Name: KEY   Date: ____________

SOLUTIONS TO LINEAR SYSTEMS AND SOLVING BY GRAPHING

Systems of equations (and inequalities) are essential to modeling situations with **multiple variables and multiple relationships between the variables.** At the end of the day, though, the solution set of a system of equations can be easily defined:

SOLUTIONS TO A SYSTEM OF EQUATION

1. A point (x, y) is a **solution** to a system **if it makes all equations true.**
2. The **solution** set of a system is the collection of **all** pairs (x, y) that are solutions to the system (see 1).

***Exercise* #1:** Determine if the point $(2, 5)$ is a solution to each of the systems provided. Show the work that leads to your answer for each.

(a) $y = 4x - 3$

$2x + y = 9$

$5 = 4(2) - 3$
$5 = 8 - 3$
$5 = 5$ ✓

$2(2) + 5 = 9$
$4 + 5 = 9$
$9 = 9$ ✓

(b) $y - x = 3$

$y = \frac{1}{2}x + 6$

$5 - 2 = 3$
$3 = 3$ ✓

$5 = \frac{1}{2}(2) + 6$
$5 = 1 + 6$
$5 \neq 7$

no

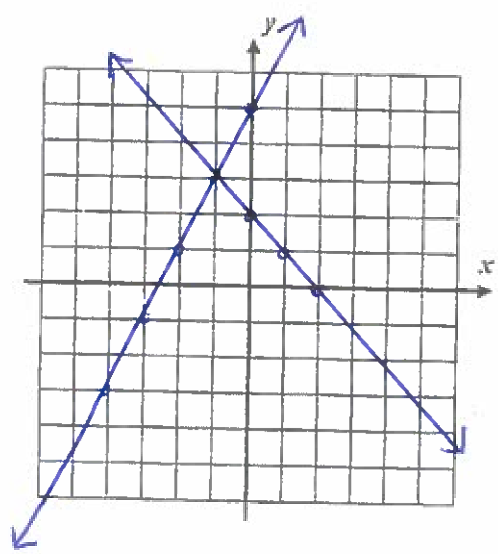
We can solve a system by using a graph. Review this process in the next exercise.

***Exercise* #2:** Consider the system of equations shown below:

$$y = 2x + 5$$

$$y = 2 - x$$

(a) Graph both equations on the grid shown. Use TABLES on your calculator to make the process faster, if necessary. Label each line with its equation.



(b) At what point do the two lines intersect?

$(-1, 3)$

(c) Show that this point is a solution to the system.

$3 = 2(-1) + 5$
$3 = -2 + 5$
$3 = 3$ ✓

$3 = 2 - (-1)$
$3 = 2 + 1$
$3 = 3$ ✓

Graphing Systems of Equations

Vocabulary:

A system of linear equations is a set of two or more linear equations in the same variables

A solution of a system of linear equations is an ordered pair that makes each equation true

Point of Intersections (POI) is the same thing as the solution of a system.

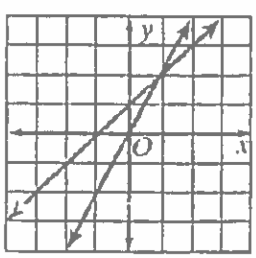
No solution means the lines are parallel (never intersect) same slope, different y-intercept

A system of equations has infinitely many solutions when lines are coinciding (same line) same slope, same y-intercept

Vocabulary and Key Concepts

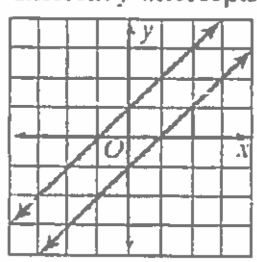
Numbers of Solutions of Systems of Linear Equations

different slopes



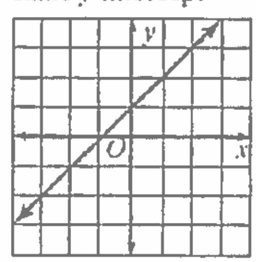
The lines intersect so there is one solution.

same slope
different y-intercepts



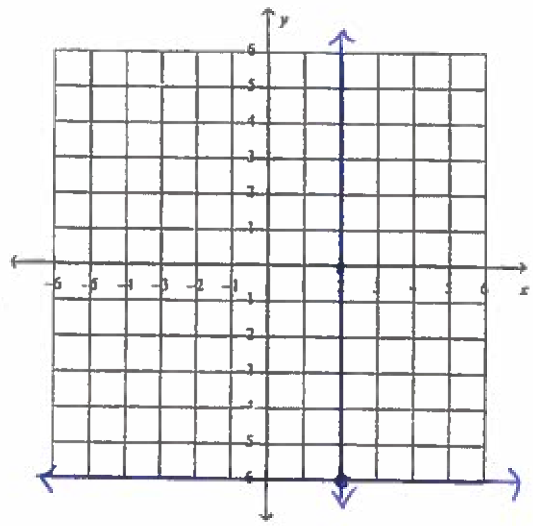
The lines are parallel so there are no solutions.

same slope
same y-intercept

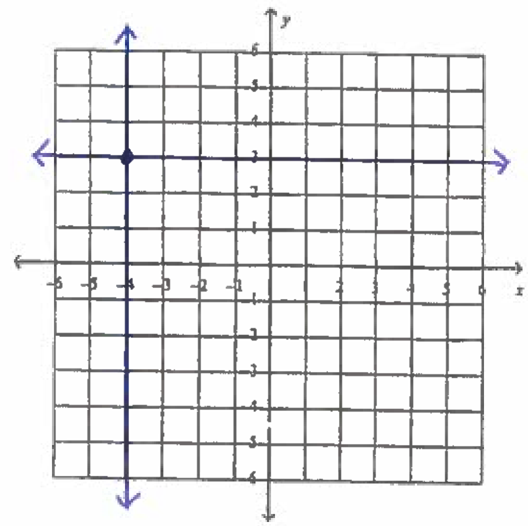


The lines are coinciding so there are infinitely many solutions.

2a.) $\begin{cases} x = 2 \\ y = -6 \end{cases}$ (2, -6)

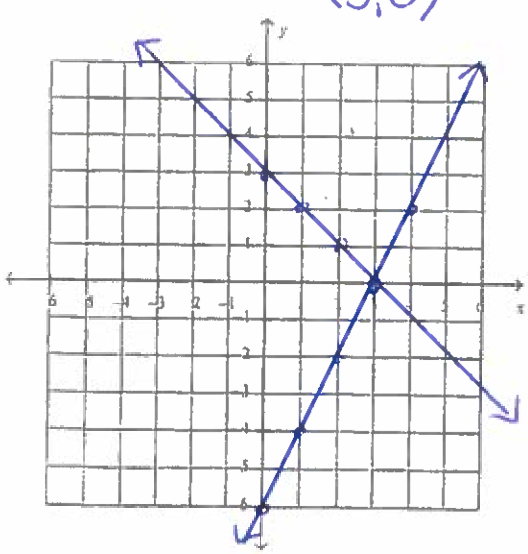


2b.) $\begin{cases} y = 3 \\ x = -4 \end{cases}$ (-4, 3)



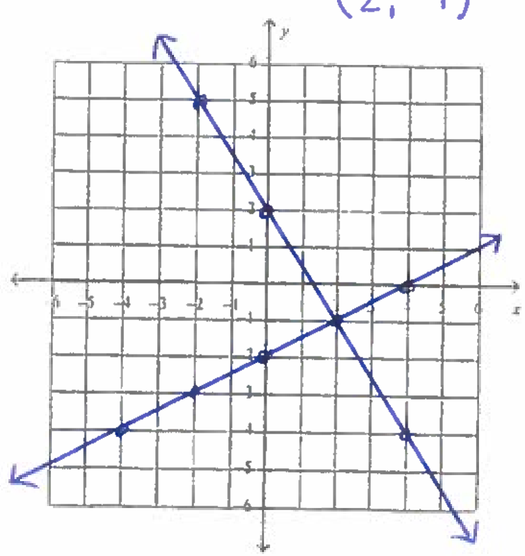
3a.) $\begin{cases} 2x - 6 = y \\ 3 - x = y \end{cases}$ $y = 2x - 6$ $y = -x + 3$

(3, 0)



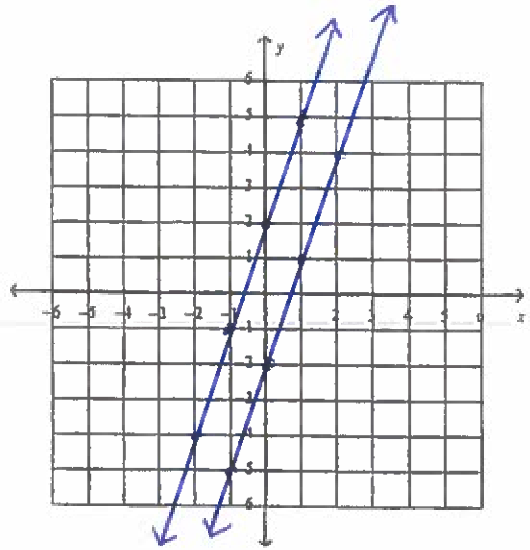
3b.) $\begin{cases} -\frac{3}{2}x + 2 = y \\ -2 + \frac{1}{2}x = y \end{cases}$ $y = -\frac{3}{2}x + 2$ $y = \frac{1}{2}x - 2$

(2, -1)



Systems with No solutions

1.) Solve by graphing: $\begin{cases} y = 3x + 2 \\ y = 3x - 2 \end{cases}$

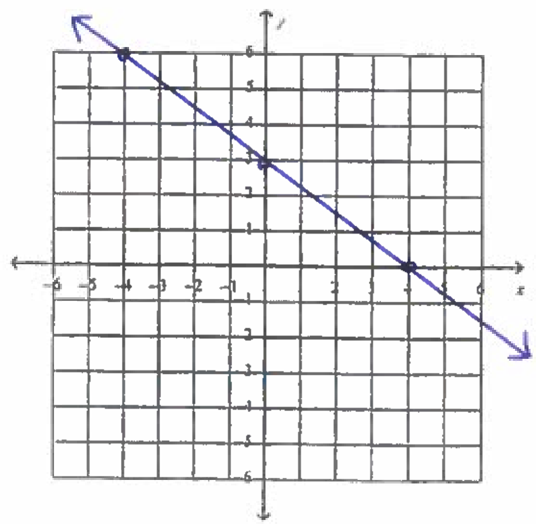


parallel lines

no solution

Systems with Infinitely Many solutions

2.) $\begin{cases} y = -\dfrac{3}{4}x + 3 \\ y = -\dfrac{3}{4}x + 3 \end{cases}$



Same line

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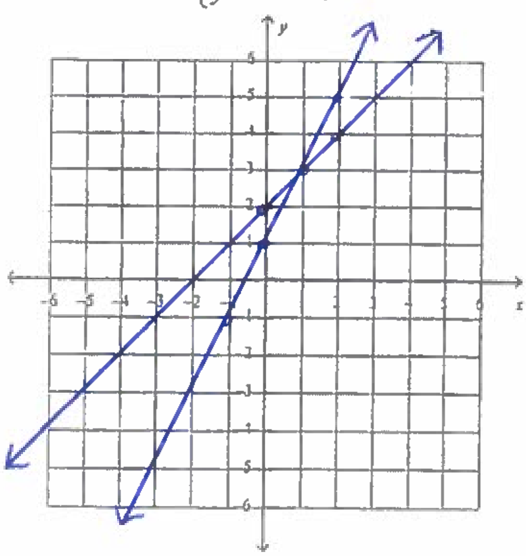
Examples:

1a.) $\begin{cases} y = x + 2 \\ y = 2x + 1 \end{cases}$ (1, 3)



1b.) $\begin{cases} y = -\dfrac{1}{2}x - 1 \\ y = x - 4 \end{cases}$ (2, -2)