3-5

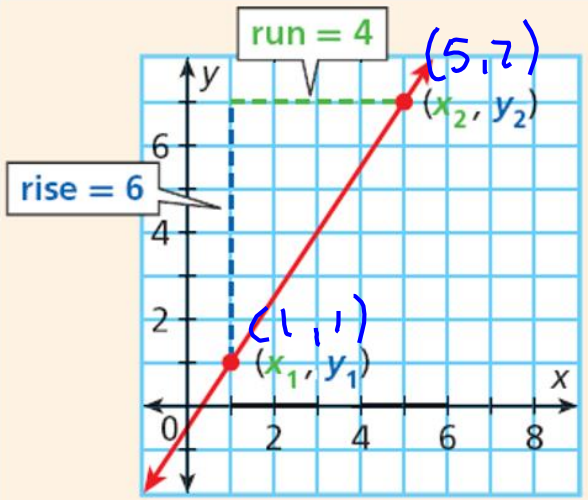
Slopes of Lines

OBJECTIVES

- To find the slope of a line
- To use slopes to identify parallel and perpendicular lines

KEY CONCEPTS

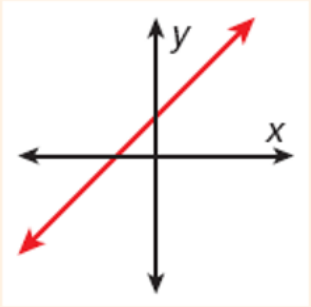
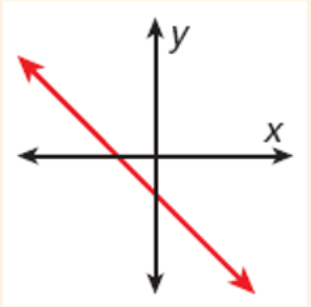
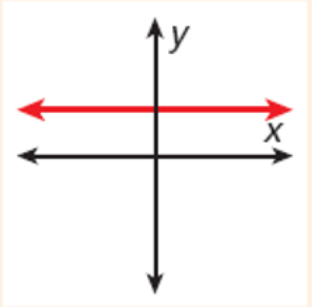
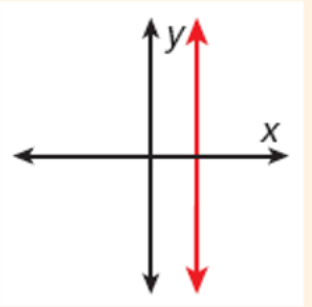
Slope of a Line

DEFINITION	EXAMPLE
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 the rise to run. If (x_1, y_1) and (x_2, y_2) are any two points on a line, the slope of the line is $m = \frac{y_2 - y_1}{x_2 - x_1}$.	

slope $= \frac{6}{4} = \frac{3}{2}$

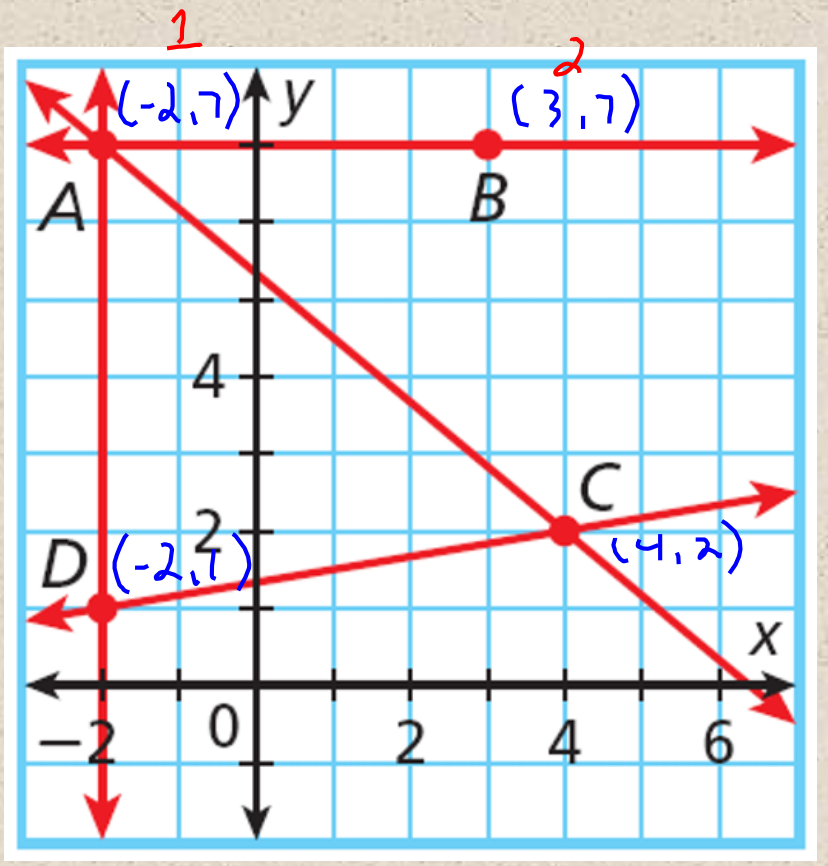
KEY CONCEPTS

Summary: Slope of a Line

Positive Slope	Negative Slope	Zero Slope	Undefined Slope
			

CLASS WORK

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



$\overleftrightarrow{AB}$: $m = \frac{7-7}{3+2} = \frac{0}{5} = 0$

$\overleftrightarrow{AC}$: $m = \frac{2-7}{4+2} = \frac{-5}{6}$

$\overleftrightarrow{AD}$: $m = \frac{1-7}{-2+2} = \frac{-6}{0}$ → undefined

$\overleftrightarrow{CD}$: $m = \frac{2-1}{4+2} = \frac{1}{6}$

KEY CONCEPTS

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.

If the slope of a line is $\frac{a}{b}$, then the slope of a parallel line is $\frac{a}{b}$.

If the slope of a line is $\frac{a}{b}$, then the slope of a perpendicular line is $-\frac{b}{a}$.

$\frac{a}{b}$ and $-\frac{b}{a}$ are called opposite reciprocals.

CLASS WORK

Find the slopes of the given lines to determine if they are parallel, perpendicular, or neither.

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

$\overleftrightarrow{UV}$: $m = \frac{-1-2}{-1-0} = \frac{-3}{-1} = 3$ $\overleftrightarrow{XY}$: $m = \frac{3-1}{-3-3} = \frac{2}{-6} = -\frac{1}{3}$ 1

3. $\overleftrightarrow{UV}$ and $\overleftrightarrow{XY}$ for U(-3, -2), V(1, 2), X(-2, 4), and Y(2, -4).

$\overleftrightarrow{UV}$: $m = \frac{2+2}{1+3} = \frac{4}{4} = 1$ $\overleftrightarrow{XY}$: $m = \frac{-4-4}{2+2} = \frac{-8}{4} = -2$

neither

CLASS WORK

Find the slopes of the given lines to determine if they are parallel, perpendicular, or neither.

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

5. $\overleftrightarrow{UV}$ and $\overleftrightarrow{XY}$ for U(-4, 4), V(-2, -3), X(3, 1), and Y(-5, -1).

CLASS WORK

Find the slopes of the given lines to determine if they are parallel, perpendicular, or neither.

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

$\frac{1+3}{1+1} = \frac{4}{2} = 2$ $\frac{3-1}{0+1} = \frac{2}{1} = 2$

Parallel

5. $\overleftrightarrow{UV}$ and $\overleftrightarrow{XY}$ for U(-4, 4), V(-2, -3), X(3, 1), and Y(-5, -1).

$\frac{-3-4}{-2+4} = \frac{-7}{2}$ $\frac{-1-1}{-5-3} = \frac{-2}{-8} = \frac{2}{8} = \frac{1}{4}$

neither

CHALLENGE

Justin is driving from home to his college dormitory. At 4:00 pm, he is 260 miles from home. At 7:00 pm, 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

CHALLENGE

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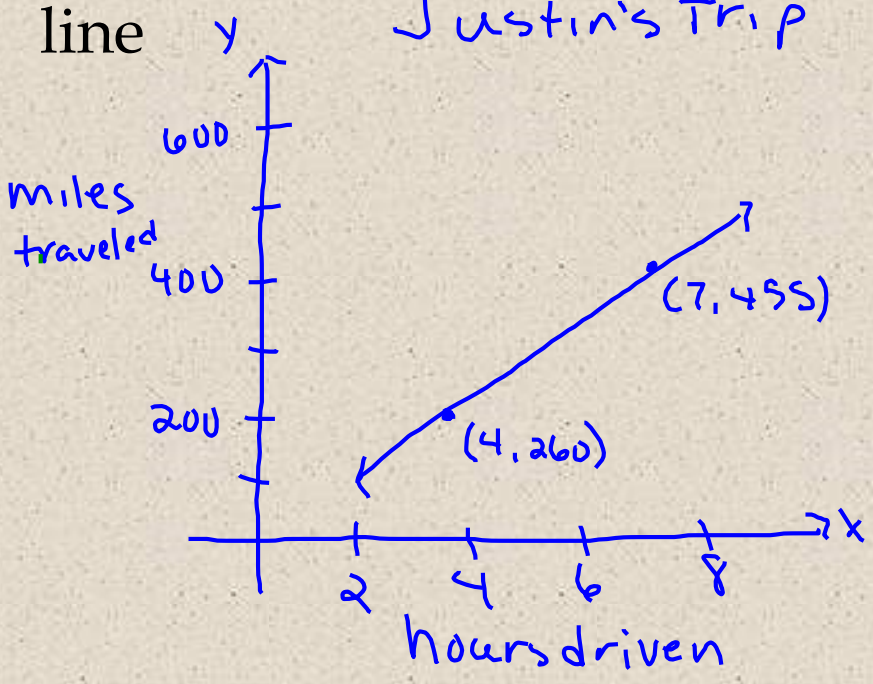

$$m = \frac{455 - 260}{7 - 4} = \frac{195}{3} = \frac{65}{1} \frac{\text{miles}}{\text{hr}}$$

Justin is travelling 65 miles per hour

SUMMARY

- The slopes of parallel lines are the same.
- The slopes of perpendicular lines are opposite reciprocals.

LEARNING RUBRIC

- Got It: Proves Calculates slope and categorizes lines in complex/real-world situations
- Almost There: Calculates and compares slopes to classify as parallel, perpendicular, or neither
- Moving Forward: Compare two slopes to categorize as parallel, perpendicular or neither
- Getting Started: Uses a graphed line or given points to calculate slope

HOMEWORK

Pages 186 – 187

10 – 18 all;

25 – 28 all