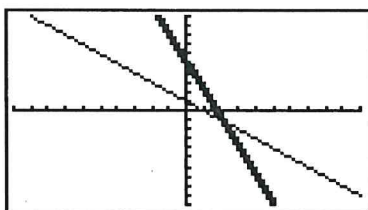


## SOLVING LINEAR SYSTEMS USING SUBSTITUTION

The substitution method is another way to solve a linear system using ALGEBRA!  
The method requires you to write both equations in the slope  $y$ -intercept form.

$$y = mx + b$$

**Recall:** Solving a linear system means finding the POINT OF INTERSECTION.



**To find the POINT OF INTERSECTION  $(x, y)$ :**

**FIRST find the  $x$  component (STEP 1)**

**THEN find the  $y$  component (STEP 2)**

**METHOD FOR STEP 1 – finding the  $x$  component of the POI  $(x, y)$**

\*1\* Make sure both equations are in  $y = mx + b$  form; if not, rearrange them into this form.

\*2\* Both equations equal  $y$ , so they are equal to each other!  
So....set the right side of each equation equal to each other!!!.

\*3\* Solve for  $x$ .

**EXAMPLES:** Solve for  $x$  for the following linear systems:

$$\begin{aligned} y &= 2x + 7 \\ y &= -x - 11 \end{aligned}$$

$$2x + 7 = -x - 11$$

$$2x + x = -11 - 7$$

$$\frac{3x}{3} = \frac{-18}{3}$$

$$\boxed{x = -6}$$

$$x + y = -2 \rightarrow y = -x - 2$$

$$x - y = 6$$

$$\frac{-y}{-1} = \frac{-x+6}{-1} \quad \frac{-1}{-1}$$

$$\boxed{y = x - 6}$$

$$-x - 2 = x - 6$$

$$-x - x = -6 + 2$$

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

$$\boxed{x = 2}$$

$$6x + 2y = 12$$

$$4x - y = 5$$

$$\frac{-y}{-1} = \frac{-4x+5}{-1} \quad \frac{-1}{-1}$$

$$\boxed{y = 4x - 5}$$

$$\frac{2y}{2} = \frac{-6x+12}{2} \quad \frac{2}{2}$$

$$\boxed{y = -3x + 6}$$

$$4x - 5 = -3x + 6$$

$$4x + 3x = 6 + 5$$

$$\frac{7x}{7} = \frac{11}{7}$$

$$\boxed{x = \frac{11}{7}}$$

**METHOD FOR STEP 2 – finding the  $y$  component of the POI  $(x, y)$** 

\*1\* Use the equation of the line in the  $y = mx + b$  form

\*2\* Substitute the value of  $x$  (from STEP 1) into that equation

\*3\* Solve for  $y$

**EXAMPLES** - Solve the following equations by substituting in for the  $x$  value

a)  $y = x + 5$  when  $x = 2$

$$y = (2) + 5$$
$$\boxed{y = 7}$$

$$\therefore (2, 7)$$

b)  $y = 6x - 3$  when  $x = -5$

$$y = 6(-5) - 3$$
$$y = -30 - 3$$
$$\boxed{y = -33}$$

$$\therefore (-5, -33)$$

c)  $y = 3x + 8$  when  $x = 7$

$$y = 3(7) + 8$$
$$y = 21 + 8$$
$$\boxed{y = 29}$$

$$\therefore (7, 29)$$

d)  $y = -9x - 25$  when  $x = -4$

$$y = -9(-4) - 25$$
$$y = 36 - 25$$
$$\boxed{y = 11}$$

$$\therefore (-4, 11)$$