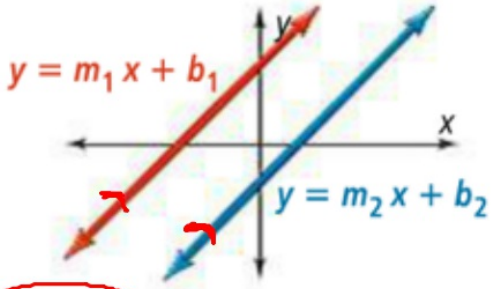
3.8 Slopes of Parallel and Perpendicular Lines

Learning Targets for today

- To be able to find the slope of a line on a coordinate plane.
- To be able to identify parallel and perpendicular lines on a coordinate plane by comparing their slopes.
- To be able to write an equation of a line parallel or perpendicular to a given line in a coordinate plane.

KEY CONCEPTS – Parallel and Perpendicular Lines

The slopes of **parallel lines** are equal.



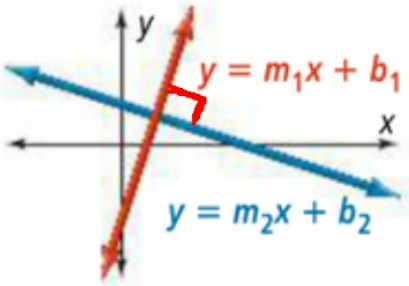
$m_1 = m_2$

$b_1 \neq b_2$

SAME SLOPE!

No line can be vertical.

The slopes of **perpendicular lines** are negative reciprocals of each other.



$m_1 \cdot m_2 = -1$

$m_1 = \frac{1}{m_2}$

$m_2 = \frac{1}{m_1}$

m_1 and m_2 are negative reciprocals of each other.

Ex: $y = 3x + 7$

$m = 3$

$m = -\frac{1}{3}$

(opposite reciprocals)

$M = -\frac{1}{2} \rightsquigarrow M = 2$

Identifying the Relationship of Two Lines

Example for you…	**Your turn to try….**
Determine whether the following lines are parallel, perpendicular or neither.	Determine whether the following lines are parallel, perpendicular or neither.

1. Line 1: (2, 0), (-1, 6)
   Line 2: (4, 7), (5, 5)

$x_1\ y_1 \quad x_2\ y_2$

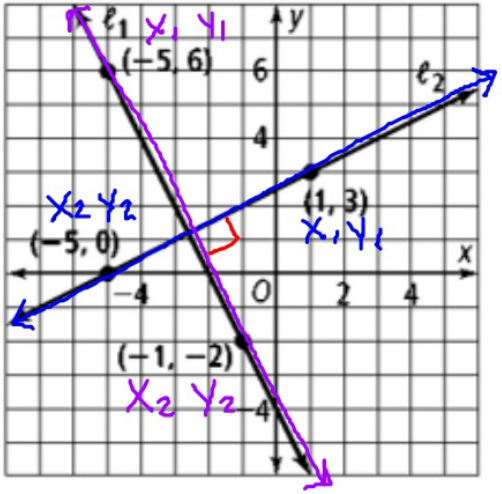
$m = \frac{y_2 - y_1}{x_2 - x_1}$

$m_1 = \frac{6-0}{-1-2} = \frac{6}{-3} = -2$ ✓

PARALLEL!

$m_2 = \frac{5-7}{5-4} = \frac{-2}{1} = -2$ ✓

1.



$m_1 = \frac{-2-6}{-1-5} = \frac{-8}{4} = -2$ ✓

$m_2 = \frac{0-3}{-5-1} = \frac{-3}{-6} = \frac{1}{2}$ ✓

Perpendicular

$y = mx + b$

Identifying the Relationship of Two Lines

Example for you…	**Your turn to try….**
Tell whether $\overleftrightarrow{JK}$ and $\overleftrightarrow{LM}$ are *parallel, perpendicular,* or *neither.*	Tell whether $\overleftrightarrow{JK}$ and $\overleftrightarrow{LM}$ are *parallel, perpendicular,* or *neither.*
1. Line $\overleftrightarrow{JK}$: $2x - y = 1$ Line $\overleftrightarrow{LM}$: $x + 2y = -1$ $y = 2x - 1$ $y = -\frac{1}{2}x - \frac{1}{2}$ Perpendicular $\overleftrightarrow{JK} \perp \overleftrightarrow{LM}$	1. Line $\overleftrightarrow{JK}$: $2y = 4x + 15$ Line $\overleftrightarrow{LM}$: $6y - 30 = 12x$ $y = 2x + 7.5$ $y = 2x + 5$ Parallel $\overleftrightarrow{JK} \parallel \overleftrightarrow{LM}$

Writing Equations of Parallel and Perpendicular Lines

Example for you.	Your turn to try….
1. Write an equation of the line that passes through (-4, 1) and is ***parallel*** to the line ~~$y = -2x + 3$~~.	1. Write an equation of the line that passes through (-6, 4) and is ***parallel*** to the line ~~$y = \frac{1}{2}x + 2$~~.
$m = -2$ $y - y_1 = m(x - x_1)$ $y - 1 = -2(x - -4)$ $y - 1 = -2(x + 4)$ $y - 1 = -2x - 8$ $+1 \quad +1$ $y = -2x - 7$	$m = \frac{1}{2}$ $y - 4 = \frac{1}{2}(x - -6)$ $y - 4 = \frac{1}{2}(x + 6)$ $y - 4 = \frac{1}{2}x + 3$ $+4 \quad +4$ $y = \frac{1}{2}x + 7$
2. Write an equation of the line that passes through (-4, 1) and is ***perpendicular*** to the line ~~$y = -2x + 3$~~.	2. Write an equation of the line that passes through (-6, 4) and is ***perpendicular*** to the line ~~$y = \frac{1}{2}x + 2$~~.
$m = \frac{1}{2}$ $y - y_1 = m(x - x_1)$ $y - 1 = \frac{1}{2}(x - -4)$ $y - 1 = \frac{1}{2}(x + 4)$ $y - 1 = \frac{1}{2}x + 2$ $+1 \quad +1$ $y = \frac{1}{2}x + 3$	$m = -2$ $y - 4 = -2(x - -6)$ $y - 4 = -2(x + 6)$ $y - 4 = -2x - 12$ $+4 \quad +4$ $y = -2x - 8$

3.5	Parallel Lines and Triangles	❑ To be able to use parallel lines to prove a theorem about triangles. ❑ To be able to find measures of angles of triangles. ❑ To know and understand that the sum of the angle measures of a triangle is always the same.	
3.6	Constructing Parallel and Perpendicular Lines	❑ To be able to use a straightedge and compass to construct parallel and perpendicular lines.	
3.7	Equations of Lines in the Coordinate Plane	❑ To be able to write a linear equation when given information about the equations such as its slope and or a point on the line. ❑ To be able to graph a linear equation when given information about the equation such as its slope and or a point on the line.	
3.8	Slopes of Parallel and Perpendicular Lines	❑ To be able to find the slope of a line on a coordinate plane. ❑ To be able to identify parallel and perpendicular lines on a coordinate plane by comparing their slopes. ❑ To be able to write an equation of a line parallel or perpendicular to a given line in a coordinate plane.	

pg. 201
#8 - #26
(even)

TEST WEDNESDAY!