# Lesson 7.1: Solving Systems of Equations

**Substitution Method:**

1. Take one of the two equations and solve for either x or y (pick the easier one to solve for)

2. Substitute into the other equation

3. Solve for the variable

4. Plug the answer in to any equation to find the other variable.

**Substitution Method**

$$\begin{cases} 3x - 6y = 3 \\ 2x + y = 12 \end{cases}$$

$-2x \qquad\qquad -2x$

① $y = \boxed{-2x + 12}$

② $3x - 6(-2x + 12) = 3$

③ $3x + 12x - 72 = 3$

$15x - 72 = 3$

$+72 \qquad +72$

$\dfrac{15x}{15} = \dfrac{75}{15}$

$X = 5$

④ $y = -2(5) + 12$

$y = 2$

Answer:

$$\boxed{\begin{array}{cc} (5 & , & 2) \\ x & & y \end{array}}$$

**Substitution Method**

4
$$\begin{cases} 2x + \underline{\phantom{y}}y = 1 \\ 4x + 2y = 3 \end{cases}$$

$-2x \qquad -2x$

① $y = \boxed{-2x + 1}$

② $4x + 2(-2x + 1) = 3$

③ $4x - 4x + 2 = 3$

$$2 \neq 3$$

↓ False

No Solution

✱ No Variables
with a
true
Statement

infinitely
many
Solutions.

**Elimination Method:**

1. Multiply one or both equations so that the coefficients match (it's easiest if one of the coefficents is negative)

2. Add the equations

3. Solve for the remaining variable

4. Plug the answer in to any equation to find the other variable.

**Elimination Method**

7 $\begin{cases} 3x + 3y = -1 \\ -3\left(4x + y = \frac{8}{3}\right) \end{cases}$ ①

① $3x + 3y = -1$

② $-12x - 3y = -8$

+

③ $\dfrac{-9x}{-9} = \dfrac{-9}{-9}$

$x = 1$

④ $3(1) + 3y = -1$

$3 + 3y = -1$
$-3 \qquad -3$

$\dfrac{3y}{3} = \dfrac{-4}{3}$

$y = -4/3$

$\boxed{(1, -4/3)}$

**Elimination Method**

15
$$\begin{cases} 4x + 9y = 5 \\ 2x + 6y = 3 \end{cases}$$
-2

$$4x + 9y = 5$$
$$-4x - 12y = -6$$
$$\overline{\phantom{-4x}}$$
$$\frac{-3y}{-3} = \frac{-1}{-3}$$
$$y = \frac{1}{3}$$

$$4x + 9\left(\frac{1}{3}\right) = 5$$

$$4x + 3 = 5$$
$$\phantom{4x} -3 \quad -3$$

$$\frac{4x}{4} = \frac{2}{4}$$

$$x = \frac{1}{2}$$

$$\left(\frac{1}{2}, \frac{1}{3}\right)$$