MTH1W – Unit 7: Coordinate Geometry

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Lesson 7.3: Slope of a Line

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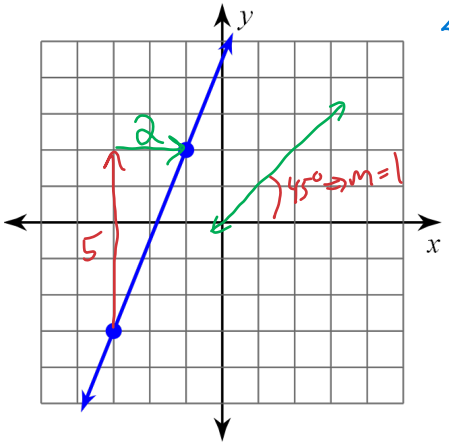
Learning Goal: We are learning how slope impacts a linear equation. It's all downhill from here!

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: $m = \frac{Rise}{Run}$ → vertical movement → horizontal movement

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

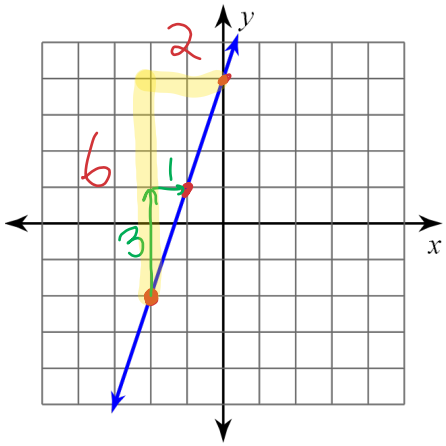


* Always go left point to right point.

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

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

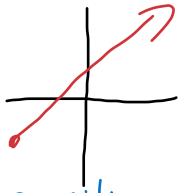
Example 2: Given the line, locate two points, then calculate the slope.



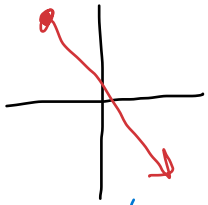
$m = \frac{3}{1} = 3$

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

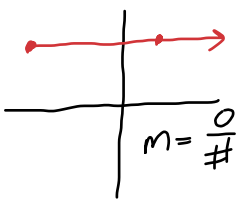
Are slopes always positive? There are 4 possible slopes:



positive



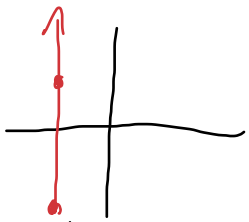
negative



m = zero

Horizontal Line

opposites

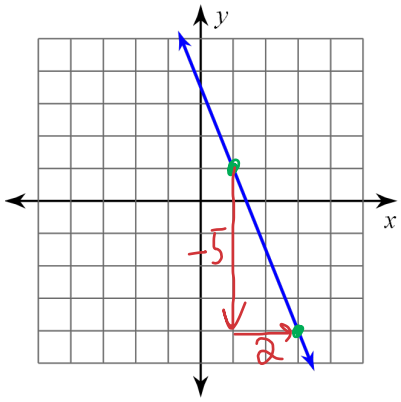


$m = \frac{\#}{0}$

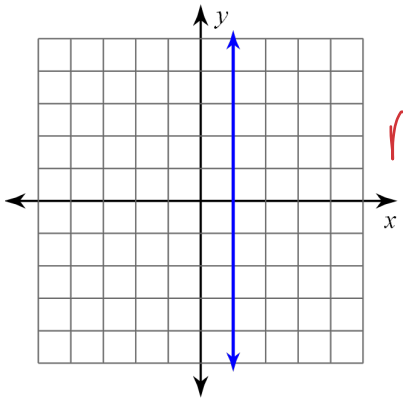
m = undefined

Vertical Line.

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



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



m = undefined

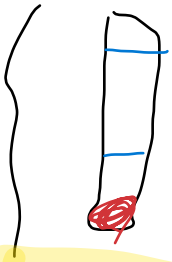
Now that we know about slope, we can derive a formula so that we do not need a graph.

9° today

2° yesterday

The change in temperature is:

9 − 2 = 7°C



8° yesterday

−3° today

The change is

−3 − 8 = −11°

Note: Change: today − yesterday

= 2nd temp − 1st temp

$= temp_2 - temp_1$

Rise = the change in y's

Run = the change in x's

Δ → delta

$m = \frac{Rise}{Run} = \frac{\Delta y}{\Delta x}$

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

(x_1, y_1) and (x_2, y_2)

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

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

x_1 y_1 x_2 y_2

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

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

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

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

1s 2s

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

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

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

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

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

$$m = \frac{1 - (-12)}{6 - 6}$$

$$m = \frac{13}{0} = \text{undefined}$$

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

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

$$m = \frac{9 - 9}{3 - (-3)}$$

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

$$m = 0$$

Examples 9 and 10, use the idea of "change" to calculate the slope:

9. $(5,8),(10,2)$

-6, $+5$

$$m = \frac{\text{Rise}}{\text{Run}} = \frac{-6}{5}$$

10. $(-7,9),(-15,-11)$

-20, -8

$$m = \frac{-20}{-8} \quad \begin{matrix} \div -4 \\ \div -4 \end{matrix}$$

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

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