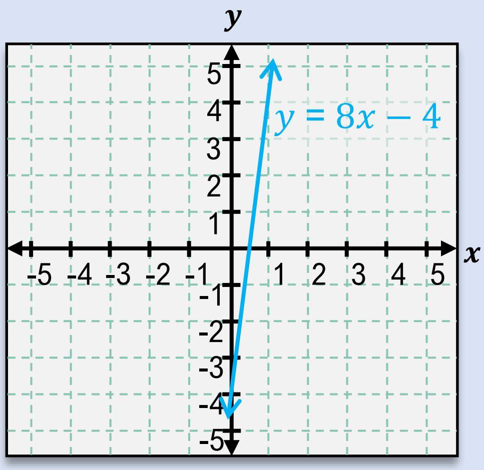
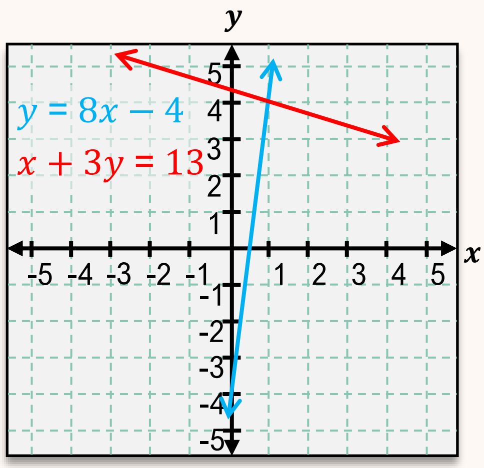
TOPIC: SYSTEMS OF LINEAR EQUATIONS
Introduction to Systems of Linear Equations

◆ Previously, we solved & plotted *single* equations on graphs. Now we'll look at **Systems of (__________) Equations.**

- To solve, find (x, y) which satisfy ______ equations. Graphically, this is where the lines ______________.

Recall **Single Equation**	New **Multiple Equations a.k.a "System"**
	

EXAMPLE

Determine if each point is a solution to the equation.

(A) $(-2,0)$ (B) $(0,-4)$ (C) $(1,4)$

Solution: **[1 | MANY]** point(s) satisfying **[1 | ALL]** line(s)

Determine if each point is a solution to the system of equations.

(A) $(0,-4)$ (B) $(-2,5)$ (C) $(1,4)$

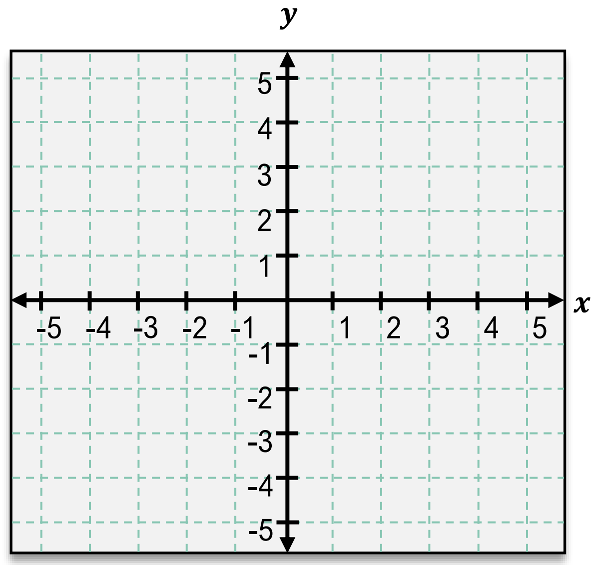
Solution: **[1* | MANY]** point(s) satisfying **[1 | ALL]** line(s)

* True for ***most*** problems, but there are other types of solutions

TOPIC: SYSTEMS OF LINEAR EQUATIONS

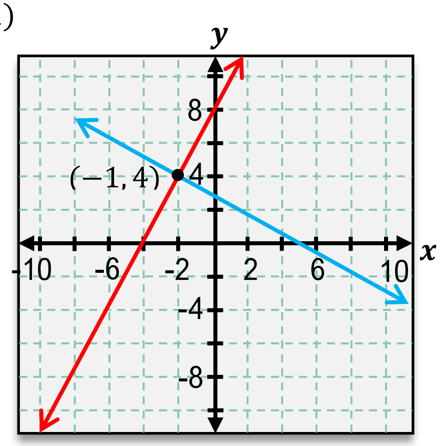
EXAMPLE Graph the system of equations. Identify the intersection point and verify it is a solution to both equations.

$$y = 2x + 3$$
$$y = x + 4$$

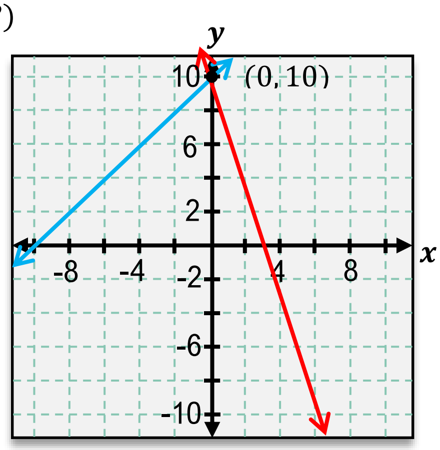


EXAMPLE Match each system of equations to its graph and solution.

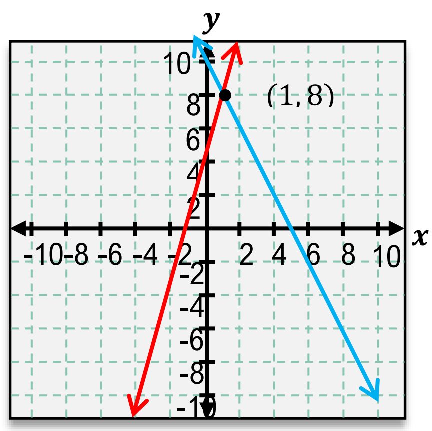
(A)



(B)



(C)



(1)

$$y = 3x + 5$$
$$y = -2x + 10$$

(2)

$$y = 4x + 8$$
$$2x + 3y = 10$$

(3)

$$3x + y = 10$$
$$-x + y = 10$$

TOPIC: SYSTEMS OF LINEAR EQUATIONS
Solving Systems of Linear Equations – Substitution

◆ One way to solve systems of equations *without* graphing is by ______________ one equation into another.

EXAMPLE Solve the system of equations using substitution.

$$y = 7x - 14$$
$$2x - y = 4$$

HOW TO: Solve Systems of Equations – Substitution

1) Choose easiest equation to isolate $\boldsymbol{x}$ or $\boldsymbol{y}$ as **(A)**
2) Solve **(A)** for $\boldsymbol{x}$ OR $\boldsymbol{y}$
3) Substitute **(A)** into **(B)**, then solve **(B)**
4) Plug value from **3)** back into *either* eq'n, then solve
5) Check answer by plugging values into both eqn's

PRACTICE Use substitution to solve the following system of linear equations.

$$4x + y = 1$$
$$x - y = 4$$

TOPIC: SYSTEMS OF LINEAR EQUATIONS

PRACTICE Use substitution to solve the following system of linear equations.

$$4x + 2y = 7$$
$$x + 5y = 4$$

HOW TO: Solve Systems of Equations – Substitution
1) Choose easiest equation to isolate x or y as **(A)**
2) Solve **(A)** for x OR y
3) Substitute **(A)** into **(B)**, then solve **(B)**
4) Plug value from **3)** back into *either* eq'n, then solve
5) Check answer by plugging values into both eqn's

TOPIC: SYSTEMS OF LINEAR EQUATIONS

Solving Systems of Linear Equations – Elimination

- Another way to solve systems of equations is by __________ the equations & ______________ a variable.
  - If not asked to use a specific method, use this when equations are in standard form or have large coefficients. $(\boldsymbol{Ax} + \boldsymbol{By} = \boldsymbol{C})$

Recall **Substitution**	New **Elimination**
$y = 5x - 3$ $x = 2$	$x + y = 1$ $-x + y = 5$

EXAMPLE Solve the system of equations using elimination.

$$3x + 2y = 1$$
$$-x + y = 3$$

HOW TO: Solve Systems of Equations - Elimination

1) Write *BOTH* equations in the form $\boldsymbol{Ax} + \boldsymbol{By} = \boldsymbol{C}$, aligning coeff's vertically on top of each other

2) Multiply eq'n(s) by # (+ or −) so $\boldsymbol{x}$ or $\boldsymbol{y}$ coeff's are _________ with _____________ signs

3) _______ equations vertically to eliminate one variable, then solve for other

4) Plug value from **3)** back into *either* eq'n, then solve

5) Check answer by plugging values into both eqn's

TOPIC: SYSTEMS OF LINEAR EQUATIONS
How to Multiply Equations in Elimination Method

◆ To determine what # to multiply by in Step **2)**, look at the coefficients of each equation.

Elimination Method – What to Multiply Equation(s) by to Eliminate Variable

If coefficients of x or y are…	**Equal with *OPPOSITE* sign**	**Equal with *SAME* sign**	**Factors of each other (Evenly divisible)**	**Anything Else**
Multiply…	Nothing! Just add	Either eq'n by -1	Eq'n with smaller coeff's by quotient	Each eq'n by *other* coeff (+ or −)
EXAMPLE	$7x + 13y = 12$ $-7x + 2y = 18$	$5x + 7y = 17$ $6x + 7y = 12$	$12x - 5y = 24$ $3x - 2y = 6$	$6x + 2y = -10$ $-4x - 3y = 15$

HOW TO: Solve Systems of Equations - Elimination

1) Write *BOTH* equations in the form $\boldsymbol{Ax + By = C}$, aligning coeff's vertically on top of each other

2) Multiply eq'n(s) by # (+ or −) so $\boldsymbol{x}$ or $\boldsymbol{y}$ coeff's are **EQUAL** with **OPPOSITE** signs

3) **ADD** equations vertically to eliminate one variable, then solve for other

4) Plug value from **3)** back into *either* eq'n, then solve

5) Check answer by plugging values into both eq'ns

TOPIC: SYSTEMS OF LINEAR EQUATIONS

EXAMPLE Without *fully* solving, multiply one or both equation(s) by an appropriate factor to cancel out a variable.

Elimination Method – What to Multiply Equation(s) by to Eliminate Variable				
If coefficients of x or y are…	**Equal with *OPPOSITE* signs**	**Equal with *SAME* signs**	**Factors of each other (Evenly divisible)**	**Anything Else**
Multiply…	Nothing! Just add	Either eq'n by -1	Eq'n with smaller coeff's by quotient	Each eq'n by *other* coeff (+ or −)

$$2x + 3y = 1$$
$$x - y = 3$$

EXAMPLE Without *fully* solving, multiply one or both equation(s) by an appropriate factor to cancel out a variable.

$$5x + 3y = 10$$
$$-7x + 5y = 15$$

TOPIC: SYSTEMS OF LINEAR EQUATIONS

PRACTICE Use the elimination method to solve the following system of linear equations.

$$2x + y = 1$$
$$3x - y = 4$$

HOW TO: Solve Systems of Equations – Elimination

1) Write *BOTH* equations in the form $\boldsymbol{Ax} + \boldsymbol{By} = \boldsymbol{C}$, aligning coeff's vertically on top of each other
2) Multiply eq'n(s) by # (+ or −) so $\boldsymbol{x}$ or $\boldsymbol{y}$ coeff's are **EQUAL** with **OPPOSITE** signs
3) **ADD** equations vertically to eliminate one variable, then solve for other
4) Plug value from 3) back into *either* eq'n, then solve
5) Check answer by plugging values into both eqn's

PRACTICE Use the elimination method to solve the following system of linear equations.

$$10x - 4y = 5$$
$$5x - 4y = 1$$

<u>**TOPIC: SYSTEMS OF LINEAR EQUATIONS**</u>
<u>**Classifying Systems of Linear Equations**</u>

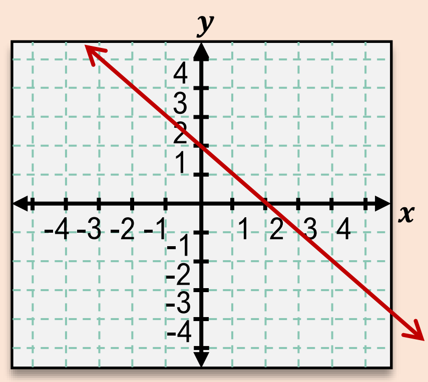
Like linear equations, systems can be put in 3 **categories** based on the ______________ of solutions they have.

EXAMPLE Solve each system of equations. Then graph and categorize the system.

Consistent

Independent

$y = 3$
$x + y = 2$

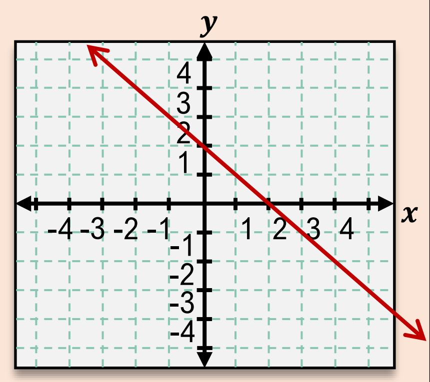


Lines are ______________

[1 | ∞ | 0] Solutions

Dependent

$-x - y = -2$
$x + y = 2$

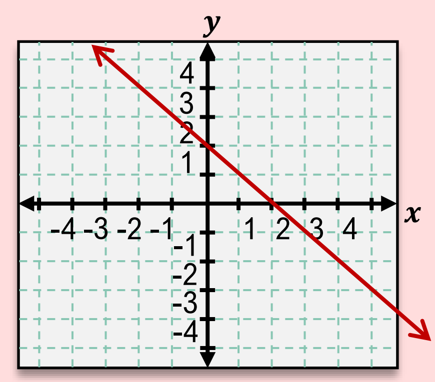


Lines are ______________

[1 | ∞ | 0] Solutions

Inconsistent

$y = -x + 3$
$x + y = 2$



Lines are ______________

[1 | ∞ | 0] Solutions

TOPIC: SYSTEMS OF LINEAR EQUATIONS

PRACTICE Solve the following system of equations. Classify it as CONSISTENT (INDEPENDENT or DEPENDENT) or INCONSISTENT.

$$y = 5x - 17$$
$$15x - 3y = 51$$

PRACTICE Solve the following system of equations. Classify it as CONSISTENT (INDEPENDENT or DEPENDENT) or INCONSISTENT.

$$2x + 8y = 7$$
$$x + 4y = 19$$