

6.2 Part 1

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6.2 – Solving a system of linear equations by substitution – Part 1

The **substitution method** is an algebraic method of finding the solution to a system of equations. When using the substitution method the system of two linear equations is changed into a single equation with one variable.

Example 1 : Solve by substitution and check your answer. Write your solution as an ordered pair.

$$\begin{array}{l} \textcircled{1} \quad 3x - 2y = -3 \\ \textcircled{2} \quad 7x + y = 10 \end{array}$$

↖ 1y

$$\textcircled{2} \quad 7x + 1y = 10$$

$$y = -7x + 10$$

$$\begin{aligned} \textcircled{1} \quad 3x - 2y &= -3 \\ 3x - 2(-7x + 10) &= -3 \\ 3x + 14x - 20 &= -3 \\ \underbrace{3x + 14x} & - 20 = -3 \\ 17x - 20 &= -3 \\ +20 & \quad +20 \\ 17x &= 17 \\ \frac{17x}{17} &= \frac{17}{17} \\ x &= 1 \end{aligned}$$

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

(1, 3)

Mrs. Shaw

1. Make one equation be $x =$ or $y =$!
Look for a $1x$ or $1y$

2. Sub your $y =$ or $x =$ equation into the OTHER equation

3. Solve the equation

4. Sub your solution into either equation to find the other value

$$\begin{aligned} \textcircled{2} \quad 7x + y &= 10 \\ 7(1) + y &= 10 \\ 7 + y &= 10 \\ -7 & \quad -7 \\ y &= 3 \end{aligned}$$

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$$\begin{array}{l} \textcircled{1} \quad x + 3y = 3 \\ \textcircled{2} \quad -2x + 7y = 20 \end{array}$$

$$\begin{array}{l} \textcircled{1} \quad x + 3y = 3 \\ \quad \quad x = -3y + 3 \end{array}$$

$$\begin{array}{l} \textcircled{2} \quad -2x + 7y = 20 \\ \quad -2(-3y + 3) + 7y = 20 \\ \quad \quad 6y - 6 + 7y = 20 \\ \quad \quad \quad 13y - 6 = 20 \\ \quad \quad \quad \quad +6 \quad +6 \\ \quad \quad \quad 13y = 26 \\ \quad \quad \quad \quad \underline{13} \quad \underline{13} \end{array}$$

$$\begin{array}{l} \textcircled{1} \quad x + 3y = 3 \\ \quad \quad x + 3(2) = 3 \\ \quad \quad x + 6 = 3 \\ \quad \quad \quad -6 \quad -6 \\ \quad \quad x = -3 \end{array}$$

$$(-3, 2)$$

$$y = 2$$

$$\textcircled{1} \quad \frac{x}{2} + y = \frac{5}{2}$$

$$\textcircled{2} \quad \frac{1}{3}x - \frac{1}{3}y = -\frac{1}{3}$$

Clear The Fractions First
Multiply equation ① by 2

$$\textcircled{1} \quad 2\left(\frac{x}{2}\right) + 2(y) = 2\left(\frac{5}{2}\right)$$

$$\textcircled{1} \quad x + 2y = 5$$

Multiply equation ② by 3

$$\textcircled{2} \quad 3\left(\frac{1}{3}x\right) - 3\left(\frac{1}{3}y\right) = 3\left(-\frac{1}{3}\right)$$

$$\textcircled{2} \quad x - y = -1$$

$$\textcircled{2} \quad x = y - 1$$

$$\begin{array}{l} \textcircled{1} \quad x + 2y = 5 \\ \quad \quad (y-1) + 2y = 5 \\ \quad \quad \quad y - 1 + 2y = 5 \end{array}$$

$$\quad \quad \quad \quad 3y - 1 = 5$$

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$$\quad \quad \quad \quad \quad \quad \frac{3y}{3} = \frac{6}{3}$$

$$\quad \quad \quad \quad \quad \quad \quad y = 2$$

$$\begin{array}{l} x = 2 - 1 \\ x = 1 \end{array} \quad (1, 2)$$