

WARM UP

Find the slope of each of the equations below.

$$3x + 4y = 9$$

$$-4x - 6y = -9$$

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

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

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

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

ESSENTIAL QUESTION

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

NEEDED VOCAB:

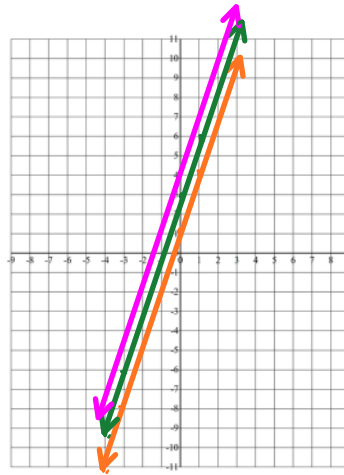
- ▶ **Parallel Lines**
- ▶ **Perpendicular Lines**
- ▶ **Reciprocal**

GOAL: "I CAN. . .

Write equations of parallel and perpendicular lines."

Graph these three equations.

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



These 3 lines are parallel. Parallel lines have equal slopes.

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).

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

$m = \frac{3}{4}$ ↑ point

point slope

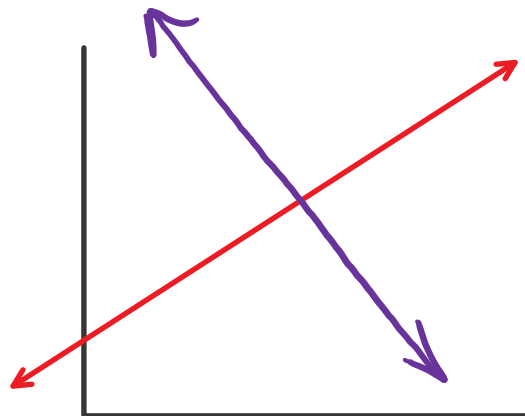
$$y - 9 = \frac{3}{4}(x - 8) \quad \text{then solve for } y.$$
$$y - 9 = \frac{3}{4}x - 6$$
$$\begin{array}{r} +9 \\ y - 9 = \frac{3}{4}x - 6 \\ \hline y = \frac{3}{4}x + 3 \end{array}$$

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

In general, what makes lines perpendicular to one another? *intersect at 90°*

What will this look like in the coordinate plane? *opposite of one another*

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



*line drawn is +
so perpendicular
would be -.*

EXAMPLE 2

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

Perpendicular slopes are negative reciprocals of each other. \perp to $-\frac{1}{4}$ is $+4$.

$y - 7 = 4(x - 1)$ point slope.

$y - 7 = 4(x - 1)$ point slope.

$y = 4x + 5$ slope-intercept.

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

EXAMPLE 3

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

$y = -\frac{4}{3}x + 2$ $y = -\frac{3}{4}x - 5$



reciprocals but same sign... neither

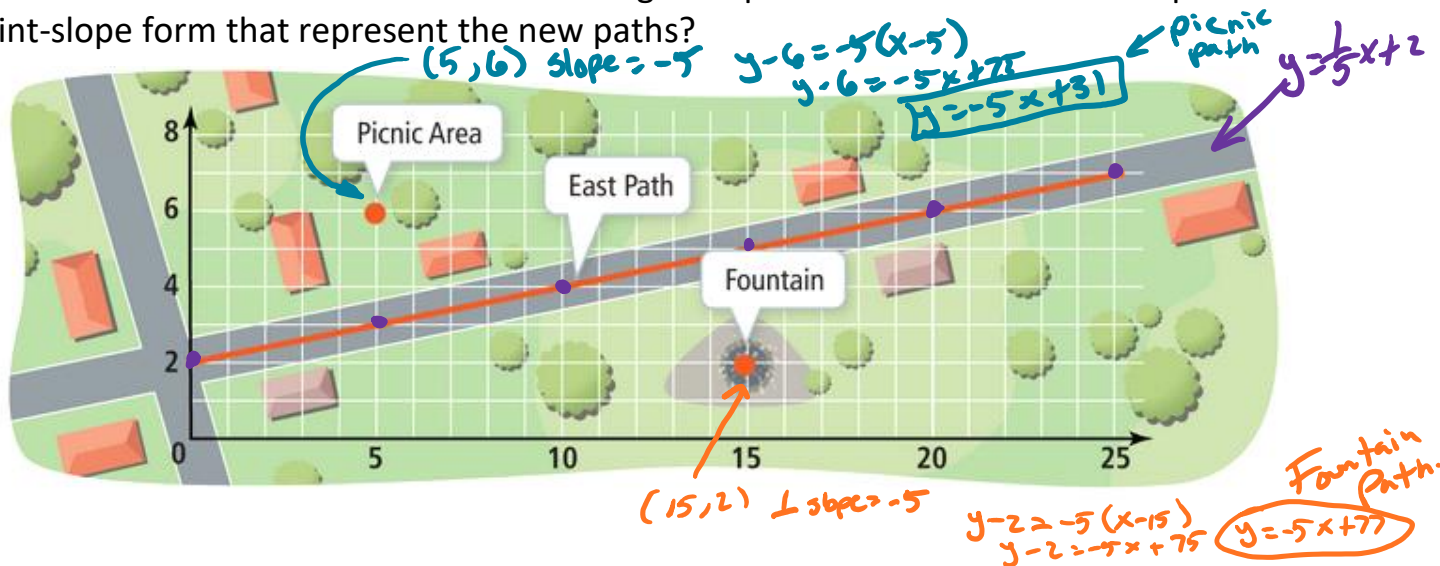
3. Are the graphs of the equations parallel, perpendicular or neither?

a. $y = 2x + 6$ and $y = \frac{1}{2}x + 3$

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

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?



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.

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

Parallel Lines and Perpendicular Lines

Parallel Lines

WORDS

The graphs of two equations are parallel if the slopes are the same.

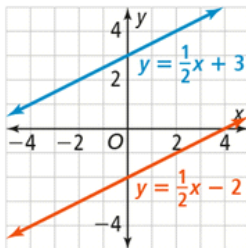
$$\frac{1}{2} = \frac{1}{2}$$

NUMBERS

$$y = \frac{1}{2}x + 3$$

$$y = \frac{1}{2}x - 2$$

GRAPHS



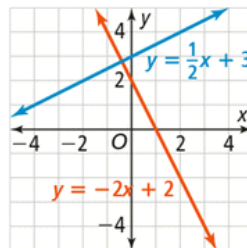
Perpendicular Lines

The graphs of two equations are perpendicular if the slopes are opposite reciprocals.

$$\frac{1}{2} \cdot -2 = -1$$

$$y = \frac{1}{2}x + 3$$

$$y = -2x + 2$$



HOMework

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