Algebra 1
Moore/Hinds

Name: Key

4.3 Notes – Rate of Change and Slope

rate of change is a ratio that compares the amount of change in a dependent variable to the amount of change in an dependent variable.

Δ = change

Rate of change = $\frac{\Delta y}{\Delta x}$ OR Rate of change = $\frac{\text{change in } y}{\text{change in } x}$

Example 1: The table shows the average temperature (°F) for five months in a certain city. Find the rate of change for each time period. During which time period did the temperature increase at the fastest rate?

Month	2	3	5	7	8
Temp. (°F)	56	56	63	71	72

Dependent variable (y): temperature

Independent variable (x): # of months

Rate of change from month 2 to 3: $\frac{56-56}{3-2} = \frac{0}{1} = 0°F/\text{month}$

Rate of change from month 3 to 5: $\frac{63-56}{5-3} = \frac{7}{2} = 3.5°F/\text{month}$

Rate of change from month 5 to 7: $\frac{71-63}{7-5} = \frac{8}{2} = 4°F/\text{month}$

Rate of change from month 7 to 8: $\frac{72-71}{8-7} = \frac{1}{1} = 1°F/\text{month}$

The temperature increase increased the fastest from month 5–7

Example 2: The table shows the balance of a bank account on different days of the month. Find the rate of change during each time interval. During which time interval did the balance decrease at the greatest rate?

Day	1	6	16	22	30
Balance ($)	550	285	210	210	175

Dependent variable: balance ($)

Independent variable: # of days

Rate of change from day 1 to 6: $\frac{285-550}{6-1} = \frac{-265}{5} = \$-53/\text{day}$

Rate of change from day 6 to 16: $\frac{210-285}{16-6} = \frac{}{10} = \$-7.50/\text{day}$

Rate of change from day 16 to 22: $\frac{210-210}{22-16} = \frac{0}{6} = \$0/\text{day}$

Rate of change from day 22 to 30: $\frac{175-210}{30-22} = \frac{}{8} = \$4.38/\text{day}$

The balance decreased at the greatest rate from Day 1 to Day 6

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Slope of a Line

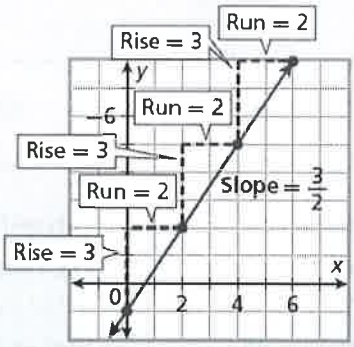
The **rise** is the difference in the *y*-values of two points on a line.

The **run** is the difference in the *x*-values of two points on a line.

The **slope** of a line is the ratio of rise to run for any two points on the line.

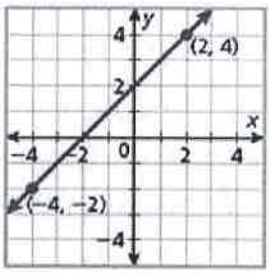
$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x}$$

(Remember that *y* is the **dependent variable** and *x* is the **independent variable**.)

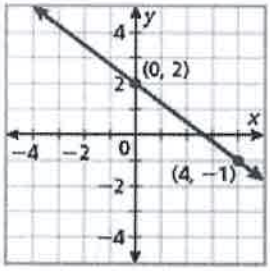


Example 3: Find the slope of each line.

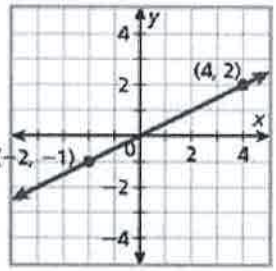
a.)



b.)



c.)



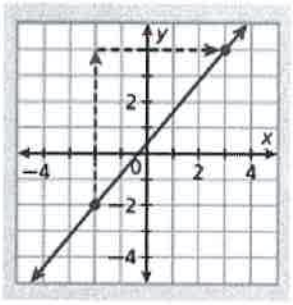
Slope = $\frac{\text{rise}}{\text{run}} = \frac{6}{6} = 1$

Slope = $\frac{\text{rise}}{\text{run}} = \frac{-3}{4}$

Slope = $\frac{\text{rise}}{\text{run}} = \frac{3}{6} = \frac{1}{2}$

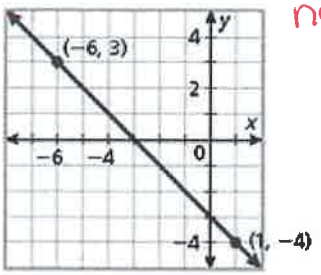
Try it! Find the slope of each line.

1.



positive

2.



negative

Slope = $\frac{6}{5}$

Slope = $\frac{-7}{7} = -1$

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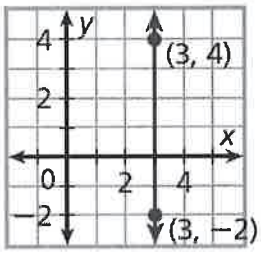
ecial Cases: Vertical and Horizontal lines

Example 4: Find the slope of each line.

a.) The slope of a vertical line is:

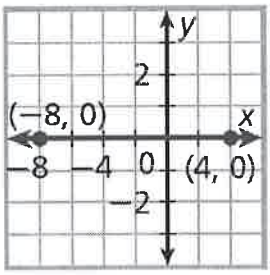


Rise: 6

Run: 0

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

b.) The slope of a horizontal line is:

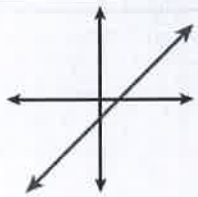
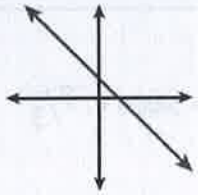
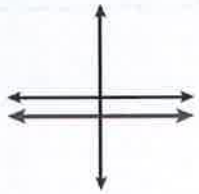
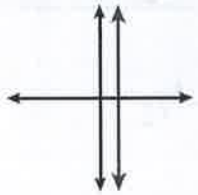


Rise: 0

Run: 6

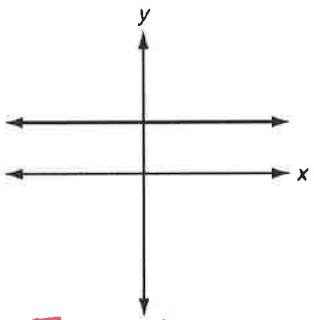
Slope: $\frac{0}{6}$ = 0

Example 5: Tell whether the slope of each line is positive, negative, zero, or undefined.

Positive Slope	Negative Slope	Zero Slope	Undefined Slope
			
Line rises from left to right.	Line falls from left to right.	Horizontal line	Vertical line

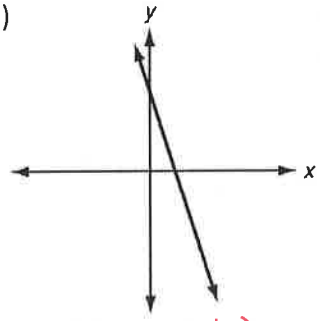
Try it! Tell whether the slope of each line is positive, negative, zero, or undefined.

a.)



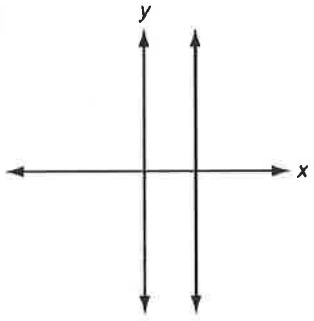
Zero

b.)



Negative

c.)



Undefined

HOY
* horizontal line
* zero slope
* y = __

VUX
* vertical line
* undefined slope
* x = __

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Example 6: The slope of a line is $^1/_3$ and the rise is 6. What is the run?

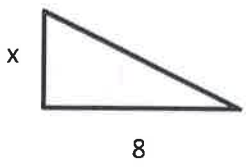
m x = run

$m = \frac{rise}{run}$ $\frac{1}{3} = \frac{6}{x}$ $x = 18$

The run is 18

Example 7: Given the slope, find the value of x using $\frac{rise}{run}$.

a.) Slope = $-^1/_2$

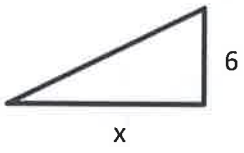


rise is -4

$m = \frac{rise}{run}$ $\frac{-1}{2} = \frac{x}{8}$

$\frac{-8}{2} = \frac{2x}{2}$ $-4 = x$

b.) Slope = $^2/_3$



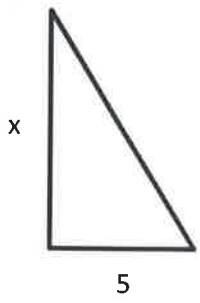
run is 9

$m = \frac{rise}{run}$ $\frac{2}{3} = \frac{6}{x}$

$\frac{2x}{2} = \frac{18}{2}$ $x = 9$

Try it!

1. Slope = $-^5/_2$

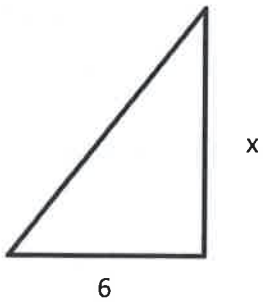


$\frac{-5}{2} = \frac{x}{5}$

$\frac{2x}{2} = \frac{-25}{2}$

$x = -12.5$

2. Slope = $^8/_3$



$\frac{8}{3} = \frac{x}{6}$

$\frac{3x}{3} = \frac{48}{3}$

$x = 16$

3. The slope of a line is $^1/_2$ and the run is 7. What is the rise?

$\frac{rise}{run}$ $\frac{1}{2} = \frac{x}{7}$

$\frac{2x}{2} = \frac{7}{2}$

$x = 3.5$