Warm Up

Find the slope of each of the equations below.

$3x + 4y = 9$ $\boxed{-\frac{3}{4}}$

$-4x - 6y = -9$ $\boxed{-\frac{2}{3}}$

$-\frac{4}{3}x + 2y = 6$ $\boxed{\frac{2}{3}}$

$\frac{3}{4}x - \frac{4}{3}y = \frac{5}{3}$ $\boxed{\frac{9}{16}}$

$-\frac{2}{3}x + \frac{3}{5}y = \frac{5}{6}$ $\boxed{\frac{10}{9}}$

$\frac{4}{5}x - \frac{13}{4}y = -\frac{6}{5}$ $\boxed{\frac{16}{65}}$

Essential Question

How can the equations of lines help you identify whether the lines are parallel, perpendicular, or neither?

Needed Vocab:
► **Parallel Lines**
► **Perpendicular Lines**
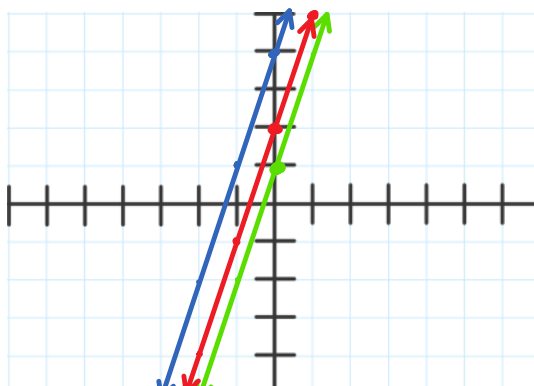► **Reciprocal**

Goal: "I can...
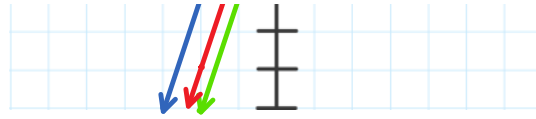**Write equations of parallel and perpendicular lines."**

Graph these three equations.

$y = 3x + 1$
$y = 3x + 2$
$y = 3x + 4$

Pick any of the two lines you graphed above, how are the two lines related to one another? Would your answer be the same if you picked another set of two lines? Discuss with the people next to you what you think the relationship is and why you think that. Can you identify in the equations something that could tell you this prior to graphing?

EXAMPLE 1

What is the equation of a line, in slope-intercept form, that is parallel to the given line below and passes through the point (8, 9).

$$y = \frac{3}{4}x - 2$$

$\uparrow$

$\frac{3}{4}$ is //.

$y - 9 = \frac{3}{4}(x-8)$

$y - 9 = \frac{3}{4}x - 6$

$\boxed{y = \frac{3}{4}x + 3}$

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1. Write the equation of the line in slope-intercept form that passes through the point (-3, 5) and is parallel to $y = \boxed{-\frac{2}{3}}x$.

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

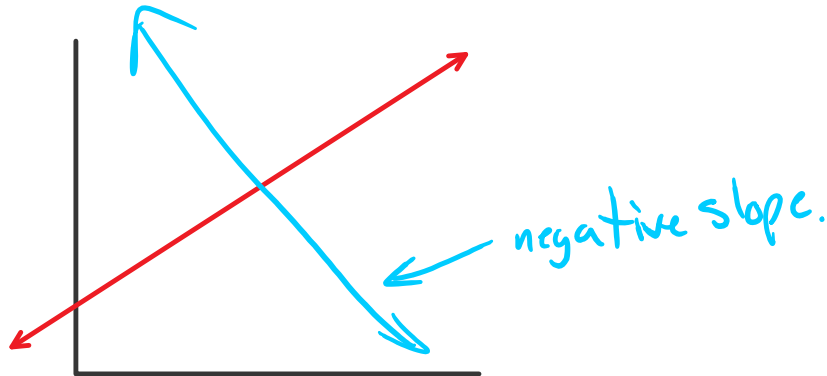$y - 5 = -\frac{2}{3}x - 2$

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

In general, what makes lines perpendicular to one another?

What will this look like in the coordinate plane?

original slope	$\perp$ slope	$\parallel$ slope
$\frac{a}{b}$	$-\frac{b}{a}$	$\frac{a}{b}$

What do we know, if anything, about the slope of the perpendicular line to the line drawn below?

negative slope.

Example 2

What is the equation of the line that passes through the point (1, 7) and is perpendicular to the graph of $y = -\frac{1}{4}x + 11$

$$\frac{4}{1}$$

$$y - 7 = 4(x - 1)$$
$$y = 4x + 3$$

either

2. Write the equation of the line that passes through the point (4, 5) and is perpendicular to the graph of $y = 2x - 3$.

$$y - 5 = -\frac{1}{2}(x - 4)$$

EXAMPLE 3

Are the graphs of the equations $3y = -4x + 6$ and $y = -\frac{3}{4}x - 5$ parallel, perpendicular or neither?

$-\frac{4}{3}$ $\qquad$ $-\frac{3}{4}$

neither

3. Are the graphs of the equations parallel, perpendicular or neither?

a. $y = 2x + 6$ and $y = \frac{1}{2}x + 3$
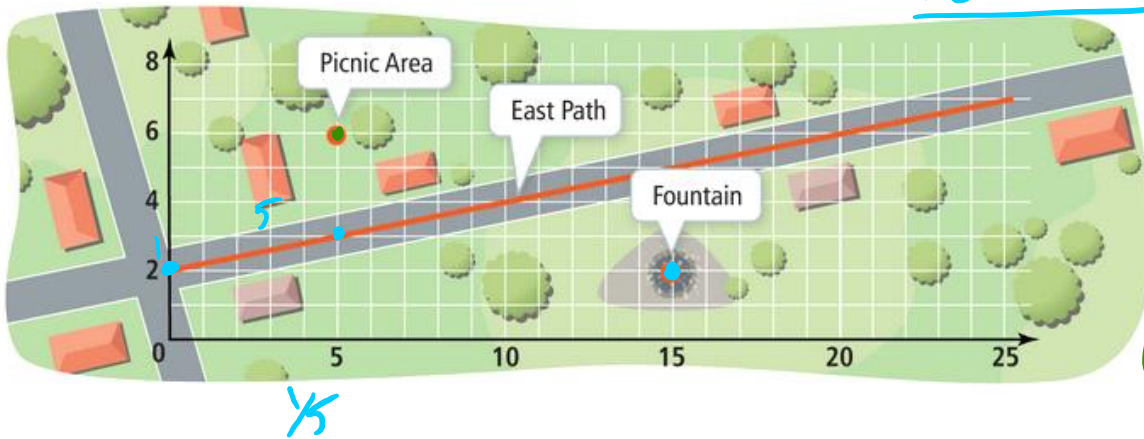
neither

b. $y = -5x$ and $25x + 5y = 1$

$-5 = -5$

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EXAMPLE 4

A landscaper plans to install two new paths in a park. The new Fountain Path will be perpendicular to the east path and lead to the fountain. The new Picnic Path will be parallel to the Fountain Path and Pass through the picnic area. What are the equations in point-slope form that represent the new paths?

Fountain (15,2) ⊥

$y - 2 = -5(x - 15)$
$y - 2 = -5x + 75$
$y = -5x + 77$

Picnic (5,6)

$y - 6 = \frac{1}{5}(x - 5)$
$y = \frac{1}{5}x + 5$

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4. The equation $y = 2x + 7$ represents the North Path on a map.

   Find the equation for a path that passes through the point (6, 3) and is parallel to the North Path.

   m = 2

   $y - 3 = 2(x - 6)$ $y = 2x - 9$

   Find the equation for a path that passes through the same point but is perpendicular to the North Path.

   m = -½

   $y - 3 = -\frac{1}{2}(x - 6)$ $y = -\frac{1}{2}x + 6$

Parallel Lines and Perpendicular Lines

	Parallel Lines	Perpendicular Lines
WORDS	The graphs of two equations are parallel if the slopes are the same.	The graphs of two equations are perpendicular if the slopes are opposite reciprocals.
NUMBERS	$\frac{1}{2} = \frac{1}{2}$ $\quad$ $y = \frac{1}{2}x + 3$ $\qquad$ $y = \frac{1}{2}x - 2$	$\frac{1}{2} \cdot -2 = -1$ $\quad$ $y = \frac{1}{2}x + 3$ $\qquad$ $y = -2x + 2$
GRAPHS	$y = \frac{1}{2}x + 3$ $\quad$ $y = \frac{1}{2}x - 2$	$y = \frac{1}{2}x + 3$ $\quad$ $y = -2x + 2$
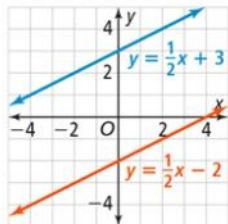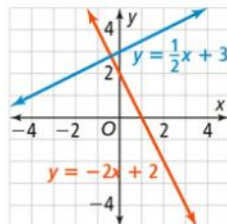
Homework

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