

# Constant Rate of Change

Rate of Change: a rate that describes how one quantity changes in relation to another quantity.

In a linear function/equation, the rate of change between any two quantities is the same, or constant.

To find the rate of change, use the following procedure:  $\frac{\text{change in quantity \#2}}{\text{change in quantity \#1}}$

- use subtraction to find the change
- make sure to simplify the fraction and/or divide to get per one unit
- in a table or graph, time (years, weeks, days, hours, minutes, etc) is normally quantity #1
- in a table, quantity #2 is normally listed first (I know confusing right?)
- in a graph, quantity #2 is the y, and quantity #1 is the x

## Slope (m)

In a linear function/equation, the rate of change is called slope (m).

Slope is a ratio of the vertical change  
horizontal change or rise (fall)  
run

Slope (m) = change in y-coordinates  
change in x-coordinates ← how to calculate slope

### 4 Types of Slope

1) Positive - line rises



2) Negative - line falls



3) Zero - horizontal line



4) Undefined - vertical line



Find the slope of the line that passes through the points.

1. A (-2, 5) B (0, -3)

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

$$\frac{8}{-2}$$

$$m = \frac{-4}{1}$$

2. M (3, -4) N (3, 1)

$$m = \frac{-4 - 1}{3 - 3}$$

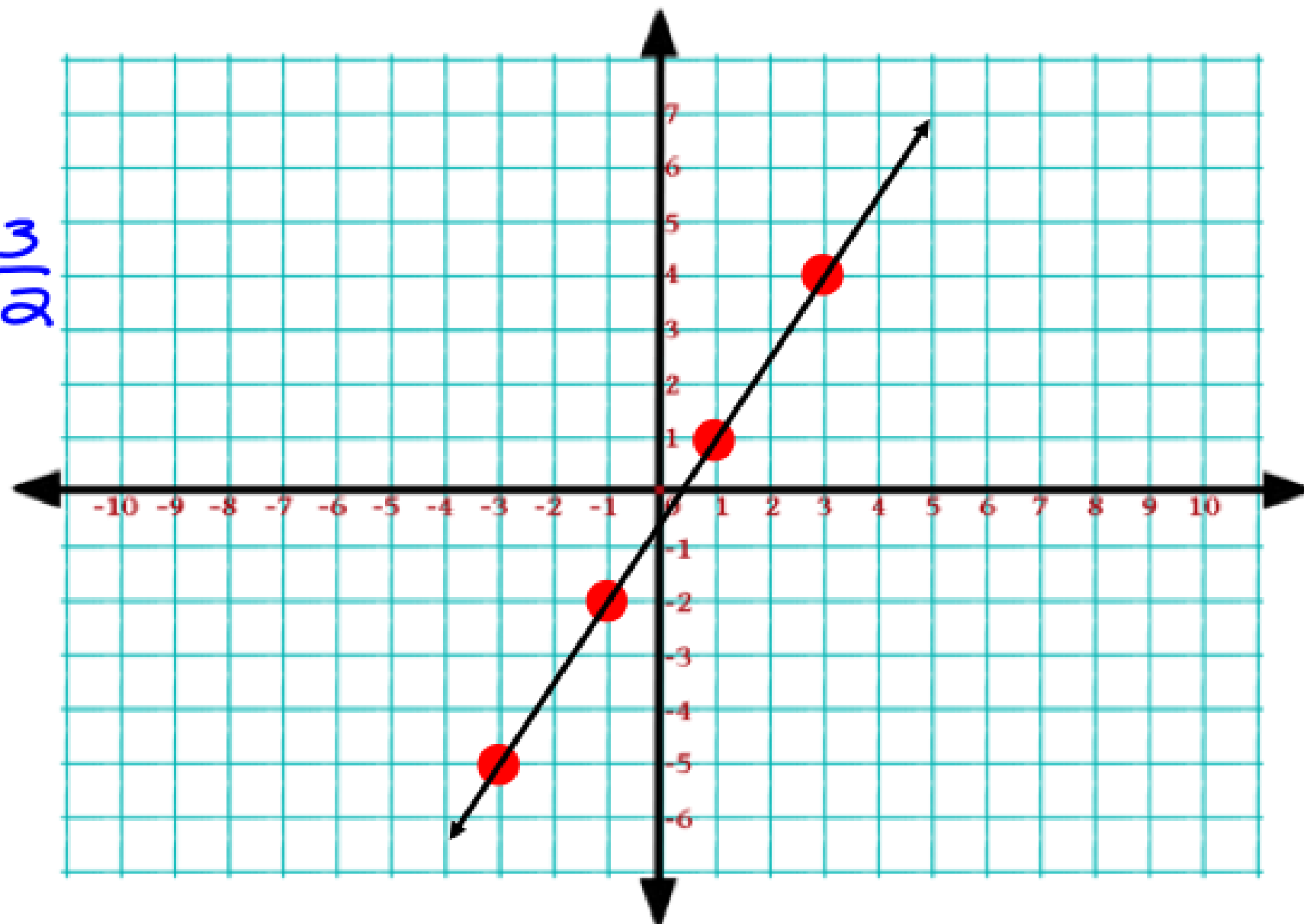
$$= \frac{-5}{0}$$

$$m = \text{undefined}$$

3. Find the slope of the line.

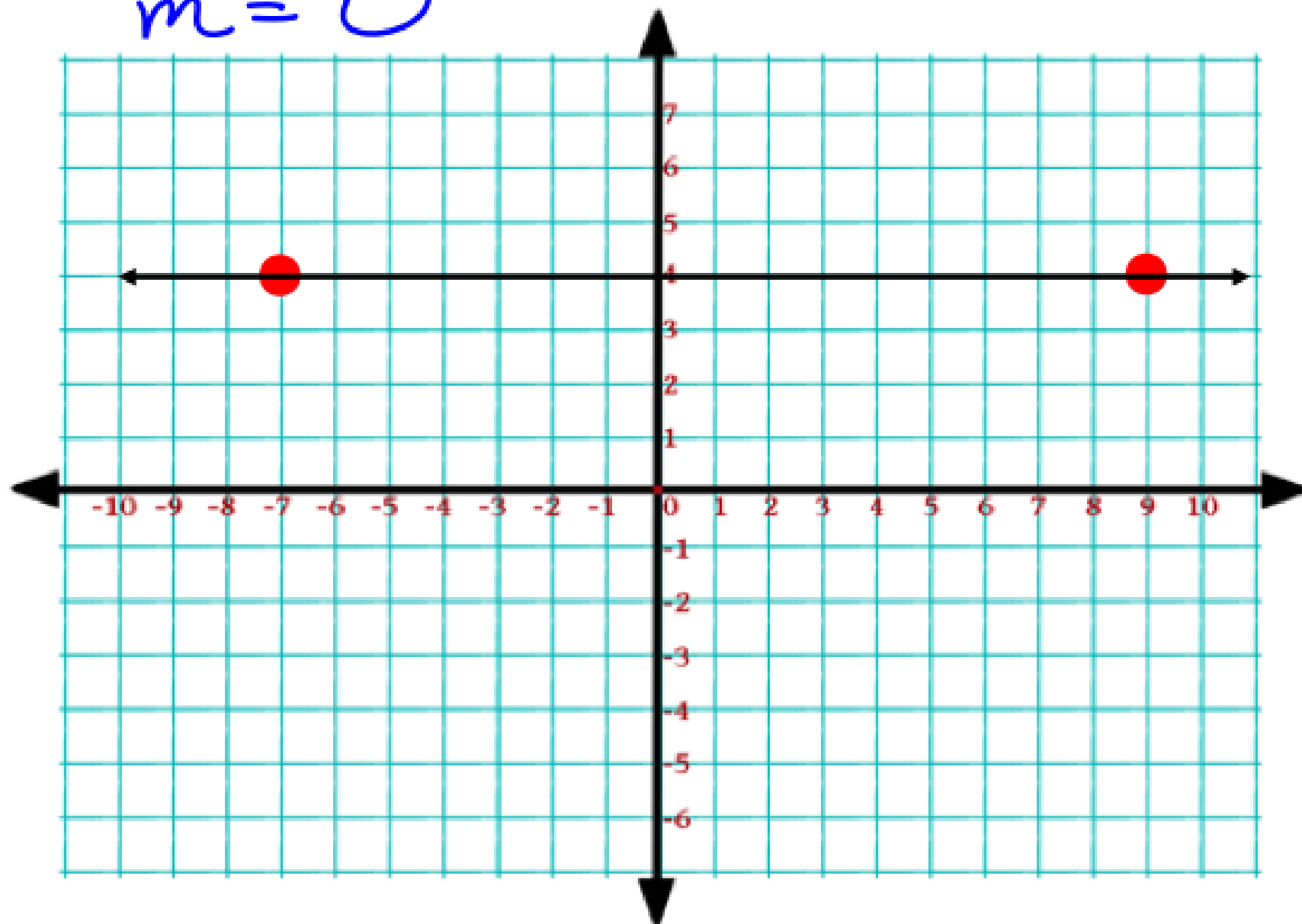
$$\frac{\text{rise}}{\text{run}}$$

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



4. Find the slope of the line.

$$m = 0$$



Find the value of  $y$  when given the slope.

5.  $(3, y), (1, 5); m = -2$

$$\frac{y-5}{3-1} = \frac{-2}{1}$$

$$1(y-5) = 2 \cdot -2$$

$$y-5 = -4$$

$$y = 1$$

6.  $(3, 5), (1, y); m = 3/2$

$$\frac{y-5}{1-3} = \frac{3}{2}$$

$$2(y-5) = 3 \cdot -2$$

$$2y-10 = -6$$

$$2y = 4$$

$$y = 2$$

## Applications of Slope in Real-Life Situations

The *grade* of a road is its **slope** written as a **percent**. A warning sign must be posted if a section of road has a grade of at least 8% and is more than 750 feet long.

7a. A road rises 63 feet over a horizontal distance of 840 feet. Should a warning sign be posted? Explain your thinking.

$$\text{slope of the road} = \frac{63}{840} = \underbrace{.075}_{7.5\% \text{ grade}}$$

Warning sign is  
not necessary  
 $7.5\% < 8\%$

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7b. The grade of a section of road that stretches over a horizontal distance of 1000 feet is 9%. How many feet does the road rise over that distance?

$$\frac{\text{rise}}{\text{run}} = \frac{y}{1000} = \frac{9}{100}$$
$$100y = 9000$$
$$y = 90 \text{ ft}$$