

7.2

Solve Linear Systems by Substitution

Goal • Solve systems of linear equations by substitution.

Your Notes

SOLVING A LINEAR SYSTEM USING THE SUBSTITUTION METHOD

- Step 1** Solve one of the equations for one of its variables. When possible, solve for a variable that has a coefficient of 1 or -1.
- Step 2** Substitute the expression from Step 1 into the other equation and solve for the other variable.
- Step 3** Substitute the value from Step 2 into the revised equation from Step 1 and solve.

Example 1 Use the substitution method

Solve the linear system: $x = -2y + 2$ Equation 1

$3x + y = 16$ Equation 2

- Solve for x . Equation 1 is already solved for x .
- Substitute $-2y + 2$ for x in Equation 2 and solve for y .

$$3x + y = 16$$

Write Equation 2.

$$3(-2y + 2) + y = 16$$

Substitute $-2y + 2$ for x .

$$\underline{-6y + 6} + y = 16$$

Distributive property

$$\underline{-5y + 6} = 16$$

Simplify.

$$\underline{-5y} = \underline{-10}$$

Subtract 6 from each side.

$$y = \underline{-2}$$

Divide each side by -5.

- Substitute -2 for y in the original Equation 1 to find the value of x .

$$x = -2y + 2 = -2(\underline{-2}) + 2 = 4 + 2 = \underline{6}$$

The solution is (6, -2).

Remember to check your solution in each of the original equations.

Your Notes

Example 2 Use the substitution method

$$\text{Solve the linear system: } 4x - 2y = 14 \quad \text{Equation 1}$$

$$2x + y = -3 \quad \text{Equation 2}$$

Solution

1. Solve Equation 2 for y .

$$2x + y = -3$$

Write original Equation 2.

$$y = \underline{-2x - 3}$$

Revised Equation 2

2. Substitute $\underline{-2x - 3}$ for y in Equation 1 and solve for x .

$$4x - 2y = 14$$

Write Equation 1.

$$4x - 2(\underline{-2x - 3}) = 14$$

Substitute $\underline{-2x - 3}$ for y .

$$4x + \underline{4x + 6} = 14$$

Distributive property

$$\underline{8x + 6} = 14$$

Simplify.

$$\underline{8x} = \underline{8}$$

Subtract $\underline{6}$ from each side.

$$x = \underline{1}$$

Divide each side by $\underline{8}$.

3. Substitute $\underline{1}$ for x in the revised Equation 2 to find the value of y .

$$y = \underline{-2x - 3} = \underline{-2(1) - 3} = \underline{-2 - 3} = \underline{-5}$$

The solution is $(\underline{1}, \underline{-5})$.

- ✓ **Checkpoint** Solve the linear system using the substitution method.

1. $5x - 4y = -1$

$$y = 6x + 5$$

$$(-1, -1)$$

2. $x + y = 5$

$$7x - 9y = 3$$

$$(3, 2)$$

Homework