MTH1W – Unit 6: Coordinate Geometry Name: Mr. Hagen

Lesson 6.3: Slope of a Line Date: Apr 22, 2022.

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.

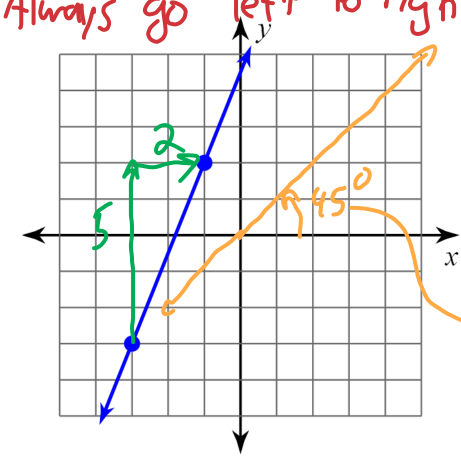
First, let's look at the slope from a geometric perspective. The slope, defined by the letter *m* for no apparent reason, is: $m = \frac{Rise}{Run}$

Rise – how does the line increase or decrease vertically.

Run → how does the line increase horizontally

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

Always go left to right →

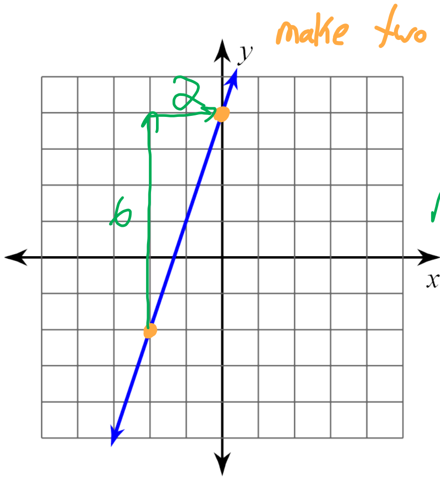


$m = \frac{Rise}{Run} = \frac{5}{2}$

$45^\circ \Rightarrow m = 1$

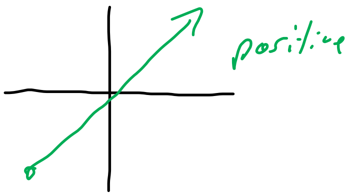
Example 2: Given the line, locate two points, then calculate the slope.

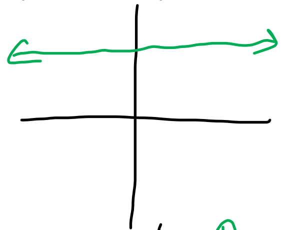
make two points a the corner of a box



$m = \frac{6}{2} = \frac{3}{1} = 3$

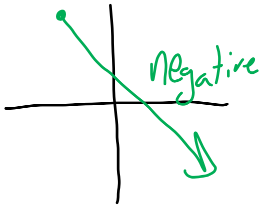
Are slopes always positive? There are 4 possible slopes:

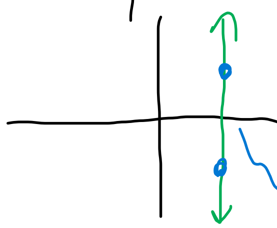




horizontal

$m = 0$



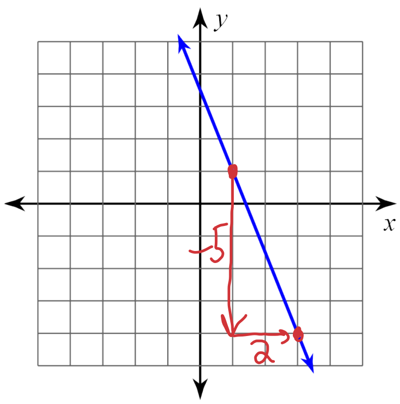


vertical

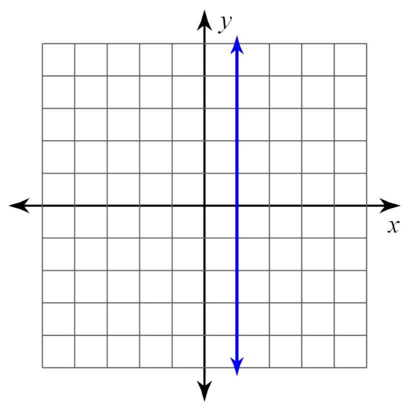
$m = \text{undefined}$

$m = \frac{5}{0}$?

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



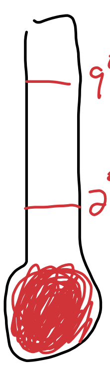
$m = \frac{-5}{2}$



vertical

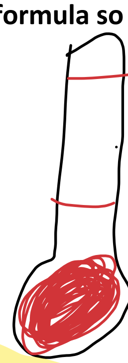
$\therefore$ $m = \text{undefined}$

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



The change in temp is

$9° - 2° = 7°C$



The change in temp is

$-3 - (8) = -11°C$

Note: Change = today - yesterday

= 2^{nd} temp - 1^{st} temp

= $temp_2 - temp_1$

Rise = the change in y's

Run = the change in x's

↳ Δ delta

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

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

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

$x_1 \quad y_1 \quad x_2 \quad y_2 \qquad (x, y)$

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

$$m=\frac{-7-(-10)}{9-7}$$

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

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

① ②

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

$$m=\frac{11-(-17)}{-20-(-6)}$$

$$m=\frac{28}{-14}=\frac{2}{-1}=-2$$

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

Run = 0

$$=\frac{\#}{0}=\text{undefined}$$

vertical

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

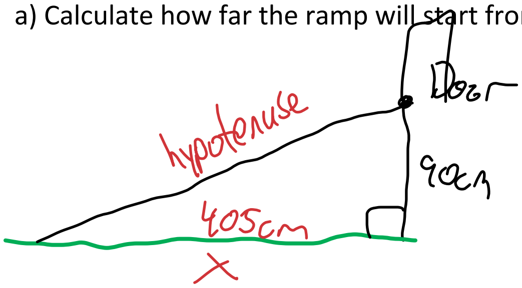
Rise = 0

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

horizontal

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.



cross multiply

$$m=\frac{\text{Rise}}{\text{Run}}$$

$$\frac{2}{9}=\frac{90}{x}$$

$$2x=90(9)$$

$$\frac{2x}{2}=\frac{810}{2}$$

$$x=405\text{ cm.}$$

b) Calculate the length of the ramp.

$$a^2+b^2=c^2$$

$$90^2+405^2=c^2$$

$$8100+164025=c^2$$

$$\sqrt{172125}=\sqrt{c^2}$$

$$414.9=c$$

Example 10 and 11: Calculate the missing coordinate.

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

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

$$\frac{3}{5} = \frac{-2 - y}{-3 - 2}$$

$$\frac{3}{5} = \frac{(-2 - y)}{-5}$$

$$-15 = 5(-2 - y)$$

$$-15 = \cancel{-10} - 5y$$
$+10 \quad \cancel{+10}$

$$\frac{-5}{-5} = \frac{\cancel{-5}y}{\cancel{-5}}$$

$$1 = y$$

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

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

$$\frac{3}{2} = \frac{10 - 4}{-5 - x}$$

$$\frac{3}{2} = \frac{6}{(-5 - x)}$$

$$3(-5 - x) = 12$$

$$\cancel{-15} - 3x = 12$$
$\cancel{+15} \quad +15$

$$\frac{\cancel{-3}x}{\cancel{-3}} = \frac{27}{-3}$$

$$x = -9$$

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