

Section 5.2 Notes:

Solving Systems of Linear Equations by Using Substitution

Key Concept:

Solving a System of Linear Equations by Using Substitution

- Step 1: Solve one of the equations for one of the variables.
- 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 one of the original equations and solve.
- Step 4: Write the ordered pair based off the x and y-values you found in Steps 2 and 3.
- Step 5: Check your solution in both equations.

Example 1)

$$\begin{aligned}
 y &= 2x - 5 \\
 y &= -4x + 13 \\
 2x - 5 &= -4x + 13 \\
 +4x & \quad +4x \\
 6x - 5 &= 13 \\
 +5 & \quad +5 \\
 6x &= 18 \\
 \frac{6x}{6} &= \frac{18}{6} \\
 x &= 3
 \end{aligned}$$

$$\begin{aligned}
 y &= 2x - 5 \\
 y &= 2(3) - 5 \\
 y &= 6 - 5 \\
 y &= 1
 \end{aligned}$$

Check (3, 1)

$$\begin{array}{ll}
 y = 2x - 5 & y = -4x + 13 \\
 1 = 2(3) - 5 & 1 = -4(3) + 13 \\
 1 = 6 - 5 & 1 = -12 + 13 \\
 1 = 1 \checkmark & 1 = 1 \checkmark
 \end{array}$$

Solution: $(3, 1)$
 (x, y)

Example 2)

$$\begin{aligned}
 y &= 6x - 1 \\
 y &= 2x - 5 \\
 6x - 1 &= 2x - 5 \\
 -2x & \quad -2x \\
 4x - 1 &= -5 \\
 +1 & \quad +1 \\
 4x &= -4 \\
 \frac{4x}{4} &= \frac{-4}{4} \\
 x &= -1
 \end{aligned}$$

$$\begin{aligned}
 y &= 6x - 1 \\
 y &= 6(-1) - 1 \\
 y &= -6 - 1 \\
 y &= -7
 \end{aligned}$$

Check (-1, -7)

$$\begin{array}{ll}
 y = 6x - 1 & y = 2x - 5 \\
 -7 = 6(-1) - 1 & -7 = 2(-1) - 5 \\
 -7 = -6 - 1 & -7 = -2 - 5 \\
 -7 = -7 \checkmark & -7 = -7 \checkmark
 \end{array}$$

Solution: $(-1, -7)$
 (x, y)

Example 3)

$$9x - 4y = 6$$

$$x = 2y + 8$$

$$9(-2y + 8) - 4y = 6$$

$$-18y + 72 - 4y = 6$$

$$-22y + 72 = 6$$

$$\frac{-22y}{-22} = \frac{-66}{-22}$$

$$y = 3$$

$$x = -2y + 8$$

$$x = -2(3) + 8$$

$$x = -6 + 8$$

$$x = 2$$

Check (2, 3)

$$9x - 4y = 6$$

$$9(2) - 4(3) = 6$$

$$18 - 12 = 6$$

$$6 = 6 \checkmark$$

$$x = -2y + 8$$

$$2 = -2(3) + 8$$

$$2 = -6 + 8$$

$$2 = 2 \checkmark$$

Solution: (2, 3)
(x, y)

Example 4)

$$3x + y = 14 \rightarrow \text{solve for } y \quad 3x + y = 14$$

$$-2x + 3y = -13$$

$$y = 14 - 3x$$

$$-2x + 3(14 - 3x) = -13$$

$$-2x + 42 - 9x = -13$$

$$-11x + 42 = -13$$

$$\frac{-11x}{-11} = \frac{-55}{-11}$$

$$x = 5$$

$$y = 14 - 3x$$

$$y = 14 - 3(5)$$

$$y = 14 - 15$$

$$y = -1$$

Check (5, -1)

$$3x + y = 14 \quad -2x + 3y = -13$$

$$3(5) + (-1) = 14 \quad -2(5) + 3(-1) = -13$$

$$15 - 1 = 14$$

$$-10 - 3 = -13$$

$$14 = 14 \checkmark$$

$$-13 = -13 \checkmark$$

Solution: (5, -1)
(x, y)