TOPIC: LINES

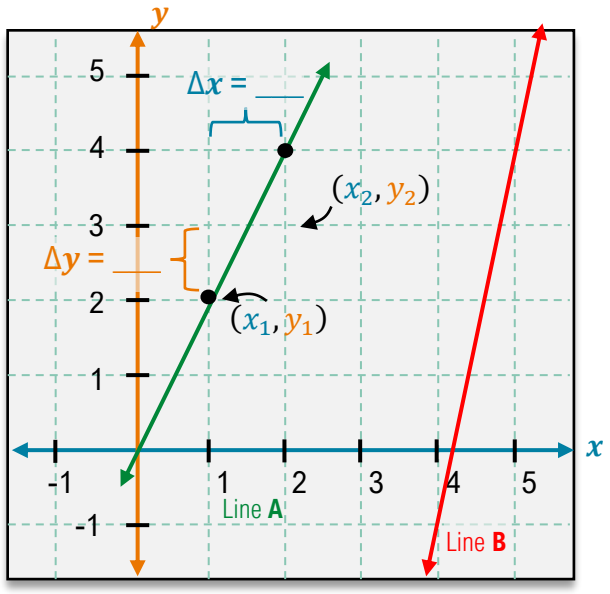
Slopes of Lines

- **Slope:** A number measuring how _____ a line is; how much ***y changes*** divided by how much ***x changes***.

$m = \frac{\text{"\_\_\_\_\_"}}{\text{"\_\_\_\_\_"}}$ over

Δ = "change in"

(x_1, y_1) & (x_2, y_2) are 2 points, may be given or chosen



EXAMPLE: Find the slopes of lines A & B shown in the graph.

Line A

(x_1, y_1) = _____

(x_2, y_2) = _____

Line B

(x_1, y_1) = _____

(x_2, y_2) = _____

Note: Order of points doesn't matter, slope will not change. Generally, set (x_1, y_1) as the _____ point.

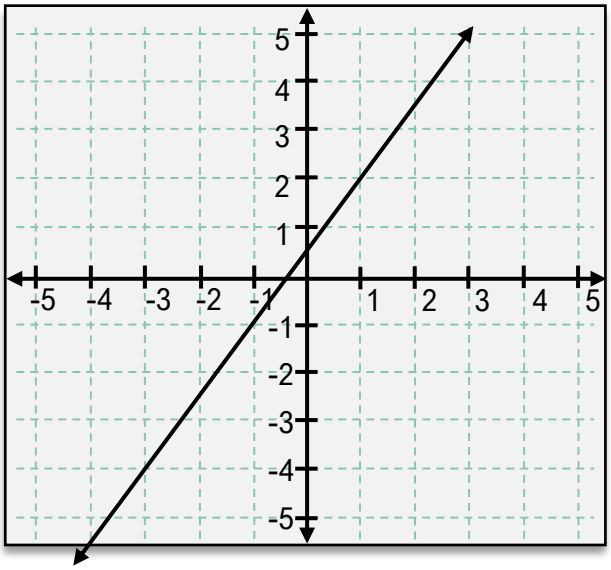
EXAMPLE: Find the slope of **Line B** above using $(x_1, y_1) = (2, 4)$ and $(x_2, y_2) = (1, 2)$ instead.

TOPIC: LINES

PRACTICE: Find the slope of the line shown below.

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

(*Slope*)



PRACTICE: Find the slope of the line containing the points $(-1,1)$ and $(4,3)$.

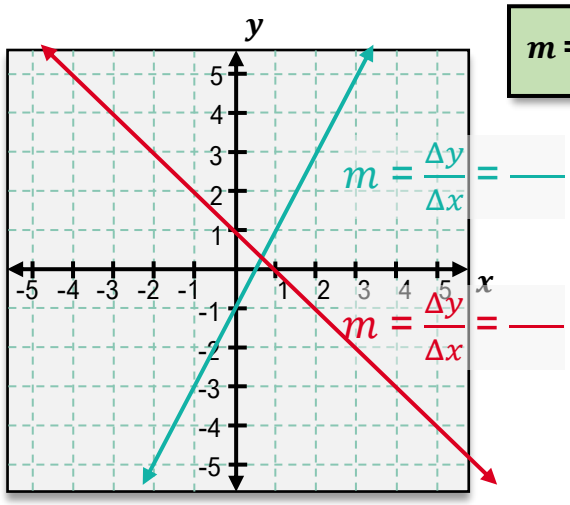
$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

(*Slope*)

TOPIC: LINES

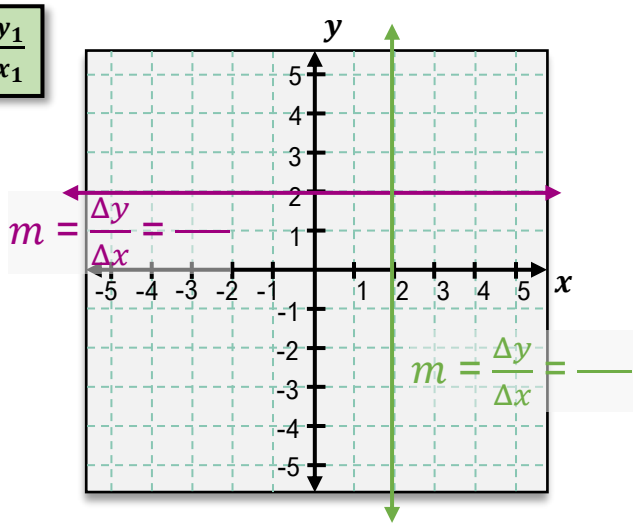
Types of Slope

- Slope can be **positive**, **negative**, **zero**, or **undefined**.



$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

(Slope)



If line goes **UP** from left to right, slope is **[+ | −]**

If line goes **DOWN** from left to right, slope is **[+ | −]**

HORIZONTAL line: slope is **[0 | UNDEFINED]** $y = \#$

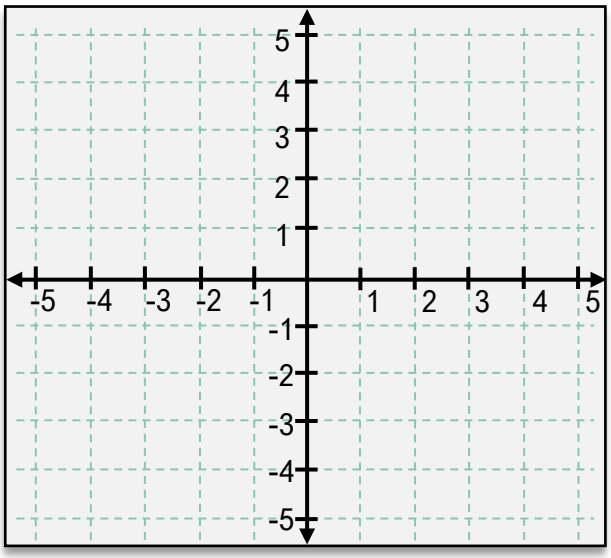
VERTICAL line: slope is **[0 | UNDEFINED]** $x = \#$

TOPIC: LINES

PRACTICE: Graph a line with a slope of 0 that passes through the point $(3, -2)$.

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

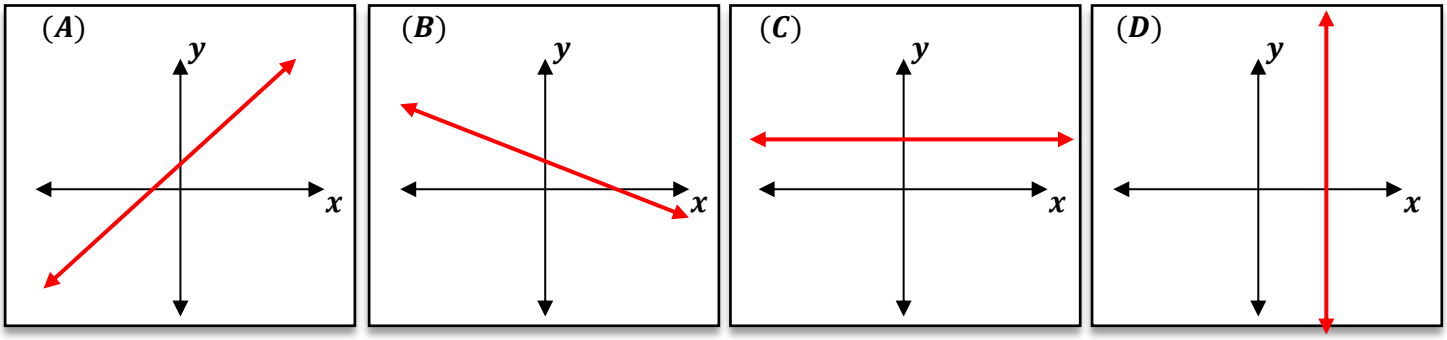
(*Slope*)



PRACTICE: Which of the following graphs below represents the equation $x = 3$?

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

(*Slope*)



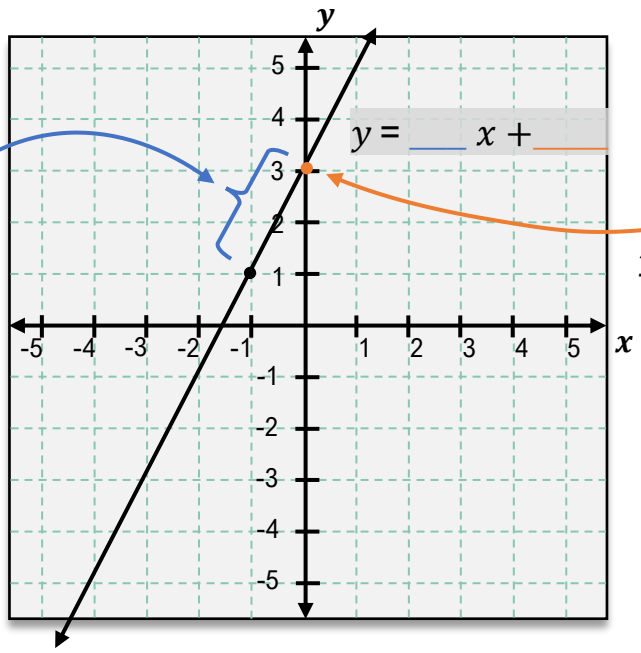
TOPIC: LINES

Slope – Intercept Form

- We can write the equation of a line using its _____ & _____.

$y = \_\_x + \_\_$

(Slope – Intercept Form)



Slope = 2

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$

y – Intercept =

y – value where line crosses y – axis

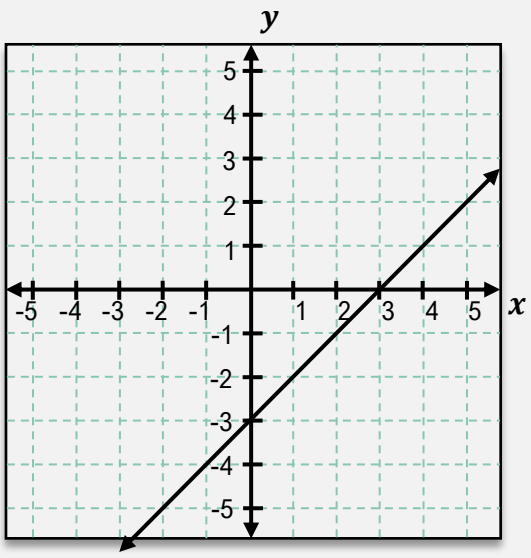
$(x = 0)$

EXAMPLE: In the graph below, identify the y – intercept & slope.

Write the equation in slope-intercept form.

b = _____

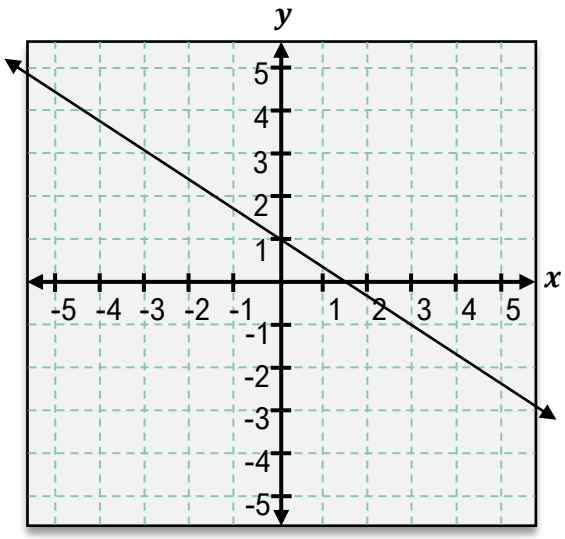
m = _____



TOPIC: LINES

PRACTICE: In the graph shown, identify the y – intercept & slope. Write the equation of this line in Slope-Intercept form.

$$y = mx + b$$



TOPIC: LINES

Graphing Lines from Equations in Slope-Intercept Form

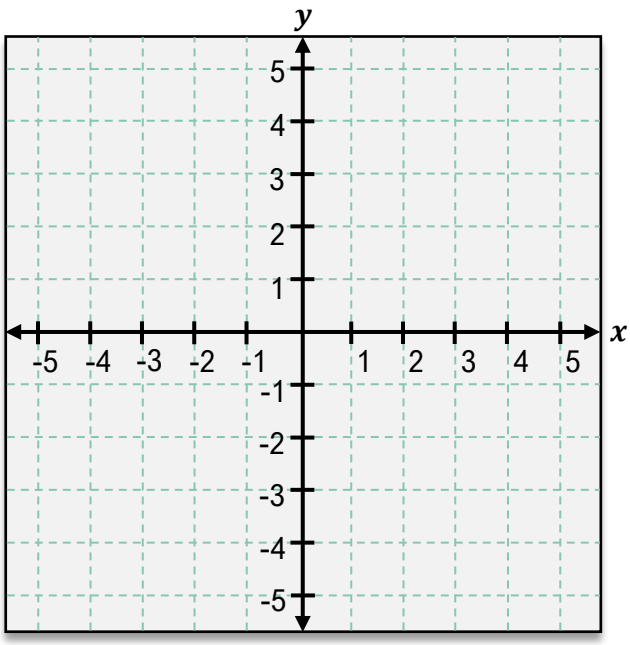
- A line equation in slope-intercept form tells you everything you need to graph it!

$$y = mx + b$$

EXAMPLE: Identify the y – intercept & slope of $y = \frac{2}{3}x + 1$, then graph the equation.

b = _____

m = _____



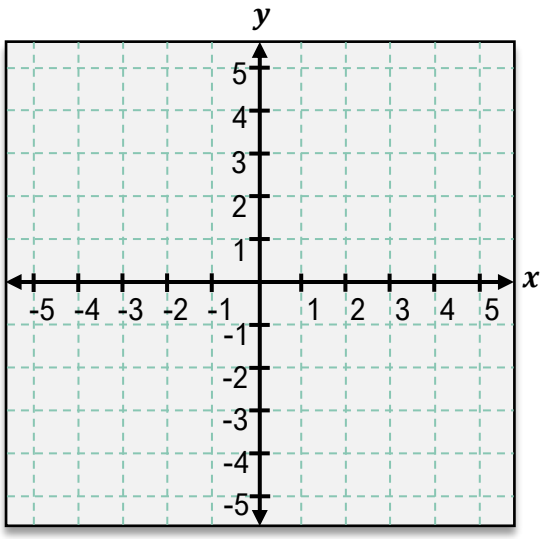
Graphing Lines in Slope-Intercept Form

1) Plot y – intercept $(0, b)$

2) Plot ONE more point using slope $\left(\frac{rise}{run}\right)$:

3) Connect points with a line

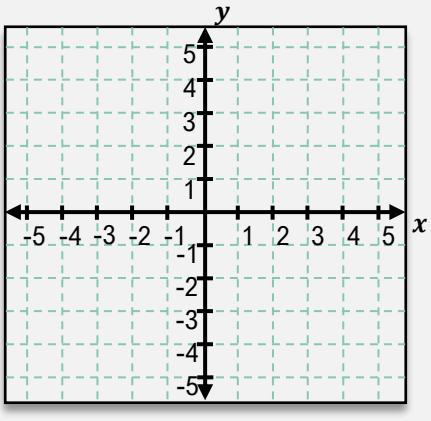
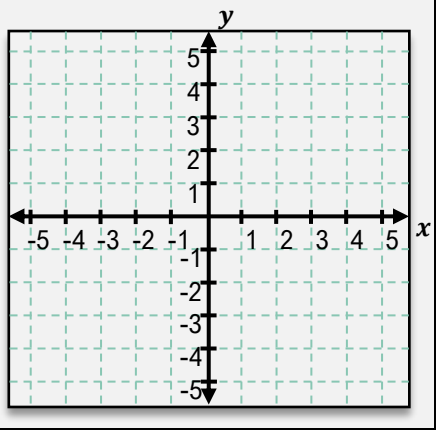
PRACTICE: Identify the y – intercept & slope of $y = -2x - 3$. Then graph the equation.



TOPIC: LINES

Point – Slope Form

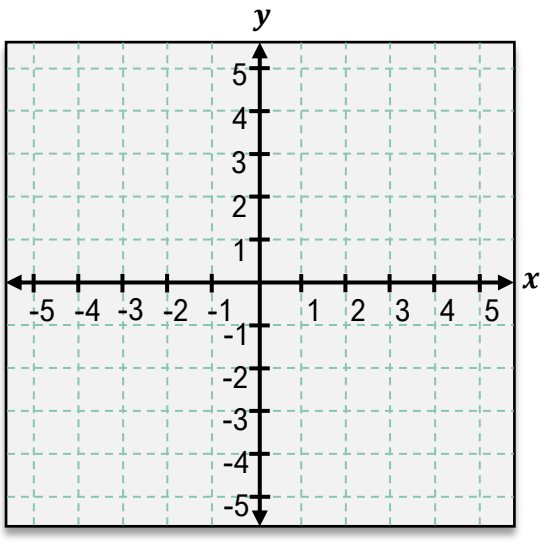
- If asked to write the equation of a line passing through a point that is _____ the y-intercept, use Point-Slope Form.

FORMS OF LINEAR EQUATIONS			
	SLOPE-INTERCEPT	POINT-SLOPE	FORM #3
EQN	$y = mx + b$	$y - y_1 = m(x - x_1)$	
USE IF	Given m & b, asked for graph/EQ Given graph/EQ, asked for m & b	Given m & point (x_1, y_1) **OR** Given 2 points (x_1, y_1) & (x_2, y_2)	
EXAMPLE	Graph the equation $y = \frac{2}{3}x - 1$ 	**a)** Write the equation of a line in point – slope form with slope = $\frac{2}{3}$ which passes through $(3,1)$. **b)** Graph the line **c)** Rewrite your equation from part (a) in Slope-Intercept form 	

PRACTICE: Write the point-slope form of the equation of a line with a slope of $-\frac{2}{5}$ that passes through $(1,3)$. Then graph the equation.

$y - y_1 = m(x - x_1)$

(Point-Slope)

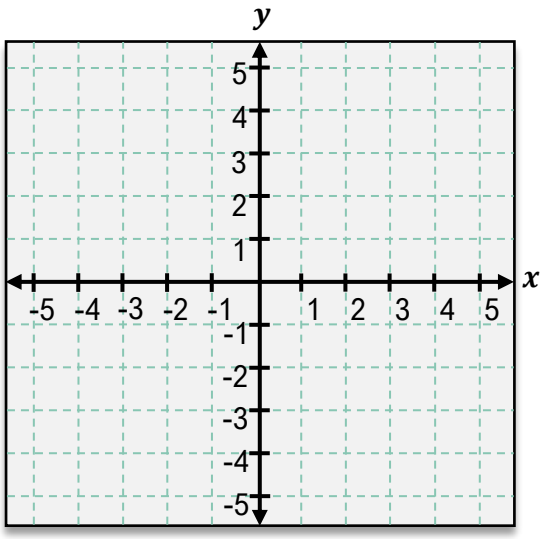


TOPIC: LINES

PRACTICE: Write the point-slope form of the equation of a line with a slope of 0 that passes through $(2, -4)$. Then graph the equation.

$$y - y_1 = m(x - x_1)$$

(*Point-Slope*)



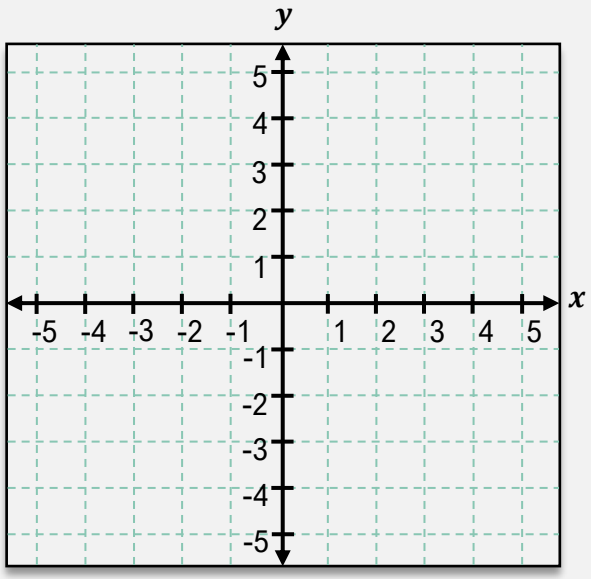
TOPIC: LINES

Finding Equations of a Line Given 2 Points

- Sometimes you will not be given slope, and you'll be asked to write an equation when given TWO points.
  - Use _____ of the two points as (x_1, y_1)

FORMS OF LINEAR EQUATIONS			
	SLOPE-INTERCEPT	POINT-SLOPE	FORM #3
EQN	$y = mx + b$	$y - y_1 = m(x - x_1)$	
USE IF	Given m & b, asked for graph/EQ Given graph/EQ, asked for m & b	Given m & point (x_1, y_1) **OR** Given 2 points (x_1, y_1) & (x_2, y_2)	

EXAMPLE: Write the equation of the line passing through the points $(-1, -5)$ & $(2, 4)$, and graph it.



$m = \frac{y_2 - y_1}{x_2 - x_1}$ (Slope)

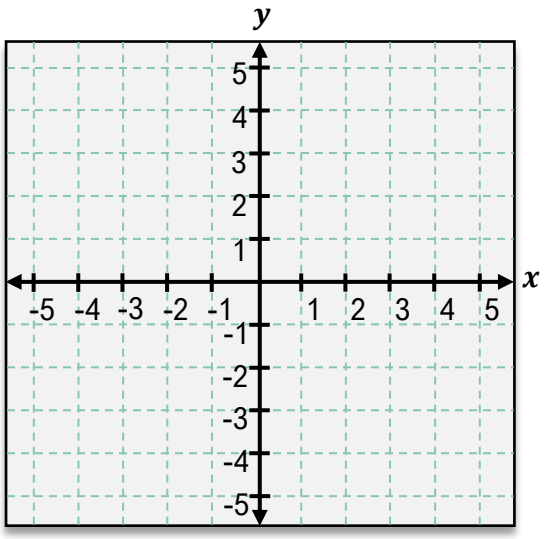
$y - y_1 = m(x - x_1)$ (Point – Slope Form)

TOPIC: LINES

PRACTICE: Write the point-slope form of the equation of a line that passes through the points $(2,1)$ and $(-4,3)$. Then graph the equation.

$$y - y_1 = m(x - x_1)$$

(Point-Slope)



TOPIC: LINES

Standard Form of a Line

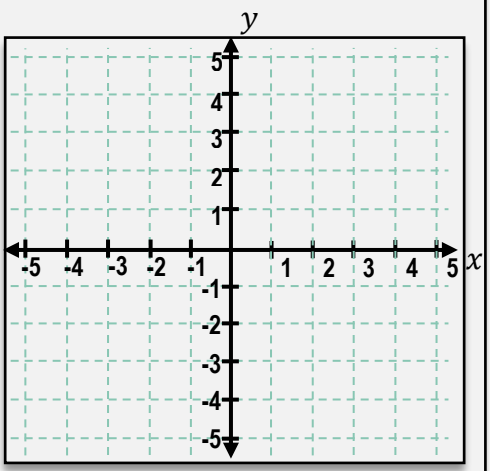
- When problems give a line in **Standard** Form and ask for Slope or Intercept, you'll have to _____ it.
  - To do this, _____ y to left side of equation.

FORMS OF LINEAR EQUATIONS			
	SLOPE-INTERCEPT	POINT-SLOPE	STANDARD or "GENERAL"
EQN	$y = mx + b$ $y = 2x + 3$	$y - y_1 = m(x - x_1)$	$Ax + By + C = 0$ $-4x + 2y - 6 = 0$
USE IF	Given/asked for b	Given (x_1, y_1) & m or (x_2, y_2)	**1)** Asked to rewrite in other form **OR** **2)** Finding x & y _____

EXAMPLE: Find the slope & y-intercept of the equation $-9x + 3y - 12 = 0$.

- To graph a line in Standard Form, you can find the x & y intercepts quickly *without* rewriting in Slope-Intercept.
  - For x-intercept, set y = 0 & solve for x. For y-intercept, set x = 0 and solve for y.

EXAMPLE: Graph the equation $3x + 2y - 6 = 0$ by finding the intercepts without using Slope-Intercept form.

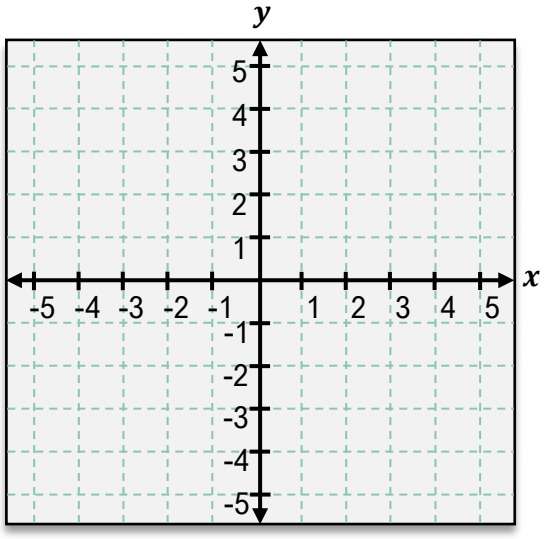


TOPIC: LINES

PRACTICE: Find the slope & y-intercept of the line given by the equation $3x + 2y - 6 = 0$.

FORMS OF LINEAR EQUATIONS		
SLOPE-INTERCEPT	POINT-SLOPE	STANDARD
$y = mx + b$	$y - y_1 = m(x - x_1)$	$Ax + By + C = 0$

PRACTICE: Graph the equation $9x + 6y + 18 = 0$ by finding the intercepts.



TOPIC: LINES

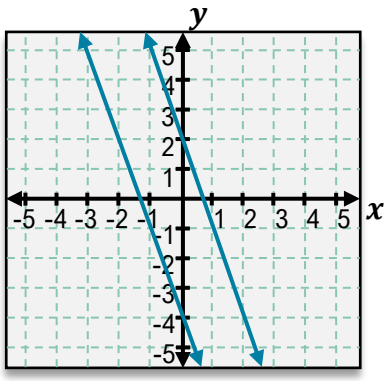
Parallel and Perpendicular Lines

- Parallel & perpendicular lines are related by _____.

FORMS OF LINEAR EQUATIONS		
SLOPE-INTERCEPT	POINT-SLOPE	STANDARD
$y = mx + b$	$y - y_1 = m(x - x_1)$	$Ax + By + C = 0$

Parallel Lines

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



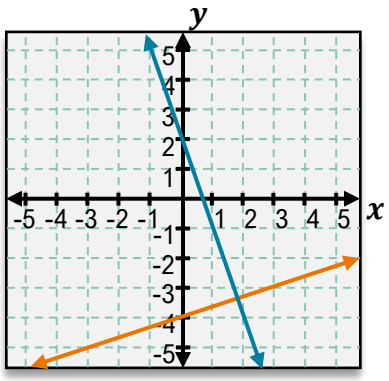
$m_1 = m_2$

Slopes are _____; y-intercepts are _____

Lines *never* intersect

Perpendicular Lines

$y = -3x + 2$ $y = \frac{1}{3}x - 4$

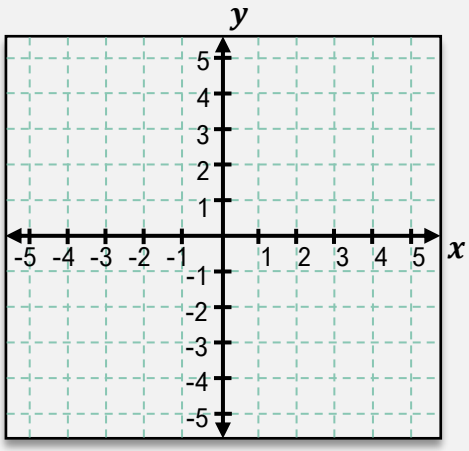


$m_1 = -\frac{1}{m_2}$

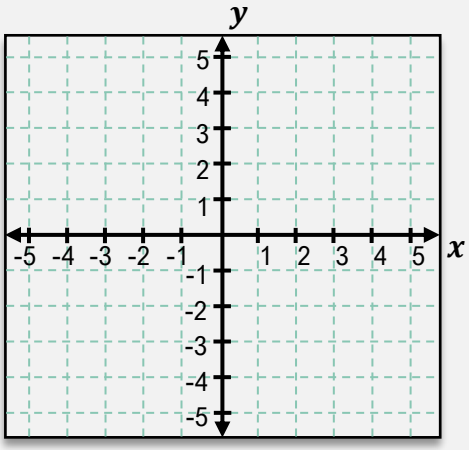
Slopes have _____ signs and are _____

Lines intersect at ***right*** angles (90°)

EXAMPLE: Write the equation of a line passing through $(-1, 4)$ that is parallel to $y = 2x - 6$.



EXAMPLE: Write the equation of a line perpendicular to $x + 4y - 8 = 0$ that has a y-intercept of 3.



TOPIC: LINES

PRACTICE: Write an equation of a line that passes through the point $(3, -4)$ and is parallel to the line $x + 2y + 18 = 0$.