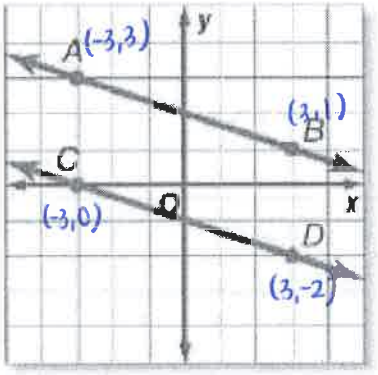
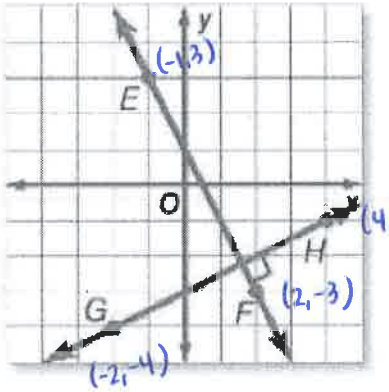
Geometry A
Slope and Parallel/Perpendicular Lines

Name: Key
Date: _____ Period : _____

LEARNING TARGETS

- I can identify parallel and perpendicular lines by examining slopes.
- I can write equations of parallel and perpendicular lines.

	Parallel Lines	Perpendicular Lines
Definition	Two lines are **parallel** if they have the Same slope.	To lines are **perpendicular** if their slopes are opposite reciprocals. **or** their product is -1
Graph Models	 Slope of $\overleftrightarrow{AB}$, $m_1 =$ -1/3 Slope of $\overleftrightarrow{CD}$, $m_2 =$ -1/3	 Slope of $\overleftrightarrow{EF}$, $m_1 =$ -2 Slope of $\overleftrightarrow{GH}$, $m_2 =$ 1/2
Symbols	$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$	$\overleftrightarrow{EF} \perp \overleftrightarrow{GH}$

$m_{\overleftrightarrow{AB}} = \frac{1-3}{3+3} = \frac{-2}{6} = -\frac{1}{3}$

$m_{\overleftrightarrow{CD}} = \frac{-2-0}{3+3} = \frac{-2}{6} =$

$m_{\overleftrightarrow{EF}} = \frac{-3-3}{2+1} = \frac{-6}{3} = -2$

$m_{\overleftrightarrow{GH}} = \frac{-4+1}{-2-4} = \frac{-3}{-6} = \frac{1}{2}$

Slope Criterion for Parallel Lines

Two non-vertical lines are parallel if and only if they have the same slope.

Vertical lines are always parallel. ↕ ↕

Example 1: Find the slope of a line parallel to the line containing A(-3, 4) and B(2, 5).

$m_{\overleftrightarrow{AB}} = \frac{5-4}{2+3} = \frac{1}{5}$

Slope of line parallel will be the same so $\boxed{m = \frac{1}{5}}$

Example 2: Write an equation of a line that is parallel to $y = \frac{2}{3}x + 7$

$y = \frac{2}{3}x + 8$ ← different y-intercept

↑ same slope

The line parallel to $y = \frac{2}{3}x + 7$ will have the same slope but a different y-intercept

Example 3: Write an equation of the line passing through the point (3, 4) that is parallel to the line $y = -4x + 5$.

old slope = -4

new slope = -4 thru (3,4)
m x y

$y = mx + b$

$4 = -4(3) + b$ ← solve for new y-intercept

$4 = -12 + b$

$16 = b$

$\boxed{y = -4x + 16}$

Example 4: Graph the line parallel to line *AB* that passes through point *P* and write its equation.

① Slope of $\overleftrightarrow{AB} = \frac{-2-0}{0-4} = \frac{-2}{-4} = \frac{1}{2}$ ← rise / ← run

② From P, count a rise of 1 and run of 2 and plot a second point

③ Equation: $m = \frac{1}{2}$ thru $P(2,2)$ (x y) ⇒

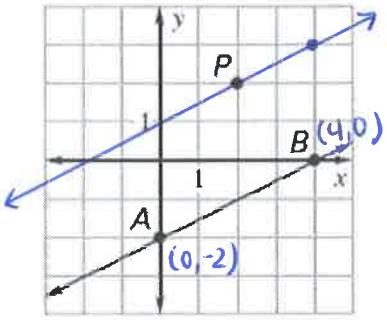
$y = mx + b$

$2 = \frac{1}{2}(2) + b$

$2 = 1 + b$

$1 = b$

⇒ $\boxed{y = \frac{1}{2}x + 1}$



Check Point: Chose One!

1. Write an equation of the line passing through the point (-2, 5) that is parallel to the line $y = 2x - 7$.

old slope = 2

new slope = 2 thru (-2,5)
m x y

$y = mx + b$

$5 = 2(-2) + b$

$5 = -4 + b$

$9 = b$

⇒ $\boxed{y = 2x + 9}$

2. Write an equation of the line passing through the point (3, 5) that is parallel to the line passing through (3, 3) and (-3, -1).

old slope = $\frac{-1-3}{-3-3}$, $\frac{-4}{-6} = \frac{2}{3}$

new slope = $\frac{2}{3}$ thru (3,5)
m x y

$y = mx + b$

$5 = \frac{2}{3}(3) + b$

$5 = 2 + b$

$3 = b$

⇒ $\boxed{y = \frac{2}{3}x + 3}$

Slope Criterion for Perpendicular Lines

Two non-vertical lines are perpendicular if and only if their slopes are opp. reciprocals.

Vertical lines and horizontal lines are always ⊥. 

Example 1: Find the slope of a line perpendicular to the line containing A(-3, 4) and B(2, 5).

old slope = $\frac{5-4}{2+3} = \frac{1}{5}$

⊥ slope = -5

The slope of the line ⊥ would have an opp. reciprocal slope of -5.

Example 2: Write an equation of a line that is perpendicular to $y = \frac{2}{3}x + 7$

$y = -\frac{3}{2}x + 8$

The line perpendicular to $y = \frac{2}{3}x + 7$ would have an opposite reciprocal slope and either the same y-intercept or a different y-intercept

Example 3: Write an equation of the line passing through the point (6, -3) that is perpendicular to the $y = -4x + 5$

old slope = -4

new slope = $\frac{1}{4}$ thru $(6, -3)$ (m, x, y)

$y = mx + b$

$-3 = \frac{1}{4}(6) + b$

$-3 = \frac{6}{4} + b$

$-3 = 1.5 + b \Rightarrow b = -4.5$

$y = \frac{1}{4}x - 4.5$

Example 4: Graph the line perpendicular to line AB that passes through point P and write its equation.

① Find slope of $\overleftrightarrow{AB}$ = $\frac{-1-1}{-1+3} = \frac{-2}{2} = \frac{-1}{1}$ ← rise / run

② slope of line ⊥ = $\frac{1}{1}$; Start at P and count a rise of 1 & run of 1 & plot point

③ Equation: $m = 1$ thru $P(1, 3)$ (x, y) ⇒

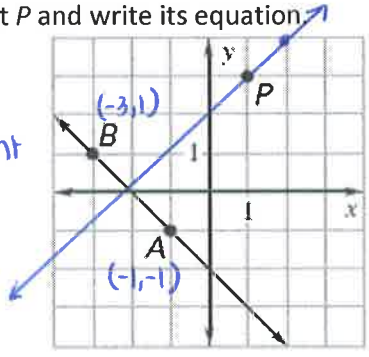
$y = mx + b$

$3 = 1(1) + b$

$3 = 1 + b$

$b = 2$

$\Rightarrow y = 1x + 2$



Check Point: Choose One!

1. Write an equation of the line passing through the point (-2, 5) that is perpendicular to the line $y = 2x - 7$

old slope = 2

new slope = $-\frac{1}{2}$ thru $(-2, 5)$ (m, x, y)

$y = mx + b$

$5 = -\frac{1}{2}(-2) + b$

$5 = 1 + b$

$b = 4$

$\Rightarrow y = -\frac{1}{2}x + 4$

2. Write an equation of the line passing through the point (3, 5) that is perpendicular to the line passing through (3, 3) and (-3, -1).

old slope = $\frac{-1-3}{-3-3} = \frac{-4}{-6} = \frac{2}{3}$

new slope = $-\frac{3}{2}$ thru $(3, 5)$

$y = mx + b$

$5 = -\frac{3}{2}(3) + b$

$5 = -\frac{9}{2} + b$

$5 = -4.5 + b \Rightarrow b = 9.5$

$\Rightarrow y = -\frac{3}{2}x + 9.5$