end{cases}$$

$$34. \begin{cases} 7x + 5y = -13 \\ x - 4y = -16 \end{cases}$$

$$35. \begin{cases} 2x + y = -7 \\ 5x + 3y = -21 \end{cases}$$

$$36. \begin{cases} -2x + 2y = -22 \\ -5x - 7y = -19 \end{cases}$$

