Geometry H Name : ______________________________________
3.4 Slopes/Equations Review Notes Date : ______________________ Period : _________

LEARNING TARGETS

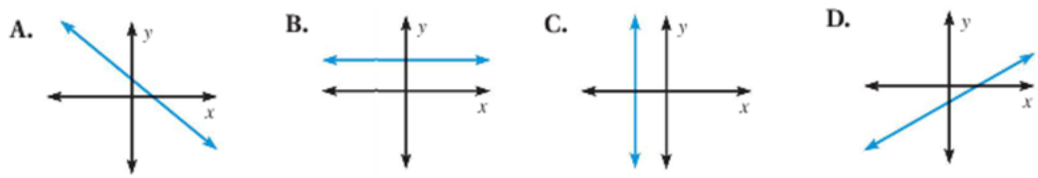
- I can find the slope of a line
- I can use slopes of lines to identify increasing, decreasing, vertical, and horizontal lines.
- I can identify parallel and perpendicular lines.

The ***slope*** of a non-vertical line is the ratio of the vertical change (*rise*) to the horizontal change (*run*) between any two points on the line.

If a line in the coordinate plane passes through points (x_1, y_1) and (x_2, y_2), then the slope *m* is:

$$m = \frac{rise}{run} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

- Types of Slope :



Negative Slope	**Zero Slope**	**Undefined Slope**	**Positive Slope**
Falls from left to right	Horizontal Line	Vertical Line	Rises from left to right

SECTION 1 : Finding the slope of a line from two points using the slope formula:

Ex 1 : (-2 , 4) and (-3 , 0)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 4}{-3 - (-2)} = \frac{-4}{-3 + 2} = \frac{-4}{-1} = 4$$

So $\boxed{m = 4.}$

Ex 2 : (3 , -1) and (3 , -5)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-1)}{3 - 3} = \frac{-5 + 1}{0} = \frac{-4}{0} = \boxed{undefined}$$

Our slope is undefined because you can never divide by zero!!

- You may recall the **slope-intercept form** of a line from Algebra I, $y = mx + b$. It is called the slope-intercept form because *m* represents the ___**slope**___ of the line and *b* represents the ___**y-intercept**___ of the line.

SECTION 2 : Identify the slope of the line and the y-intercept from the following equation.

Ex 3 : $y = 3x + 2$

m = **3**
b = **2**

Ex 4 : $y = 5$

m = **0**
b = **5**

→This equation can be re-written as $y = 0x + 5$ in slope-intercept form which makes our slope 0

SECTION 3 : Write an equation of a line given the slope and y-intercept.

Ex 5 : $m = \frac{1}{2},\ b = -5$

$y = mx + b$

$\boxed{y = \frac{1}{2}x - 5}$

Ex 6 : $m = 0,\ b = 2$

$y = mx + b$

$y = 0x + 2$

$\boxed{y = 2}$

SECTION 4 : Write the slope-intercept form of the equation of the line through the given point with the given slope.

Ex 7 : through : (6 , -2), slope = $-\frac{1}{6}$.

→I know to write an equation, I need an *m* and a *b*. My *m* is $-\frac{1}{6}$, but I don't have a *b*....

→To find b, use the point (6 , -2) and the slope $-\frac{1}{6}$ and substitute them into $y = mx + b$.

$x = 6, y = -2, m = -\frac{1}{6}$ so if I substitute those into $y = mx + b$ then solve for b, I get :

$$-2 = -\frac{1}{6}(6) + b$$
$$-2 = -1 + b$$
$$b = -1$$

So my final equation using $m = -\frac{1}{6}$ *and* $b = -1$ is : $\boxed{y = -\frac{1}{6}x - 1}$

- You may also recall a formula for writing equations of lines given a point and a slope: $y - y_1 = m(x - x_1)$. This formula is called the ***point-slope formula*** because (x_1, y_1) represents the coordinates of the given point, and m represents the slope. When given a point and a slope, we can use this formula instead of the slope-intercept equation!

SECTION 5 : Write the equation of the line through the given point with the given slope using the point-slope formula.

Ex 8 : through (5, 1), slope = $\frac{1}{6}$

Substitute the point and slope into $y - y_1 = m(x - x_1)$.

Using $x = 6,\ y = 1,\ m = \dfrac{1}{6}$:

$$y - 1 = \frac{1}{6}(x - 5)$$

$y - 1 = \frac{1}{6}x - \frac{5}{6}$ ← Distribute the $\frac{1}{6}$ to everything in the parentheses

$y - \frac{6}{6} = \frac{1}{6}x - \frac{5}{6}$ ← Turn the 1 into $\frac{6}{6}$ to make a common denominator

$y = \frac{1}{6}x + \frac{1}{6}$ ← Add $\frac{6}{6}$ to each side and write your final answer in slope-intercept form

SECTION 6 : Write the slope-intercept form of the equation of the line through the given points.

Ex 9 : (1 , -19) and (-2 , -7)

→ I know how to write an equation, I need an *m* and a *b*. Now I don't have an *m* or a *b*....

→ Let's find *m* using the slope formula and our two points!

$$m = \frac{-7 - (-19)}{-2 - 1} = \frac{-7 + 19}{-3} = \frac{12}{-3} = -4$$ so ***m* = -4**

→ Using one of our two points given (it doesn't matter which!) let's substitute *x* =1 , *y* = -19, and *m* = -4 into $y - y_1 = m(x - x_1)$:

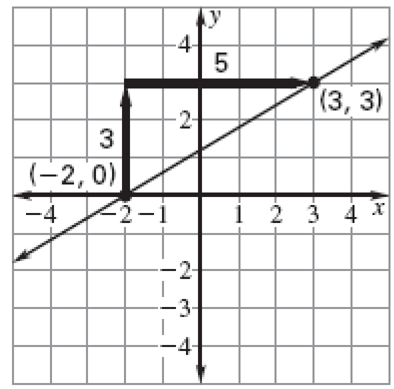
$$y - -19 = -4(x - 1)$$

$$y + 19 = -4x + 4$$

$$\boxed{y = -4x - 15}$$

SECTION 7 : Finding Slope and Graphing Lines

Ex 10 : Find the slope of the line shown in the graph.



Solution:

Pick two "nice" points : Let (x_1, y_1) = $(-2,0)$ and (x_2, y_2) = $(3,3)$

Use the slope formula : $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

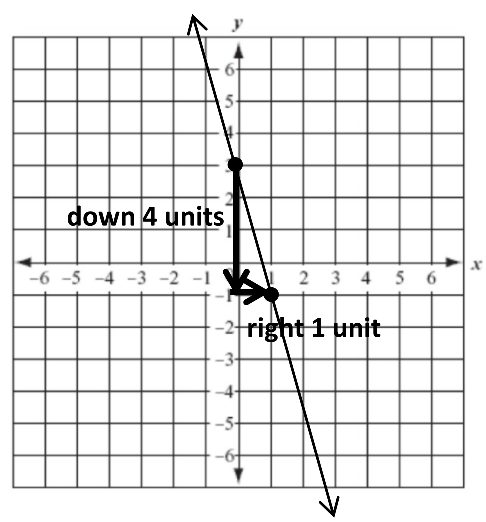
$$m = \frac{3-0}{3-(-2)} = \frac{3}{3+2} = \frac{3}{5}$$

OR : We can count our rise and our run :

The graph (from one "nice" point to another) goes 'up' 3 units (positive rise) and to the 'right' 5 units (positive run), so our slope *m* $\left(\dfrac{rise}{run}\right)$ is $\dfrac{3}{5}$.

The line rises from left to right. The slope is **positive**.

Ex 11 : Graph an equation using slope-intercept form



Graph the equation *y* =-4x + 3

Solution:

STEP 1 Identify the slope and the y-intercept. *m* = **-4** and *b* = **3**.

STEP 2 Plot the point that corresponds to the *y*-intercept

$\rightarrow$Since *b* =3, our graph crosses the y-axis at **3**, or at point $(0,3)$.

STEP 3 Count the slope (rise and run) to locate a second point on the line. Draw a line through the two points.

$\rightarrow$Since our slope is -4 , we can say $\dfrac{rise}{run} = \dfrac{-4}{1}$. Since our **rise** is **-4**, we want to count 4 **down** from the y-intercept, then to the **right** 1 because our run is **+1.**

STEP 4 Draw a line through your two points!

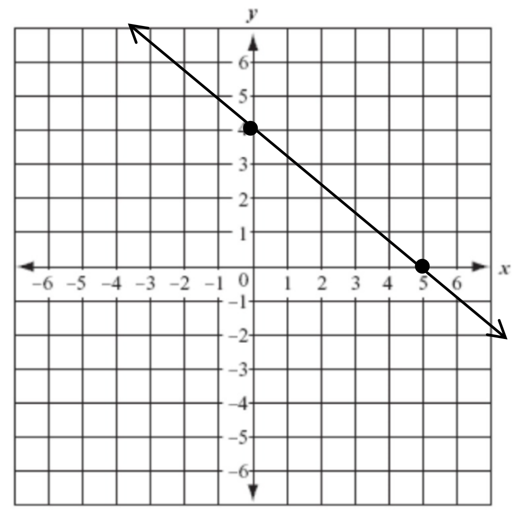
$\rightarrow$Since our graph is falling from the left to the right, we should have a **negative** slope!

Ex 12 : Graph a line using intercepts

Graph the line that has a y-intercept of 4 and an x-intercept of 5.

$\rightarrow$ The graph has a y-intercept of 4, so that means the graph crosses the y-axis at $(0,4)$

$\rightarrow$ The graph has an x-intercept of 5, so that means the graph crosses the x-axis at $(5,0)$



Through these two points, we can draw a line!