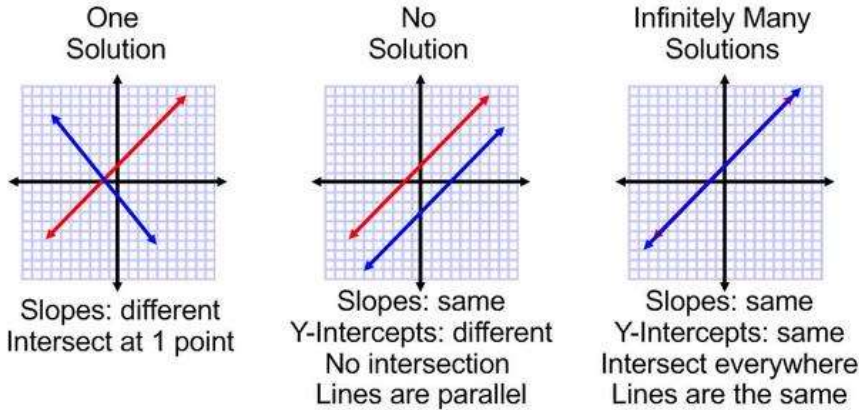UNIT 3 LESSON 2 – SYSTEM OF EQUATIONS BY
GRAPHING, SUBSTITUTION, ELIMINATION

The solution to the system is the point or points that make both equations true OR the point of intersection OR the point at which two lines cross or meet.

There are 3 ways to solve system of equations: Graphing, Substitution, Elimination



| One Solution | No Solution | Infinitely Many Solutions |
|---|---|---|
| Slopes: different Intersect at 1 point | Slopes: same Y-Intercepts: different No intersection Lines are parallel | Slopes: same Y-Intercepts: same Intersect everywhere Lines are the same |

**Graphing – graph the slope and y-intercept to see what type of solution

**Substitution – involves solving one equation for one of the variables and substituting that into the other equation

**Elimination – involves adding or subtracting the equations in the system so that one variable is eliminated

## SOLVE BY GRAPHING

Example 1) Use a graph to solve the following systems:

$y = x + 2$          $y = 3x – 2$

Step 1) Graph both lines

Step 2) Determine the solution
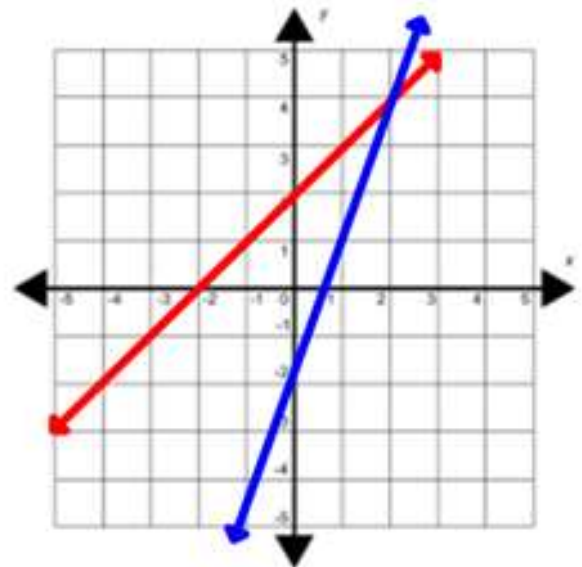
Equations intersect at the point (2, 4)

ONE SOLUTION

Step 3) Prove it!

Substitute the intersection point into original equations to prove the correct answer

$y = x + 2$
$4 = 2 + 2$
$4 = 4$   INTERSECTION IS CORRECT!

## SOLVE BY SUBSTITUTION

Example 2) Solve the system of equations using substitution.
$y = 3x$ $\qquad$ $x + y = -32$

Step 1) Identify a variable with coefficient of 1
Step 2) Isolate that variable
Step 3) Replace variable in other expression
Step 4) Solve for both variables

*Substitute what y equals (3x) into the equation $x + y = -32$
$x + 3x = -32$
$4x = -32$
$x = -8$

*Substitute $x = -8$ into the equation $y = 3x$ to solve for $y$
$y = 3x$
$y = 3(-8)$
$y = -24$

*The INTERSECTION POINT for the system is $(-8, -24)$

## SOLVE BY ELIMINATION

Example 3) Solve the system of equations using elimination.
-3x + 4y = 12 $\qquad$ 3x – 6y = 18

Step 1) Eliminate one variable (STACK THE EQUATIONS)
Step 2) Solve for the remaining variable
Step 3) Plug that solution into either equation and solve for eliminated variable

$-3x + 4y = 12$ $\qquad\qquad$ **$-3x$ and $3x$ can be eliminated!!

$+ 3x - 6y = 18$
$\qquad -2y = 30$
$\qquad\quad y = -15$

*Substitute $y = -15$ into the equation $-3x + 4y = 12$ to solve for x

$-3x + 4y = 12$

$-3x + 4(-15) = 12$

$-3x - 60 = 12$

$-3x = 72$

$x = -24$ $\qquad\qquad\qquad$ INTERSECTION IS AT POINT $(-24, -15)$ ONE SOLUTION