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### 3.1. Advanced Algebra

## Solving Systems of Equations by Graphing

DATE: 10/23

Target 3B. Solve a system of equations graphically and algebraically.



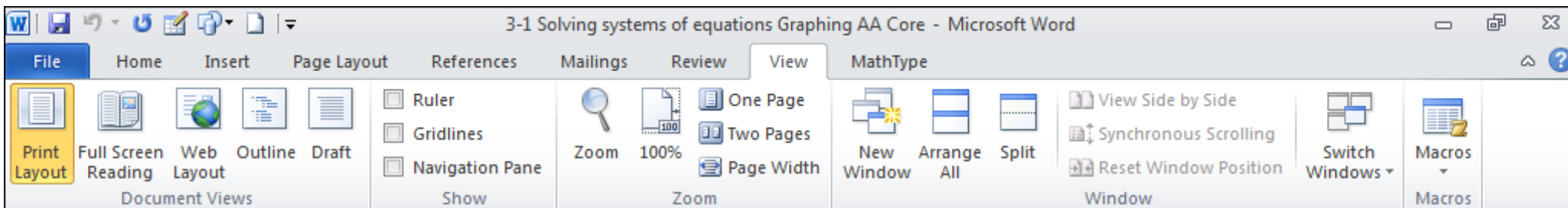
**System of Equations:** two or more equations with the same variables. To solve a system of equations, find the ordered pair,  $(x, y)$ , that satisfies all the equations.

#### **Solve by Graphing**

Make sure each equation is solved for  $y$ . In other words, each equation must be rewritten in slope-intercept form:  $y = mx + b$ . Recall that  $m$ , the number in front of  $x$ , represents the slope  $\left(\frac{\text{Rise}}{\text{Run}}\right)$  and  $b$  represents the  $y$ -intercept.

#### **Systems of Equations—Types of Solutions:**

Type of Lines	Intersecting Lines	Same Line	Parallel Lines
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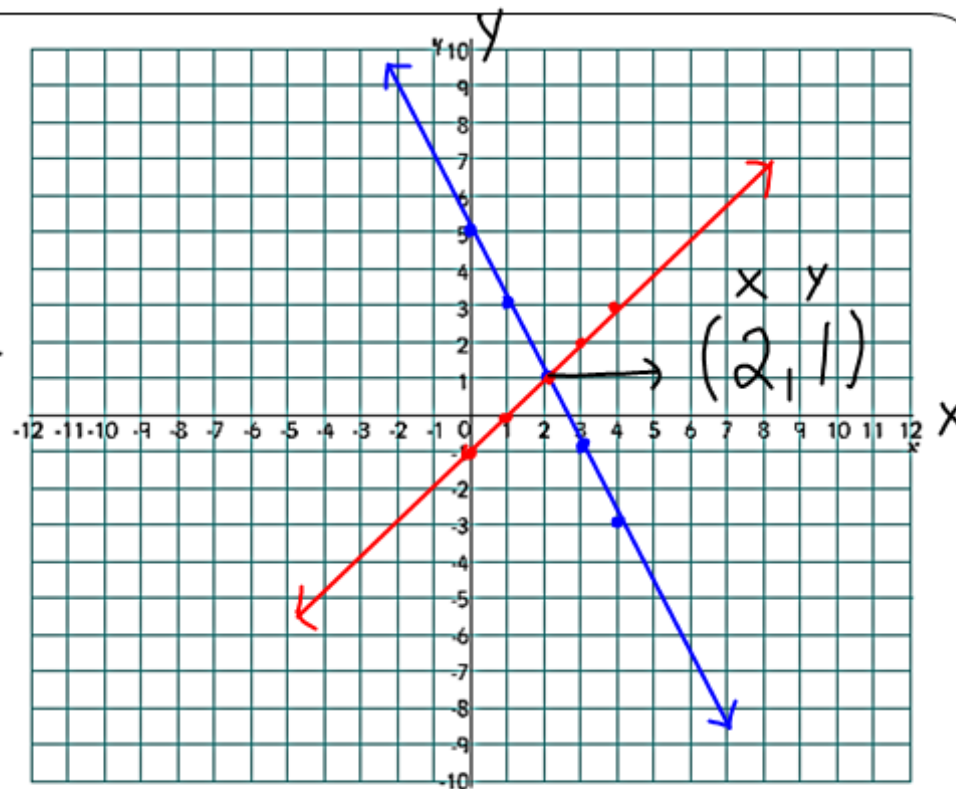


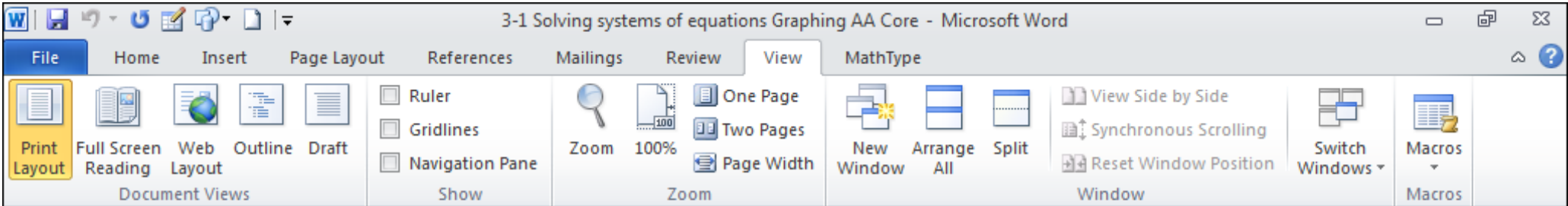
Graph each system of equations and determine its solution. Check your graph using the Nspire.

1.  $y = -2x + 5$     Slope:  $-\frac{2}{1}$     y-int: 5  
 $y = x - 1$         Slope:  $\frac{1}{1}$         y-int: -1

The solution to the system of equations is the intersection point,  $(2, 1)$ , of the two lines.

Notice: Both equations are already in slope intercept form.





Notice the equations must be solved for y.

$$\begin{aligned} 2. \quad & x + \frac{1}{2}y = 5 \\ & \underline{3y - 2x = 6} \end{aligned}$$

∴ Solution is (3, 4).

$$x + \frac{1}{2}y = 5 \quad (\text{Mult. eq. by } 2)$$

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

$$2x + y = 10$$

$$\begin{array}{r} 2x + y = 10 \\ -2x \quad -2x \\ \hline \end{array}$$

$$y = -2x + 10$$

$$\text{Slope: } -\frac{2}{1} \downarrow$$

$$y\text{-int: } 10$$

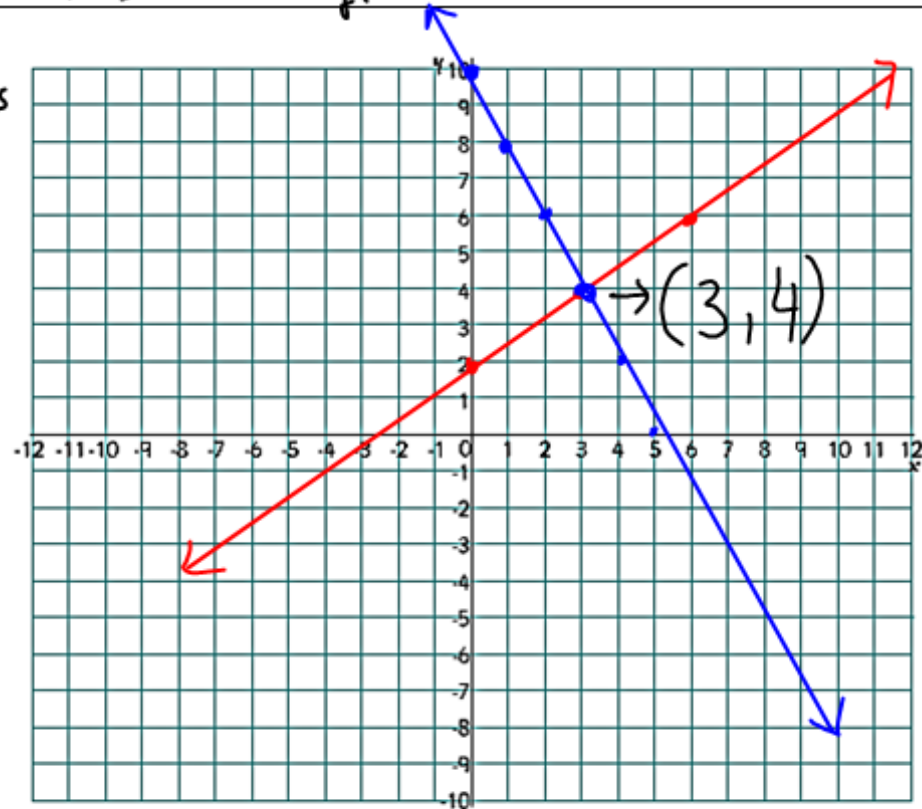
$$\begin{array}{r} 3y - 2x = 6 \\ +2x \quad +2x \\ \hline \end{array}$$

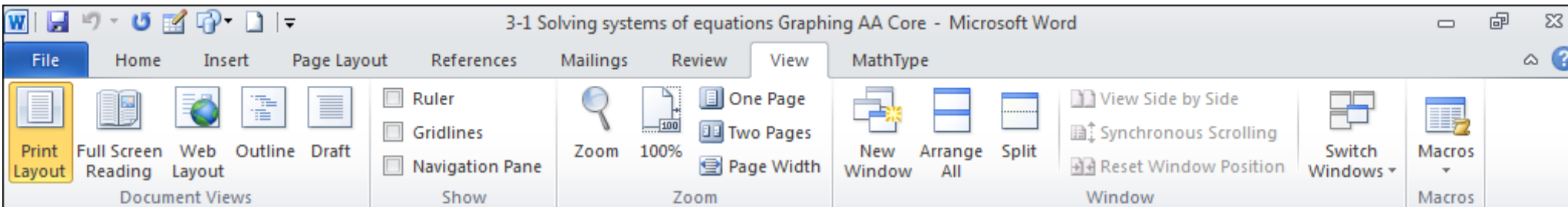
$$\frac{3y}{3} = \frac{2x+6}{3}$$

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

$$\text{Slope: } \frac{2}{3} \uparrow$$

$$y\text{-int: } 2$$





3.  $9x - 6y = 24$   
 $6x - 4y = 16$

We have a line on top of a line. This means each point on line is a solution

$$\begin{array}{r} 9x - 6y = 24 \\ -9x \quad -9x \\ \hline -6y = -9x + 24 \\ \frac{-6}{-6} \quad \frac{-9}{-6} \quad \frac{24}{-6} \end{array}$$

$$\begin{array}{r} 6x - 4y = 16 \\ -6x \quad -6x \\ \hline -4y = -6x + 16 \\ \frac{-4}{-4} \quad \frac{-6}{-4} \quad \frac{16}{-4} \end{array}$$

$y = \frac{3}{2}x - 4$

$\frac{6 \div 2}{4 \div 2} = \frac{3}{2}$

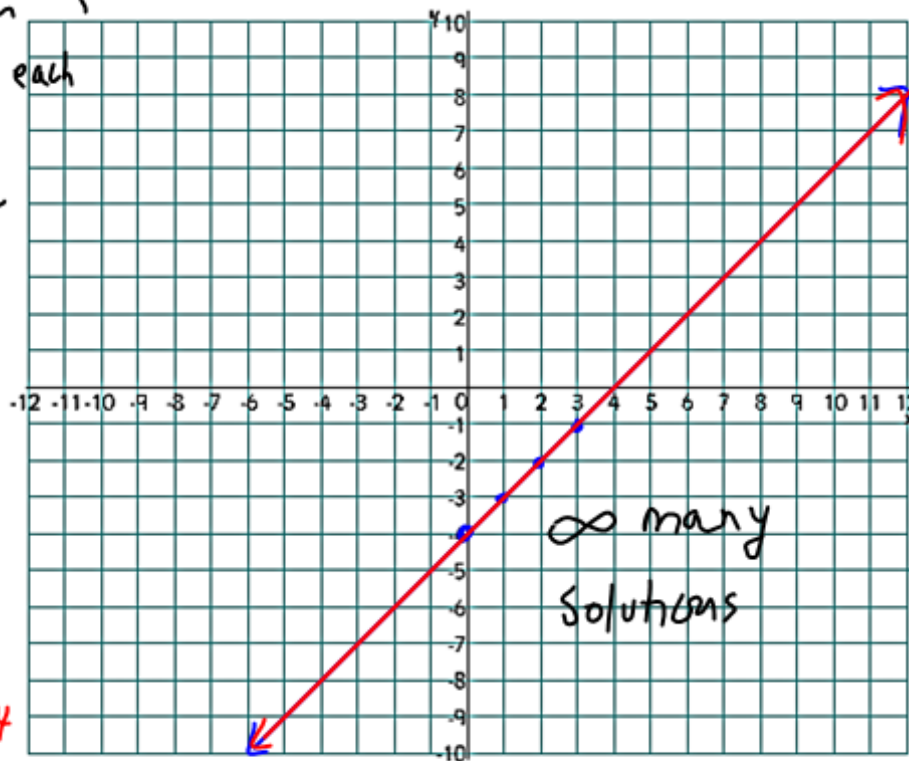
$y = \frac{3}{2}x - 4$

$y = \frac{3}{2}x - 4$

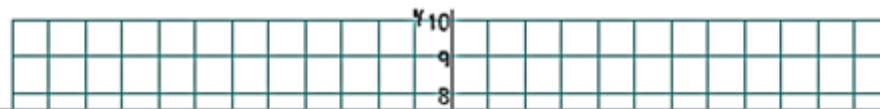
Slope:  $\frac{3}{2}$   $\rightarrow$  y-int:  $-4$

Slope:  $\frac{3}{2}$   $\rightarrow$  y-int:  $-4$

Equations are same



4.  $3x + 4y = 12$   
 $6x + 8y = -16$



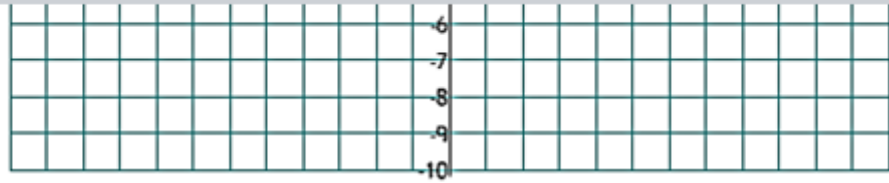
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4.  $3x + 4y = 12$   
 $6x + 8y = -16$

$\frac{-6 \div 2}{8 \div 2} = \frac{-3}{4}$

$$\begin{array}{r} 3x + 4y = 12 \\ -3x \quad -3x \\ \hline 4y = \frac{-3x + 12}{4} \end{array}$$

$$\begin{array}{r} 6x + 8y = -16 \\ -6x \quad -6x \\ \hline 8y = \frac{-6x - 16}{8} \end{array}$$

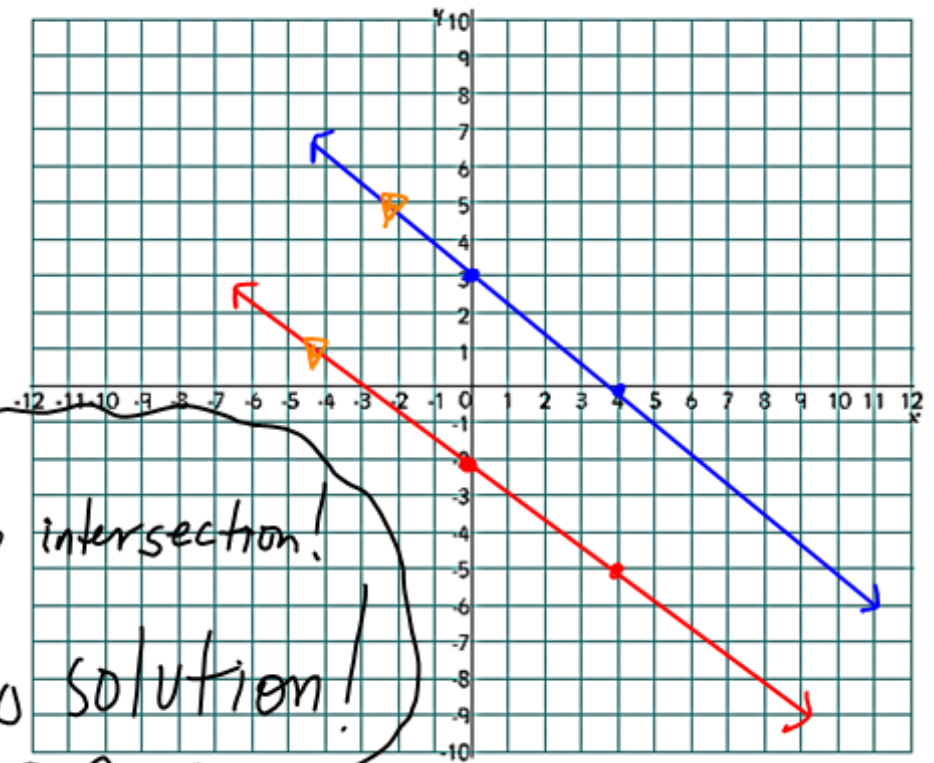
$y = \frac{-3}{4}x + 3$

$y = \frac{-6}{8}x - 2$

Slope:  $\frac{-3}{4}$   
 y-int: 3

$y = \frac{-3}{4}x - 2$   
 Slope:  $\frac{-3}{4}$   
 y-int: -2

No intersection!  
 No solution!



Equal slopes  $\Rightarrow$  || lines.

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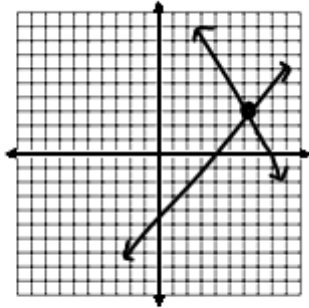
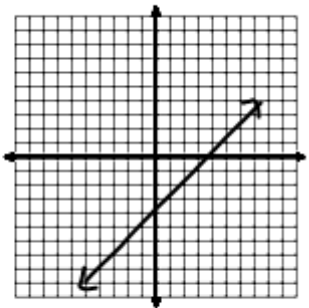
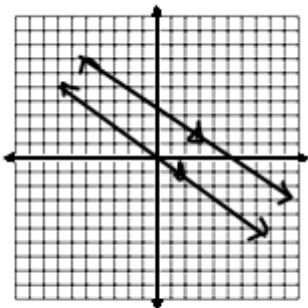
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slope-intercept form:  $y = mx + b$ . Recall that  $m$ , the number in front of  $x$ , represents the slope  $\left(\frac{\text{Rise}}{\text{Run}}\right)$  and  $b$  represents the  $y$ -intercept.

**Systems of Equations—Types of Solutions:**

*Summary Chart*

Type of Lines	Intersecting Lines (consistent & independent)	Same Line (consistent & dependent)	Parallel Lines (inconsistent)
Graph			
Number of Solution(s)	<u>1 solution</u>	<u>Infinite number of solutions</u>	<u>No solution</u>

Graph each system of equations and determine its solution. Check your graph using the Nspire.

1.  $x = 2y + 5$



Page: 1 of 2 Words: 143 125%