Parallel Lines $\parallel$                                    Perpendicular Lines $\perp$

**have same slope**                    **have opposite, reciprocal slopes**

Ex 1

What is the equation of the line in slope-intercept form that passes through the point (8, 9) and is parallel to the graph of $y = \frac{3}{4}x - 2$?

**means has** $m = \frac{3}{4}$

$$9 = \frac{3}{4}(8) + b \quad xy$$
$$9 = 6 + b$$
$$3 = b$$
$$\boxed{y = \frac{3}{4}x + 3}$$

OR
$$y - 9 = \frac{3}{4}(x - 8)$$
$$y - 9 = \frac{3}{4}x - 6$$
$$\boxed{y = \frac{3}{4}x + 3}$$

Try It!

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

$$5 = -\frac{2}{3}(-3) + b \quad xy$$
$$5 = 2 + b$$
$$3 = b$$
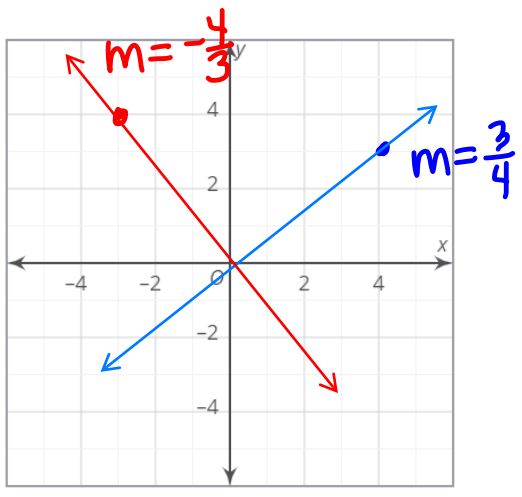$$\boxed{y = -\frac{2}{3}x + 3}$$

Ex 2  *Show video from online text Section 2-4 Ex 2

How can you show that two lines are perpendicular?

A. How can you create two perpendicular lines?

B. How do the slopes of perpendicular lines compare?

**Note:**
horizontal & vertical lines are also $\perp$ but their slopes are not opposite reciprocals

$m =$ undefined
$m = 0$

$m = -\frac{4}{3}$

$m = \frac{3}{4}$



Try It!

Why does it make sense that slopes of perpendicular lines have opposite signs?

**if one is pos**
**$\perp$ to it must be neg**

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Ex 3

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

means slope is
opp. rec → $+\frac{4}{1}$

$xy$
$7 = 4(1) + b$
$7 = 4 + b$
$3 = b$

$y = 4x + 3$

Try It!

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

$5 = -\frac{1}{2}(4) + b$
$5 = -2 + b$
$7 = b$

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

$y = -\frac{1}{2}x + 7$

Ex 4

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

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

$m = -\frac{3}{4}$

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

$m = -\frac{4}{3}$

Try It!

Are the graphs of the equations *parallel, perpendicular, or neither?*

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

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

neither

b. $y = -5x$ and $25x + 5y = 1$
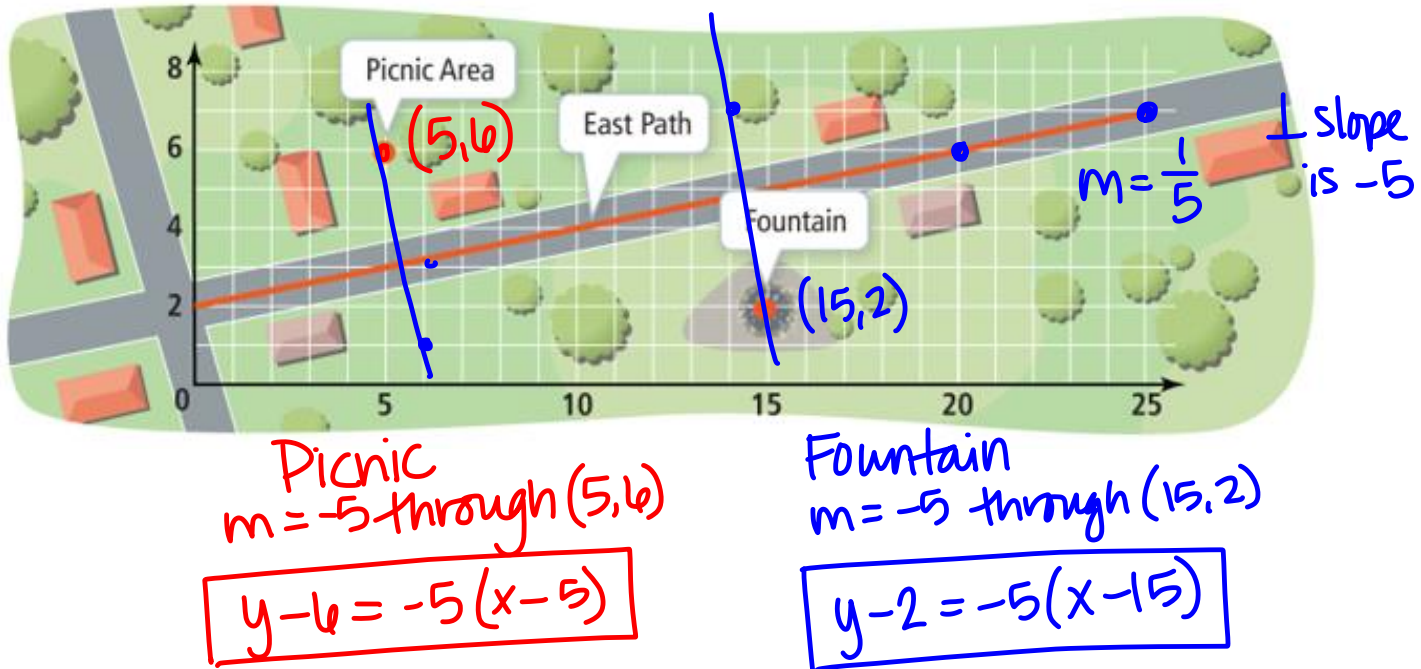
$m = -5$   $\frac{5y}{5} = \frac{-25x + 1}{5}$

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

$m = -5$

parallel

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Ex 5

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?

Picnic Area (5, 6)

East Path

Fountain

$m = \frac{1}{5}$  $\perp$ slope is -5

(15, 2)

Picnic
$m = -5$ through (5, 6)

$$y - 6 = -5(x - 5)$$

Fountain
$m = -5$ through (15, 2)

$$y - 2 = -5(x - 15)$$

Try It!

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

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

$m = 2$

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

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

(6, 3)  $m = -\frac{1}{2}$

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

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## 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_ |
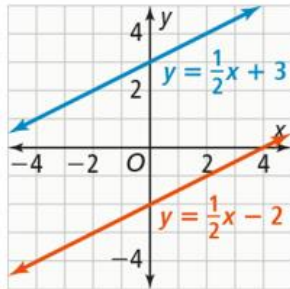
**NUMBERS**

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

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

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

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

**GRAPHS**

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

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

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

$y = -2x + 2$