Math 9 – Unit 7: Coordinate Geometry Name: ______________________

Lesson #3: Slope of a Line Date: _______________

Learning Goal: We are learning how slope impacts a linear equation. It's all downhill from here!

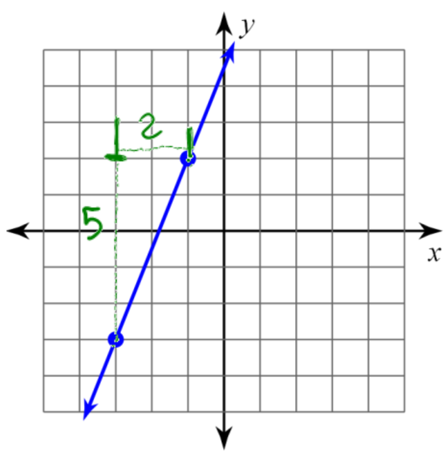
In this lesson, we will explore the most significant property of a linear relationship: the slope! The slope of a line tells us how the relationship is changing and can be thought of as how slanted/steep the line is. It has many important applications such as engineering the initial climb of a roller coaster to making safe ramps, but today we will focus on the algebra and understanding how to calculate the slope of a line.

First, let's look at the slope from a geometric perspective. The slope, defined by the letter *m* for no apparent reason, is: $\boxed{m = \dfrac{Rise}{Run}}$

→ how far you increase or decrease (y-axis)

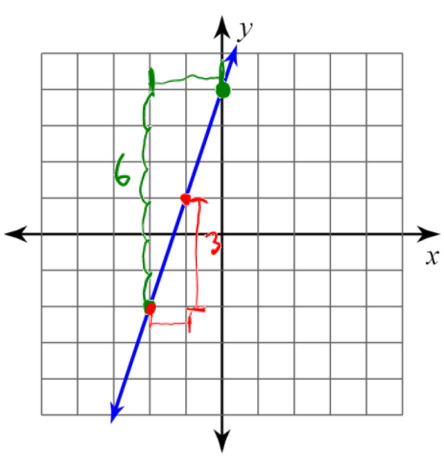
→ horizontal change (x-axis)

Example 1: Given the line with two points, calculate the slope.



$m = \dfrac{rise}{run} = \dfrac{5}{2}$ $\boxed{m = \dfrac{5}{2}}$

Example 2: Given the line, locate two points, then calculate the slope.

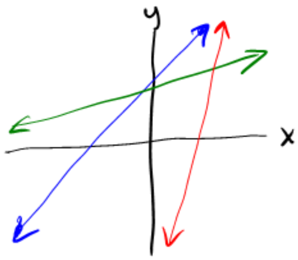


$m = \dfrac{rise}{run} = \dfrac{6}{2} = \dfrac{3}{1}$ $\boxed{m = \dfrac{3}{1}}$ OR $\boxed{3}$

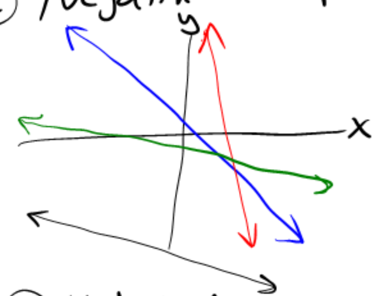
$m = \dfrac{rise}{run} = \dfrac{3}{1}$

Are slopes always positive? There are 4 possible slopes:

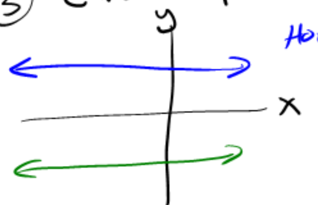
① Positive Slope



② Negative Slope



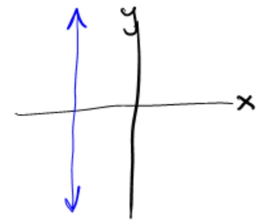
③ Zero Slope



Horizontal line

$m = \frac{0}{\#} = 0$

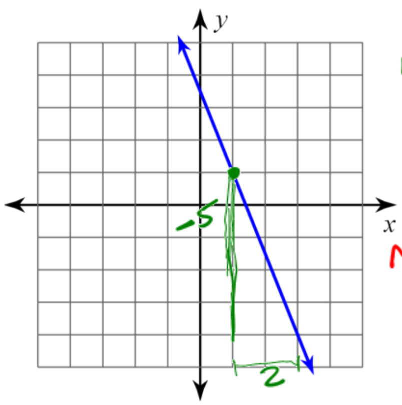
④ Undefined Slope



vertical line.

$m = \frac{\#}{0}$ can't divide by zero.

Example 3 and 4: Calculate the slopes of each line.

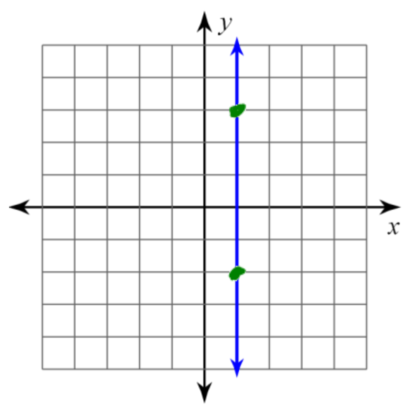


$m = \frac{\text{rise}}{\text{run}} = \frac{-5}{2}$

$\boxed{= -\frac{5}{2}}$

$m = \frac{\text{rise}}{\text{run}} = \frac{5}{-2}$

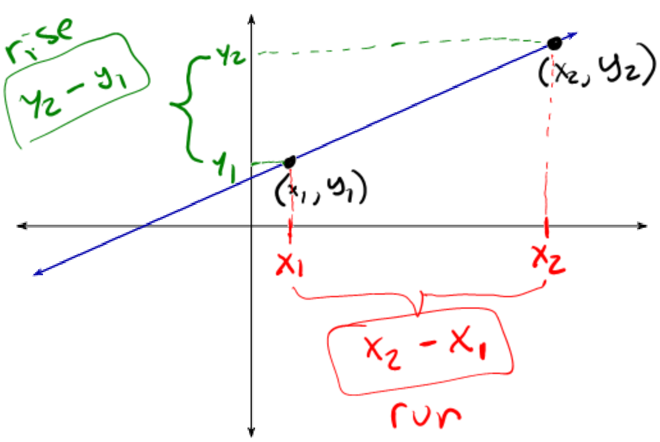
$\boxed{= -\frac{5}{2}}$



undefined

$m = \frac{\text{rise}}{\text{run}} = \cancel{\frac{5}{0}}$

Now that we know about slope, we can derive a formula so that we do not need a graph.



$m = \frac{\text{rise}}{\text{run}}$

$$\boxed{m = \frac{y_2 - y_1}{x_2 - x_1}}$$

Formula for slope.

It does not matter which ordered pair is #1 or #2.

Examples 5-8: Given the points, calculate the slope.

$(x_1, y_1)\ (x_2, y_2)$

5. $(7,-10),(9,-7)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(-7)-(-10)}{(9)-(7)}$$

$$\boxed{m = \frac{3}{2}}$$

$(x_2, y_2)\ (x_1, y_1)$

6. $(-6,-17),(-20,11)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(-17)-(11)}{(-6)-(-20)}$$

$$= \frac{-28}{14}$$

$$\boxed{m = -2}$$

$(x_1, y_1)\ (x_2, y_2)$

7. $(6,-12),(6,1)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(1)-(-12)}{(6)-(6)}$$

$$= \frac{13}{0}$$

undefined!

vertical line !!

$(x_1, y_1)(x_2, y_2)$

8. $(-3,9),(3,9)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9-9}{3-(-3)}$$

$$= \frac{0}{6}$$

$m = 0$! horizontal line!! :)

Example 9: A ramp needs to be constructed to go from the ground to a doorway. The doorway is 90 cm from the ground and the ramp needs a slope of $\frac{2}{9}$.

a) Calculate how far the ramp will start from the edge of the house.

b) Calculate the length of the ramp.

Example 10 and 11: Calculate the missing coordinate.

10. $(2,\ y)$ and $(-3,\ -2)$; slope: $\frac{3}{5}$

11. $(x,\ 4)$ and $(-5,\ 10)$; slope: $\frac{3}{2}$

Success Criteria

- I can identify the four types of slope: positive, negative, zero, undefined
- I can find the slope of a line graphically by studying its $\frac{rise}{run}$
- I can calculate the slope of a line algebraically by using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$
- I can find a missing coordinate, if given the slope