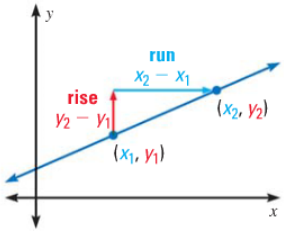
Algebra 1
5.3 Interpreting Rate of Change and Slope

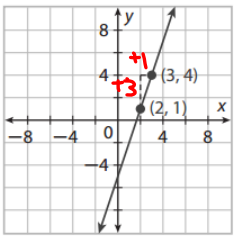
Finding the Slope of a Line

Words	Symbols	Graph
$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x}$	$m = \frac{y_2 - y_1}{x_2 - x_1}$

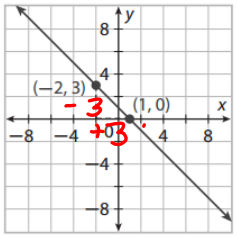


between any two points on that line

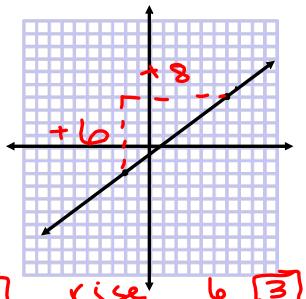
Ex 1) Find the slope of the lines shown.



$\frac{\text{rise}}{\text{run}} = \frac{3}{1} = 3$



$\frac{\text{rise}}{\text{run}} = \frac{-3}{3} = -1$



$\frac{\text{rise}}{\text{run}} = \frac{6}{8} = \frac{3}{4}$

Ex 2) Find the slope of the line that passes through the points

$(-2, 2)$ & $(3, 1)$

x_1, y_1 $\quad$ x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 2}{3 + 2} =$

$\frac{-1}{5}$

x	3	3	3	3
y	2	4	6	8

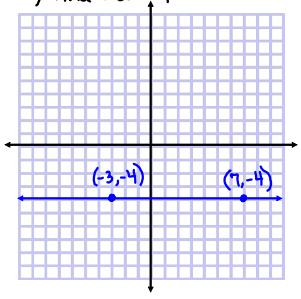
$(3, 2)$ $\quad$ $(3, 8)$

x_1, y_1 $\quad$ x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 2}{3 - 3}$

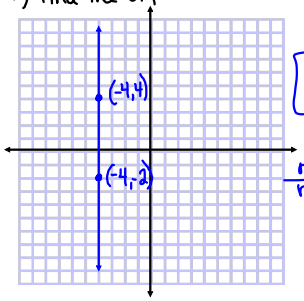
$= \frac{6}{0} =$ undefined

Ex 3) Find the slope of the line shown.



$\frac{\text{rise}}{\text{run}} = \frac{0}{10} = 0$

Ex 4) Find the slope of the line shown.



undefined

$\frac{\text{rise}}{\text{run}} = \frac{}{0}$

Try this:

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

4. (5, 2) and (5, −2) **5.** (0, 4) and (−3, 4) **6.** (0, 6) and (5, −4)

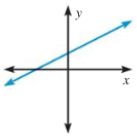
$\frac{}{5-5} = \frac{}{0}$ undefined

$\frac{4-4}{} = \frac{0}{}$ 0

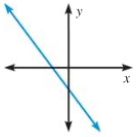
$\frac{-4-6}{5-0} = \frac{-10}{5}$ −2

Classification of Lines by Slope

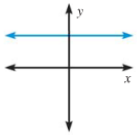
A line with positive slope ($m > 0$) *rises* from left to right.



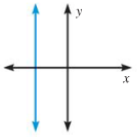
A line with negative slope ($m < 0$) *falls* from left to right.



A line with zero slope ($m = 0$) is *horizontal*.



A line with undefined slope is *vertical*.



Rate of change - compares a change in one quantity to a change in another quantity.

ex) The table shows the cost to paint a house for a given number of hours. Find the rate of change in cost with respect to time. Then interpret the slope.

y with respect to x

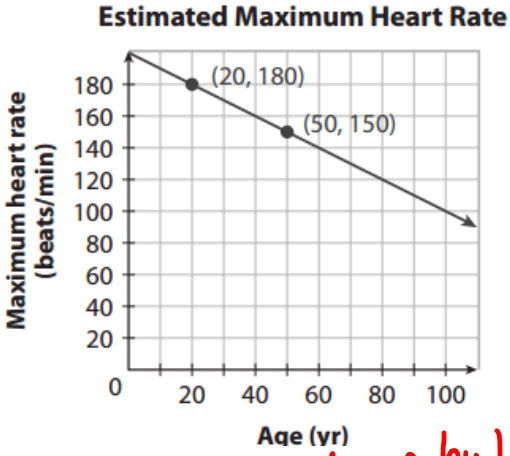
Time (hours) x	4	6	8
Cost ($) y	90	135	180

$\frac{y_2 - y_1 \text{ (cost)}}{x_2 - x_1 \text{ (time)}} = \frac{180-90}{8-4} = \frac{90}{4} \div 2 = \frac{45}{2} = \$22.50/\text{hr}$

Interpret: It's $22.50/hr to paint the house

Find and interpret the slope for each real-world situation.

The graph shows the relationship between a person's age and his or her estimated maximum heart rate.



$(20, 180)$ $(50, 150)$ (x_2, y_2) (x_1, y_1)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{180 - 150}{20 - 50}$$

$$= \frac{30 \text{ bts/min}}{-30 \text{ yrs}} = \frac{-1}{1}$$

The beats per min goes down by 1 for every yr older you get. So the older you get the slower your heart rate is.

Try this:

7. **EXERCISE** The table shows the distance a person walks for exercise. Find the rate of change in distance with respect to time.

Time (minutes) (x)	Distance (miles) (y)
30	1.5
60	3
90	4.5

$$\frac{3 - 1.5}{60 - 30} = \frac{1.5}{30} = .05$$

or $\frac{1}{20}$ miles/min

Find and interpret the slope.

The number of cubic feet of water y in a reservoir x hours after the water starts flowing into the reservoir is a linear function. The points (40, 3000) and (60, 4000) are on the line of the function.

$$\frac{4000 - 3000}{60 - 40} = \frac{1000}{20} = 50 \text{ cubic ft of water per hr}$$

The speed at which the reservoir is filling.

Discussion If you have a graph of a line, how can you determine whether the slope is positive, negative, zero, or undefined without using points on the line?

If the line is rising from left to right it's a positive slope.
If the line is falling from left to right it's a negative slope.
If it's a horizontal line the slope is zero.
If it's a vertical line the slope is undefined.

Homework:

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