**Pre-AP Algebra II**
**Notes Day #[redacted] #44**
**Solving Linear Systems of Equations and Inequalities by Graphing**

**A set of linear equations in the same two variables is called a system of linear equations, or a linear system.**
**Remember a linear equation is an equation whose graph is a line.**

**There are four methods that can be used to solve a system of linear equations: graphing, substitution, elimination, and matrix inverse.**

**The solution set for a system is the set of ordered pairs that satisfy both equations. When solving a system of equations, there are three possible types of answers: one solution (the two equations are lines that intersect at one point which is written as an ordered pair), no solution (the two equations are lines that are parallel and have no point of intersection), or infinitely many solutions (the two equations are actually the same line just written in a different form).**

| Graphs of Equations | Number of Solutions |
|---|---|
| intersecting lines | one |
| same line | infinitely many |
| parallel lines | no solution |

**Directions: Use the given ordered pair to determine if it is a solution to the system of linear equations.**

**Ex. 1:** $(2, 4)$; $\begin{cases} x - 2y = -6 \\ 2x + y = 8 \end{cases}$

(A) $x - 2y = -6$
$2 - 2(4) = -6$
$2 - 8 = -6$
$-6 = -6$ ✓

(B) $2x + y = 8$
$2(2) + 4 = 8$
$4 + 4 = 8$
$8 = 8$ ✓

(2,4) is a solution

**Ex. 2:** $(3, 2)$; $\begin{cases} 2x + 3y = 12 \\ 8x - 6y = 24 \end{cases}$

(A) $2x + 3y = 12$
$2(3) + 3(2) = 12$
$6 + 6 = 12$
$12 = 12$ ✓

(B) $8x - 6y = 24$
$8(3) - 6(2) = 24$
$24 - 12 = 24$
$12 = 24$ ✗

(3,2) is not a solution

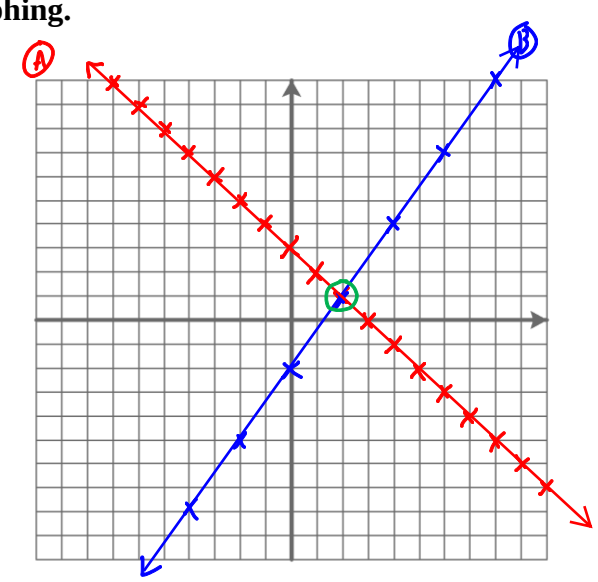
**Does the ordered pair have to work for both equations for it to be a solution?**

Yes

## SOLVING SYSTEMS OF EQUATIONS BY GRAPHING

**Directions: Solve the following systems of equations by graphing.**

**Ex. 3:** $\begin{cases} y = -x + 3 \\ y = \frac{3}{2}x - 2 \end{cases}$

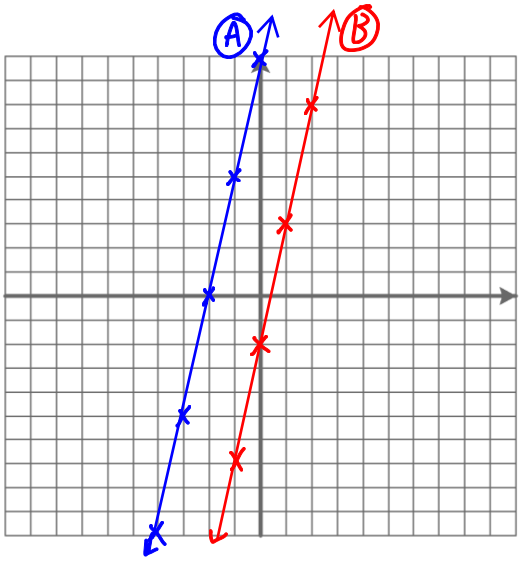



Solution: (2, 1)

**Ex. 4:** $\begin{cases} y = 5x - 2 \\ -5x + y = 10 \end{cases}$

+5x +5x

B $y = 5x + 10$




Parallel lines

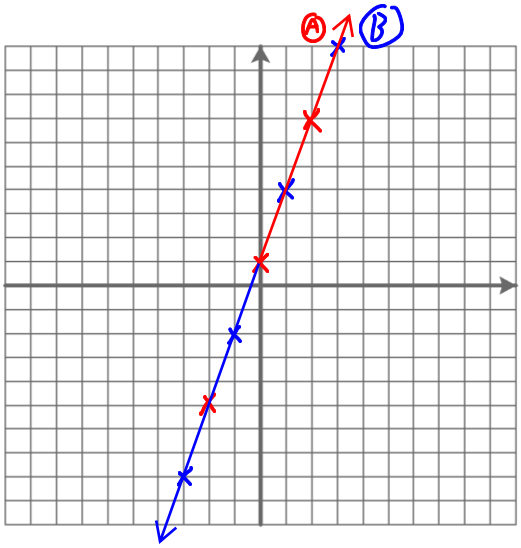
No Solution

**Ex. 5:** $\begin{cases} y = 3x + 1 \\ -6x + 2y = 2 \end{cases}$

+6x +6x

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

B $y = 3x + 1$




Same line,

Infinitely many solutions

**Directions: Solve the following system of equations by graphing.**

**Ex. 6:** $\begin{cases} y - x = 0 \\ y = -x \end{cases}$

(A) $y - x = 0$

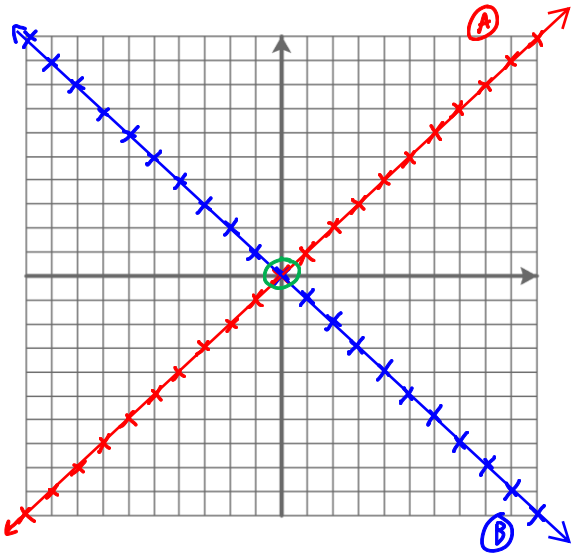
$+x \quad +x$

(A) $y = x$

Intersecting lines

Solution

$(0,0)$




**Summarize the results from the above graphs:**

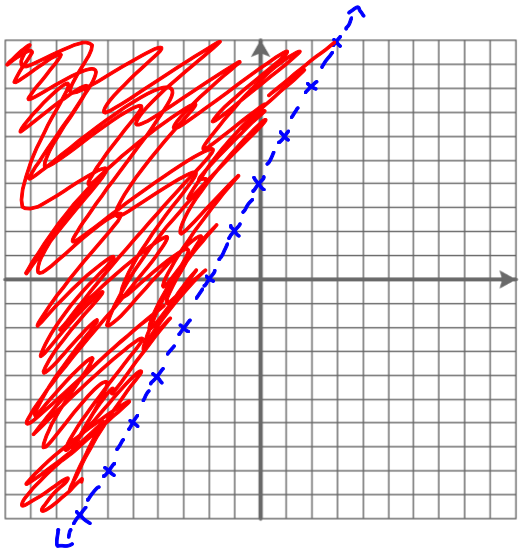
1. **A system of linear equations with two lines that have <u>different slopes</u> will have one point of intersection and <u>exactly one solution.</u>**
2. **A system of linear equations with two lines that have the <u>same slope and the same y-intercept</u> are coinciding lines and has <u>infinitely many solutions.</u>**
3. **A system of linear equations with two lines that have the <u>same slope but different y-intercepts</u> are parallel lines that do not intersect and has <u>no solution.</u>**

## GRAPHING SYSTEMS OF INEQUALITIES

**Directions: Graph the following inequality.**

**Ex. 7:** $y > 2x + 4$

dashed, shade above



**Directions: Solve each system of inequalities by graphing.**

**Ex. 8:** Ⓐ $x - 2y < 6$ Ⓑ $y \le -\frac{3}{2}x + 5$ solid, shade below

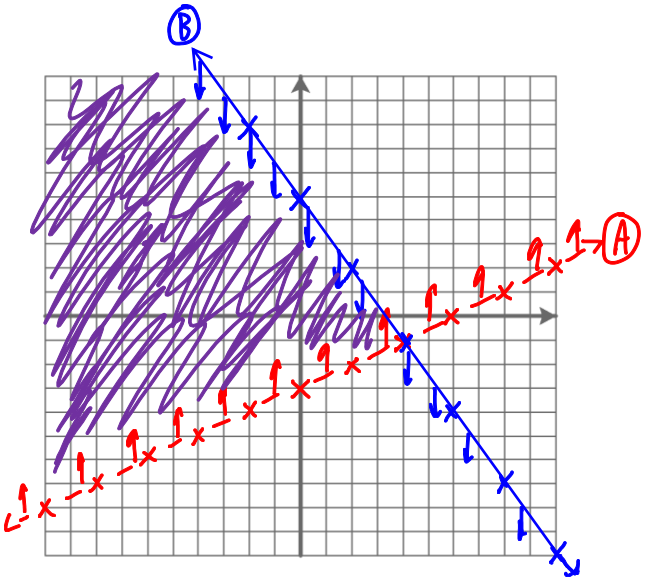
Ⓐ $x - 2y < 6$

$-x \quad -x$

$-2y < -x + 6$

$\frac{-2y}{-2} < \frac{-x+6}{-2}$

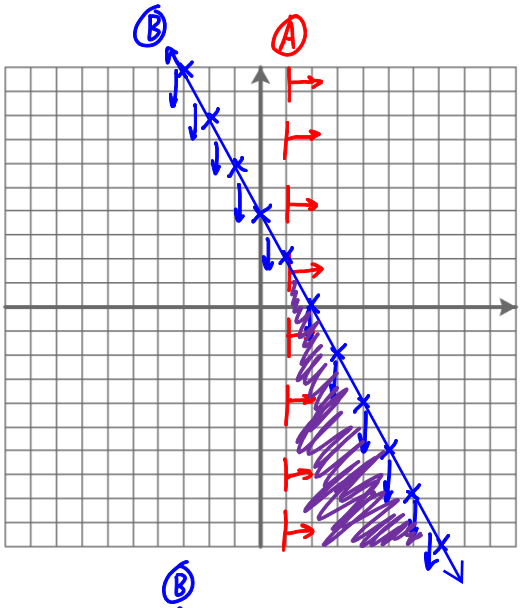
Ⓐ $\boxed{y > \frac{1}{2}x - 3}$ dashed, shade above




**Note: Where the separate solutions sets for each line overlap will be the solution set for the whole system**

**Ex. 9:** Ⓐ $x > 1$ dashed, vertical line

Ⓑ $y \le -2x + 4$ solid, shade below




**Ex. 10:** Ⓐ $y < 4$ dashed, horizontal line

Ⓑ $x \ge -3$ solid, vertical line