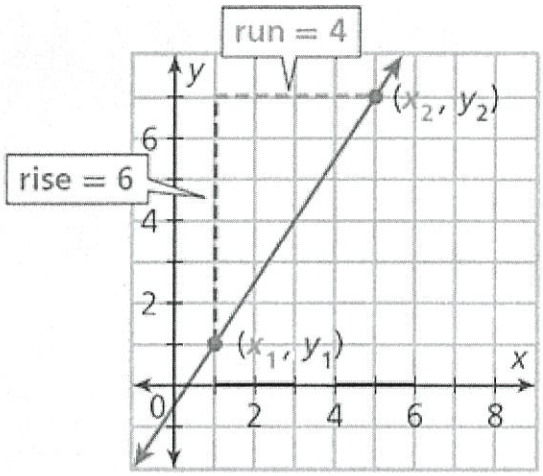
Honors Geometry
Notes – Section 3.5 Slopes of Lines

Name KEY
Date _____ Period _____

What is SLOPE?

- The **SLOPE** of a line in a coordinate plane is a number that describes the **STEEPNESS** of the line. Any two points on a line can be used to determine the slope.

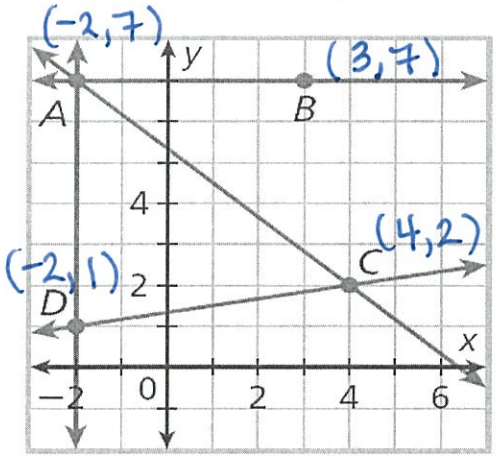
- Rise - The difference in the y-values of 2 pts on a line.
- Run - The difference in the x-values of 2 pts on a line.
- Slope - Ratio of the RISE to RUN.



If (x_1, y_1) and (x_2, y_2) are any two pts on a line, then:

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{(FORMULA)}$$

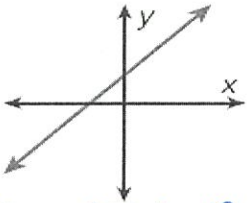
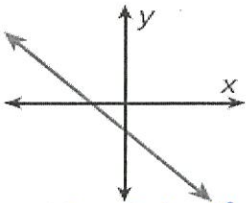
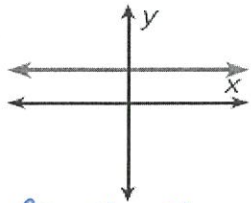
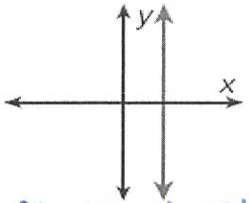
Example 1: Use the slope formula to determine the slope of each line.



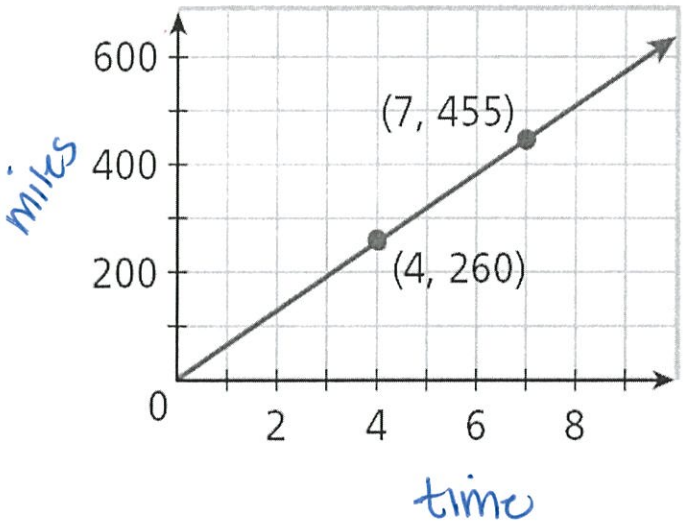
a. $\overleftrightarrow{AB}$ $m = \frac{7-7}{3-(-2)} = \frac{0}{5} = 0$ (HORIZ. LINE)

b. $\overleftrightarrow{CD}$ $m = \frac{2-1}{4-(-2)} = \frac{1}{6}$

c. $\overleftrightarrow{AD}$ $m = \frac{7-1}{-2-(-2)} = \frac{6}{0}$ = undefined (VERT. LINE)

Summary: Slope of a Line			
Positive Slope	Negative Slope	Zero Slope	Undefined Slope
			
Increases L-R	decreases L-R	y-Constant (HORIZ. LINE)	x-constant (VERT. LINE)

Example 2:
Justin is driving from home to his college dormitory. At 4:00 p.m., he is 260 miles from home. At 7:00 p.m., he is 455 miles from home. Graph the line that represents Justin's distance from home at a given time. Find and interpret the slope of the line.



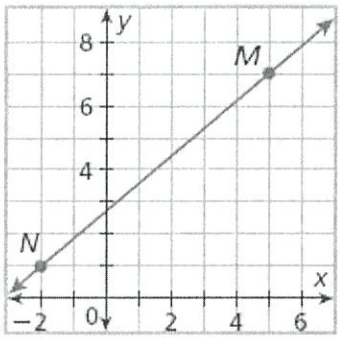
$m = \frac{455-260}{7-4} = \frac{195}{3} = \frac{65}{1} = 65$

65 mi/hr

As the time increases by 1 hour, the number of miles from home increases by 65.

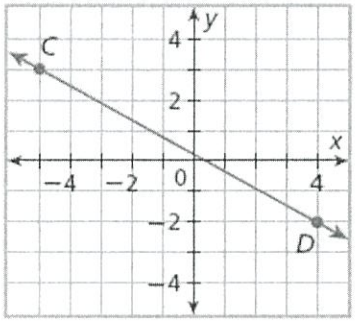
Example 3:
Identify whether the slopes of the following lines are positive, negative, zero, or undefined. Explain how you know. Compute the slopes.

a.



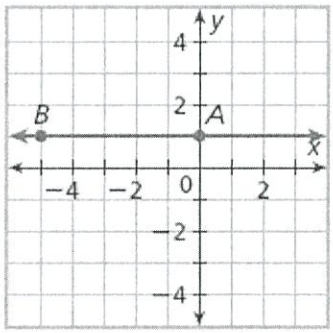
positive, $m = 6/7$

b.



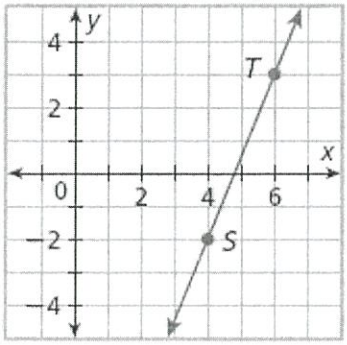
negative, $m = -5/9$

c.



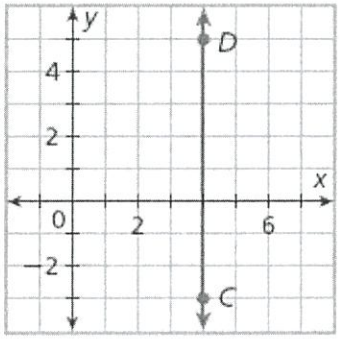
Constant, $m = 0$

d.



positive, $m = 5/2$

e.



undefined

What about Parallel and Perpendicular Lines?

Slopes of Parallel and Perpendicular Lines

3-5-1 Parallel Lines Theorem
In a coordinate plane, two nonvertical lines are parallel if and only if they have the same slope. Any two vertical lines are parallel.

3-5-2 Perpendicular Lines Theorem
In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their slopes is -1. Vertical and horizontal lines are perpendicular.

Opposite reciprocals

Example 4: Use slopes to determine whether each pair of lines are parallel, perpendicular, or neither.

a. $\overleftrightarrow{CD}: y = -3x - 1$ *and* $\overleftrightarrow{AB}: y = \frac{1}{3}x + 4$

$m = -3$ $\quad m = 1/3$

opp. recip. → perpendicular Lines!

b. $\boldsymbol{a}: 4x + 3y = 8$ *and* $\boldsymbol{b}: 4x - 3y = -8$

$3y = -4x + 8$ $\quad -3y = -4x - 8$

$y = -4/3\,x + 8/3$ $\quad y = 4/3\,x + 8/3$ → $m = -4/3$ $m = 4/3$

neither!

c. $\boldsymbol{m}: y = -\frac{3}{2}x + 5$ *and* $\boldsymbol{n}: 3x + 2y = -6$

$m = -\frac{3}{2}$ $\quad 2y = -3x - 6$

$y = -\frac{3}{2}x - 3$ → Parallel Lines!

same slope $\quad m = -3/2$

d. $\overline{UV}$ and $\overline{XY}$ for $U(0,2)$, $V(-1,-1)$, $X(3,1)$, $Y(-3,3)$

$\overleftrightarrow{UV}$: $m = \frac{-1-2}{-1-0} = \frac{-3}{-1} = 3$

$\overleftrightarrow{XY}$: $m = \frac{3-1}{-3-3} = \frac{2}{-6} = -1/3$

opp. recip → Perpendicular Lines!

e. $\overline{GH}$ and $\overline{IJ}$ for $G(-3,-2)$, $H(1,2)$, $I(-2,4)$, $J(2,-4)$

$\overleftrightarrow{GH}$: $m = \frac{2-(-2)}{1-(-3)} = \frac{4}{4} = 1$ → neither!

$\overleftrightarrow{IJ}$: $m = \frac{-4-4}{2-(-2)} = \frac{-8}{4} = -2$

f. $\overline{CD}$ and $\overline{EF}$ for $C(-1,-3)$, $D(1,1)$, $E(-1,1)$, $F(0,3)$

$\overleftrightarrow{CD}$: $m = \frac{1-(-3)}{1-(-1)} = \frac{4}{2} = 2$

same slope → Parallel Lines!

$\overleftrightarrow{EF}$: $m = \frac{3-1}{0-(-1)} = \frac{2}{1} = 2$