

Learning Goals

1. To understand what is meant by the slope of a line.
2. To understand how to use the formula to calculate the slope of a line.
3. To be able to calculate first differences.
4. To understand the purpose of the first difference calculation.
5. In the context of a real-life question, to understand what the slope and y- intercept of a line mean.

3.3 Slope and First Differences

Slope (m) - a measure used to describe the steepness of a line.

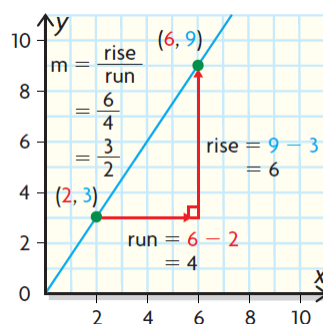
The formula for the slope of a line is:

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

$(1, 7)$
 $(-2, 8)$

x_1
 y_1

x_2
 y_2

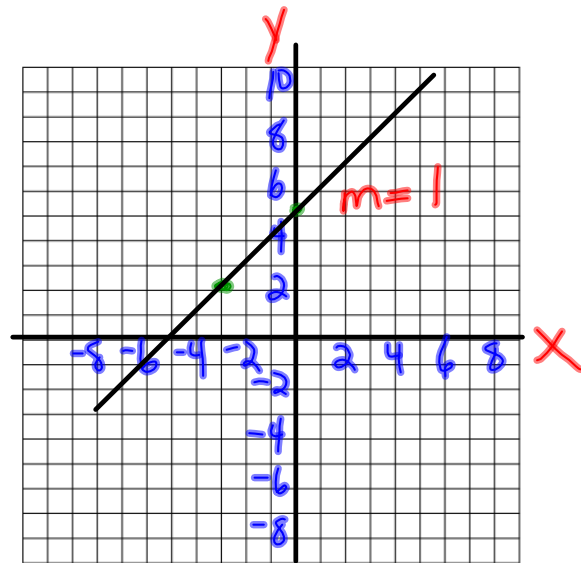


Example One

Determine the slope of the line that passes through the pt A(-3, 2) and B(0, 5).

$x_1 \ y_1$ $x_2 \ y_2$

$$\begin{aligned}
 m &= \frac{y_2 - y_1}{x_2 - x_1} \\
 &= \frac{5 - 2}{0 - (-3)} \\
 &= \frac{3}{3} \\
 &= 1
 \end{aligned}$$



First Differences - the difference between consecutive y-values in a table if the difference between the x-values is constant.

$m = \frac{\Delta y}{\Delta x}$
 slope formula

Time in Hours, x	Distance in Kilometres, y	First Difference, Δy
0	0	
2	30	$30 - 0 = 30$
4	60	$60 - 30 = 30$

$\Delta y = y_2 - y_1$
 or
 $y_3 - y_2$
 or
 $y_4 - y_3$

"the same"

If first differences are constant, then the relation is linear.

OR

If BOTH the x and y-values skip count by a constant number than the relation is linear.

Note: slope = rate of change = first difference

All of the above words mean the same thing.

Example Two

Is the following relation linear? How do you know?

x	y	1 st Difference Δy
3	12	
4	15	$15 - 12 = 3$
5	18	$18 - 15 = 3$
6	21	$21 - 18 = 3$

Yes it is linear b/c 1st differences are constant.

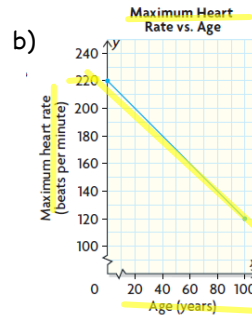
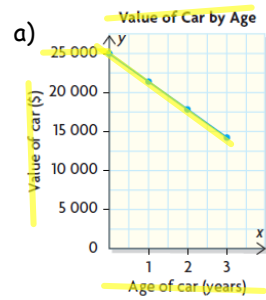
What is the rate of change for the linear relation above?

$$\text{rate of change} = \frac{\Delta y}{\Delta x}$$

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

Example Three

Use the title and axis labels to tell what the y-intercept and slope mean.



y-intercept - the spot where the line crosses the y-axis.

Graph A

y-intercept: the value of the car when it is just built.
 Slope: the value of the car drops as it ages.

Graph B

y-intercept: at age 0 the max heart rate is 220.
 Slope: your heart rate drops as you get older.

Complete: p. 156 - 159 #1 - 3, 7, 8, 11(graph ace), 13.