Chapter 7 Linear Systems and Matrices
Sec. 1 Solving Systems of Equations

- When you have two or more equations with two or more variables, this is called a **system of equations**.

- The **solution** to a system is an ordered pair that satisfies each equation of the system

<u>Example</u>

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

Check to see that the solution is $(2,1)$

$x \quad y$

$2(2) + 1 = 5 \quad \checkmark$
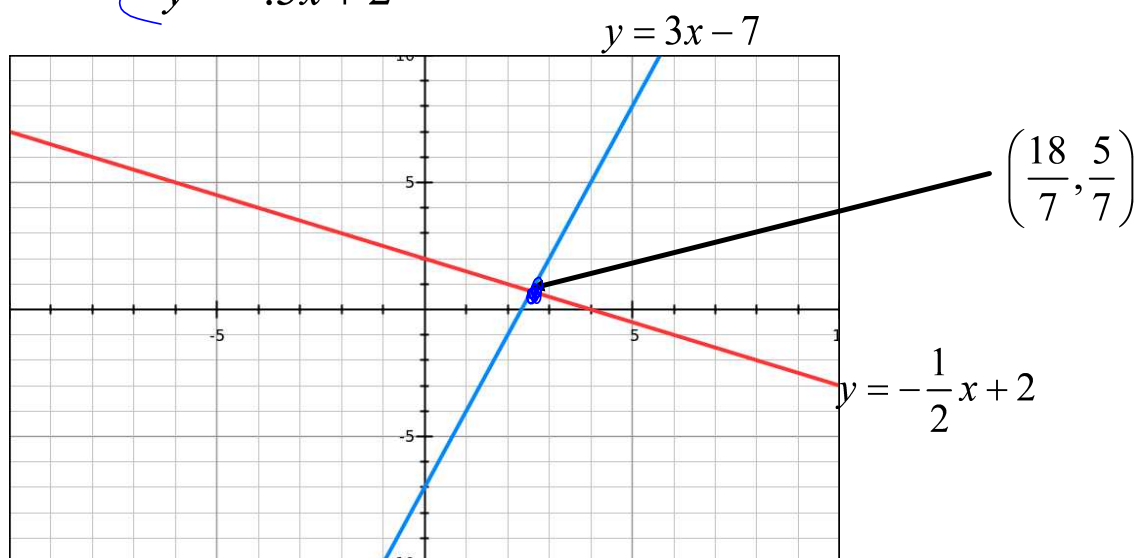
$3(2) - 2(1) = 4 \quad \checkmark$

Methods of Solving Systems

1) <u>Graphing</u> - Graph each equation and look for the intersection(s) of the two graphs.
- you can use the "Intersection" feature on the calculator if you have one

Example

$$\begin{cases} y = 3x - 7 \\ y = -.5x + 2 \end{cases}$$

$y = 3x - 7$

$\left(\dfrac{18}{7}, \dfrac{5}{7} \right)$

$y = -\dfrac{1}{2}x + 2$

2) <u>Substitution</u> - *main idea* plug one equation into the other to get one equation with one variable.

<u>Steps</u>
- solve one equation for one variable
- substitute that equation into the other
- solve for the remaining variable
- plug that answer in to the equation from the first
step to solve for the other variable.

<u>Example</u>　Solve the system using substitution method.

$$\begin{cases} 2x - y + 2 = 0 \\ 4x + y - 5 = 0 \end{cases}$$

$$2x + 2 = y$$

$$4x + 2x + 2 - 5 = 0$$

$$6x - 3 = 0$$

$$6x = 3$$

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

$$y = 2\left(\tfrac{1}{2}\right) + 2$$

$$y = 3$$

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

Example   Solve the system using substitution method.

$$\begin{cases} x^2 + y^2 = 4 \\ 2x^2 - y = 2 \end{cases}$$

$$2x^2 - 2 = y$$

$$\Rightarrow x^2 = 4 - y^2$$

or $2(4 - y^2) - y = 2$

$$8 - 2y^2 - y = 2$$

$$0 =$$

$$x^2 + (2x^2 - 2)^2 = 4$$

$$x^2 + 4x^4 - 8x^2 + 4 = 4$$

$$4x^4 - 7x^2 + 4 = 4$$
$$ -4 \;\; -4$$

$$4x^4 - 7x^2 = 0$$

$$x^2(4x^2 - 7) = 0$$

$$y = 2x^2 - 2$$

$$y = 2(0^2) - 2 = -2$$

$$\boxed{(0, -2)}$$

$$x^2 = 0 \qquad\qquad 4x^2 - 7 = 0$$

$$4x^2 = 7$$

$$x = 0$$

$$x^2 = \frac{7}{4}$$

$$y = 2\left(\sqrt{\tfrac{7}{4}}\right)^2 - 2$$

$$y = 2\left(\frac{7}{4}\right) - 2 \quad \frac{3}{2}$$
$$\frac{7}{2} - \frac{4}{2} = \frac{3}{2}$$

$$\boxed{\left(\sqrt{\tfrac{7}{4}} , \; \tfrac{3}{2}\right)}$$

$$x = \pm\sqrt{\frac{7}{4}}$$

$$y = 2\left(-\sqrt{\tfrac{7}{4}}\right)^2 - 2$$

$$y = \frac{3}{2}$$

$$\boxed{\left(-\sqrt{\tfrac{7}{4}} , \; \tfrac{3}{2}\right)}$$