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Date: _____
 LESSON 1

AIM: WHAT IS THE RELATIONSHIP BETWEEN SLOPES AND PARALLEL LINES?

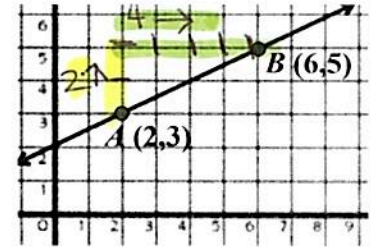
Do Now: On the graph draw where the rise and the run are and then determine the rise, run and slope of the line.

Rise = 2

Run = 4

Slope = $\frac{2}{4} = \frac{1}{2}$

RISE
RUN



Example #1: Two line segments, AB and CD are shown graphed below. Determine the slope of both of these lines graphically. Recall that slope is the ratio of the rise of the line to the run of the line as we move from left to right along the x-axis.

Slope of \overline{AB} :

rise = $\Delta y = 5$

run = $\Delta x = 10$

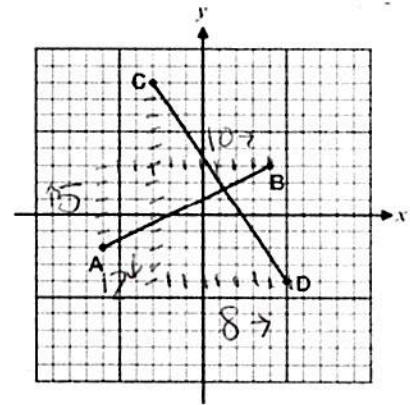
slope = $m = \frac{\Delta y}{\Delta x} = \frac{5}{10} = \frac{1}{2}$

Slope of \overline{CD} :

rise = $\Delta y = -12$

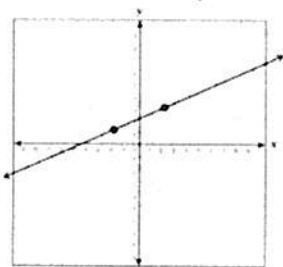
run = $\Delta x = 8$

slope = $m = \frac{\Delta y}{\Delta x} = \frac{-12}{8} = -\frac{6}{4} = -\frac{3}{2}$



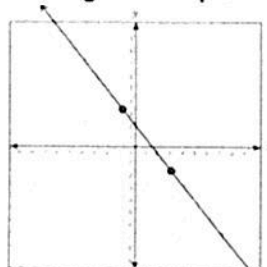
Coordinate Geometry Formula	Formal Definition
<p>SLOPE FORMULA</p>	<p>If (x_1, y_1) and (x_2, y_2) represent the endpoints of a line segment (or any two points on a line), then:</p> $m = \frac{y_2 - y_1}{x_2 - x_1}$

Positive Slope



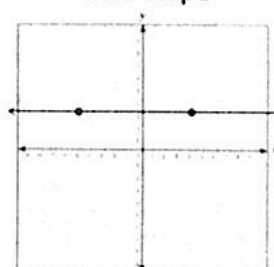
Rises to the right

Negative Slope



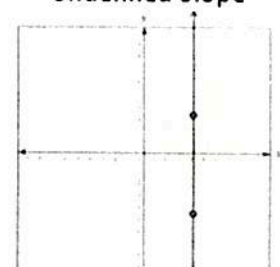
Falls to the right

Zero Slope



Horizontal line

Undefined Slope



Vertical line

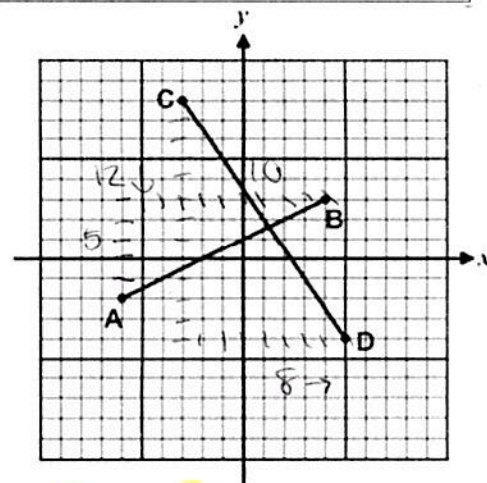
Example #2: Using the slope formula only, find the slope of the line segment that has the following endpoints. Write your slope in simplest form.

x_1, y_1 x_2, y_2	x_1, y_1 x_2, y_2	x_1, y_1 x_2, y_2	x_1, y_1 x_2, y_2	x_1, y_1 x_2, y_2
(a) A(-2, 4) B(8, 10)	(b) C(-10, 3) D(11, -9)	(c) E(2, 11) F(-2, 3)	(d) G(9, 3) H(-2, 3)	(e) I(-5, 4) J(-5, -2)
$m = \frac{10-4}{8-(-2)} = \frac{6}{10} = \frac{3}{5}$	$m = \frac{-9-3}{11-(-10)} = \frac{-12}{21} = \frac{-4}{7}$	$m = \frac{3-11}{-2-2} = \frac{-8}{-4} = \frac{2}{1}$	$m = \frac{3-3}{-2-9} = \frac{0}{-11} = 0$	$m = \frac{-2-4}{-5-(-5)} = \frac{-6}{0} = \text{undefined}$

Graphically	
Finding Slope	<p>Pick any <u>2</u> points on the line or segment. Start with the point more to the <u>LEFT</u>.</p> $m = \frac{\text{rise}}{\text{run}} \quad \begin{array}{l} \text{count boxes up or down} \\ \text{count boxes right} \end{array}$

Example #3: Two line segments, \overline{AB} and \overline{CD} are shown graphed below.

- a) Determine the slope of \overline{AB} . $\frac{5}{10} = \frac{1}{2}$
- b) Determine the slope of \overline{CD} . $-\frac{12}{8} = \frac{-3}{2}$



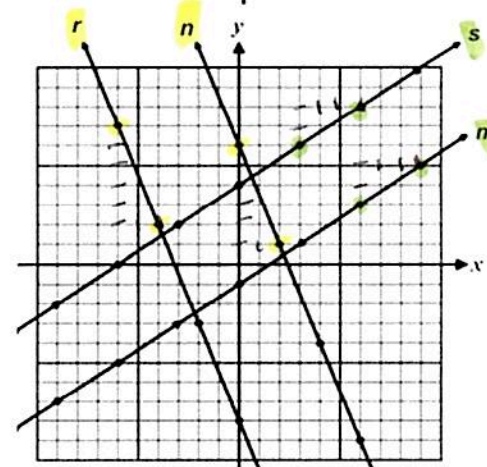
Example #4: In the diagram below, the two pairs of parallel lines are shown.

- (a) Name the parallel line pairs. $r \parallel n$ and $s \parallel m$

(b) For each pair, determine the slopes of the two lines that make up the pair. You can do this graphically or algebraically.

$m_r = -\frac{5}{2}$ $m_s = \frac{2}{3}$

$m_n = -\frac{5}{2}$ $m_m = \frac{2}{3}$



Discovery	Example
Parallel lines have <u>EQUAL</u> slopes!	$m = \frac{1}{2}$ then $\parallel m = \frac{1}{2}$

Example #5: Given the points $A(-2, 1)$, $B(6, 7)$, $C(-4, -3)$ and $D(8, 6)$.

(a) Is $\overline{AB} \parallel \overline{CD}$? Give evidence to support your answer.

$m_{\overline{AB}} = \frac{7-1}{6-(-2)} = \frac{6}{8} = \frac{3}{4}$ yes! Parallel lines have equal slopes
 $m_{\overline{CD}} = \frac{6-(-3)}{8-(-4)} = \frac{9}{12} = \frac{3}{4}$

(b) Is $\overline{AC} \parallel \overline{BD}$? Give evidence to support your answer.

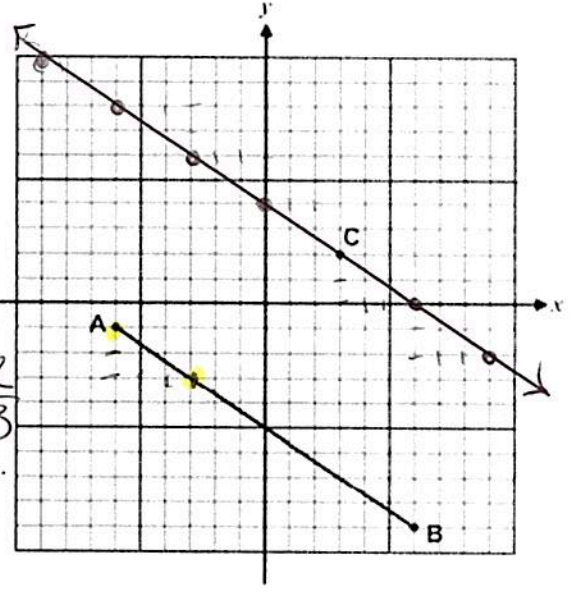
$m_{\overline{AC}} = \frac{-3-1}{-4-(-2)} = \frac{-4}{-2} = 2$ NO! Parallel lines have equal slopes.
 $m_{\overline{BD}} = \frac{6-7}{8-6} = \frac{-1}{2}$

Practice NYTS (Now You Try Some!)

1. On the diagram below, draw a line that passes through point C and is parallel to \overline{AB} . Explain how you created your line.

$m_{\overline{AB}} = -\frac{2}{3}$

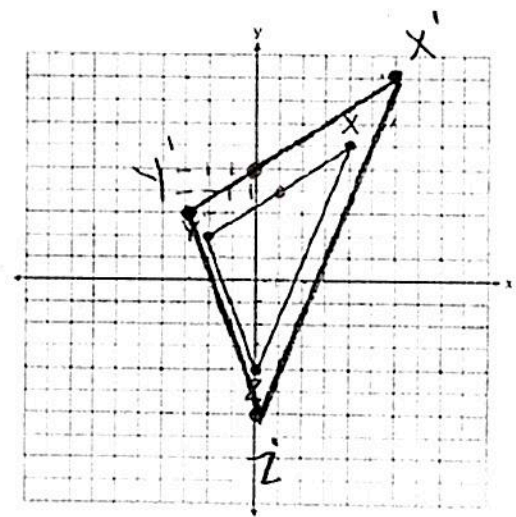
Parallel lines have equal slopes
 I found the slope of \overline{AB} to be $-\frac{2}{3}$ and repeated this from point C.



2. Triangle XYZ is graphed on the set of axes below. On the same set of axes, $\triangle X'Y'Z'$, the image of $\triangle XYZ$ after a dilation with a scale factor of $\frac{3}{2}$ centered at the origin is shown. Use slopes to explain why $\overline{Y'X'} \parallel \overline{YX}$.

$m_{\overline{Y'X'}} = \frac{2}{3}$ $m_{\overline{YX}} = \frac{2}{3}$

$\overline{Y'X'} \parallel \overline{YX}$ because parallel lines have equal slopes



Determine if #'s 1-3 are (T) rue or (F)alse.

1. If A (-3,5) and B (-5,7), then the slope of \overline{AB} is -1. ✓

(T) or F

$$m = \frac{7-5}{-5-(-3)} = \frac{2}{-2} = -1$$

2. If A (2,3) and B (4,9), then the slope of \overline{AB} is $\frac{1}{3}$. ✗

T or (F)

$$m = \frac{9-3}{4-2} = \frac{6}{2} = 3$$

3. If A (5,4) and B (5,5), then the slope of \overline{AB} is zero. ✗

T or (F)

$$\frac{5-4}{5-5} = \frac{1}{0} \text{ UNDEFINED!}$$

4. Given the four points A(-3,5), B(1,13), C(4,2) and D(10,5) are \overline{AB} and \overline{CD} parallel? Justify.

$$m_{\overline{AB}} = \frac{13-5}{1-(-3)} = \frac{8}{4} = 2 \quad m_{\overline{CD}} = \frac{5-2}{10-4} = \frac{3}{6} = \frac{1}{2}$$

NO! Parallel lines have equal slopes

5. Given the four points E(2,5), F(7,1), G(2,-3) and H(-8,5) is $\overline{EF} \parallel \overline{GH}$? Show how you determined your answer.

$$m_{\overline{EF}} = \frac{1-5}{7-2} = -\frac{4}{5} \quad m_{\overline{GH}} = \frac{5-(-3)}{-8-2} = \frac{8}{-10} = -\frac{4}{5}$$

yes! Parallel lines have equal slopes

6. Given quadrilateral ABCD shown, answer the following:

(a) Determine the slope of all four sides either algebraically or graphically. Label all slopes.

$$m_{\overline{AB}} = \frac{1}{5} \quad m_{\overline{DC}} = \frac{1}{5}$$

$$m_{\overline{BC}} = \frac{4}{1} \quad m_{\overline{AD}} = \frac{4}{1}$$

(b) State all pairs of parallel sides based on (a).

$$\overline{AB} \parallel \overline{DC}$$

$$\overline{BC} \parallel \overline{AD}$$

(c) What type of figure does this represent?

Parallelogram!

