Algebra 1   4.4
Write the equation of a line parallel to a given line
Write the equation of a line perpendicular to a given line

What do we need to write an equation for a line?

m slope $\frac{rise}{run}$ Slope, 1 point

vertical $\updownarrow$ y

horizontal $\longleftrightarrow$ x   2 points

$\parallel$ parallel never intersect, same slope

perpendicular intersect @ 90° slopes (?)

spaghetti lines

1 **Parallel Lines** Lines in the same plane that do not intersect are called **parallel lines**. Nonvertical parallel lines have the same slope.

All vertical lines are parallel.

If two nonvertical lines in a plane have the same slope, then they are parallel.
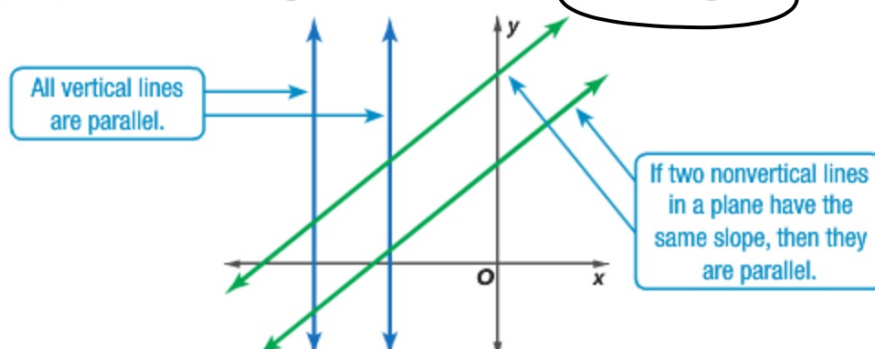
$$y = mx + B$$

Example 1 Parallel Line Through a Given Point

Write an equation in slope-intercept form for the line that passes through (−3, 5) and is parallel to the graph of y = 2x.

What do we need to know?

$$\left(-3, 5\right) \qquad m = 2$$
$$\quad\; x \quad y \qquad\qquad\quad m$$

$$y = mx + B$$
$$y = 2x + 11$$

$$5 = 2 \cdot -3 + B$$
$$5 = -6 + B$$
$$\underline{+6 \qquad +6}$$
$$11 = B$$

1. Write an equation in point-slope form for the line that passes through $(4, -1)$ and is <mark>parallel</mark> to the graph of $y = \frac{1}{4}x$.

What do we need to know?

$$\left(4, -1 \right)$$
$$\quad x \quad y$$

$$m = \frac{1}{4}$$

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

$$y = mx + B$$

$$-1 = \frac{1}{4} \cdot 4 + B$$

$$-1 = 1 + B$$
$$\underline{-1 \quad -1}$$
$$-2 = B$$

Whiteboards

$$y = mx + B$$

Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the graph of the given equation.

1. $(-1, 2)$, $y = \frac{1}{2}x$

x y

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

$2 = -0.5 + B$

$+.5 \qquad +.5$

$2.5 = B$

$y = \frac{1}{2}x + 2.5$

2. $(0, 4)$, $y = -4x$

$4 = -4 \cdot 0 + B$

$4 = 0 + B$

$4 = B$
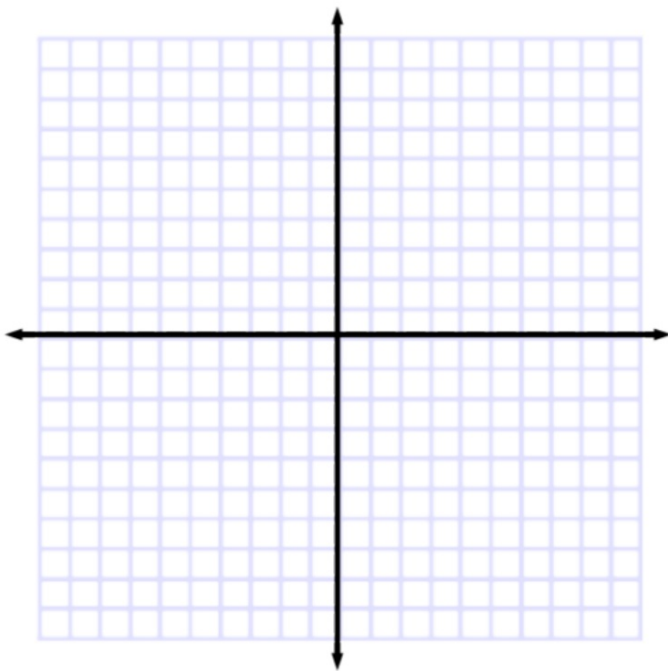
$y = -4x + 4$

$y - 3 = \left(\frac{1}{4}\right)(x - 7)$

$3x + 2y = 7$

$-3x \qquad -3x$

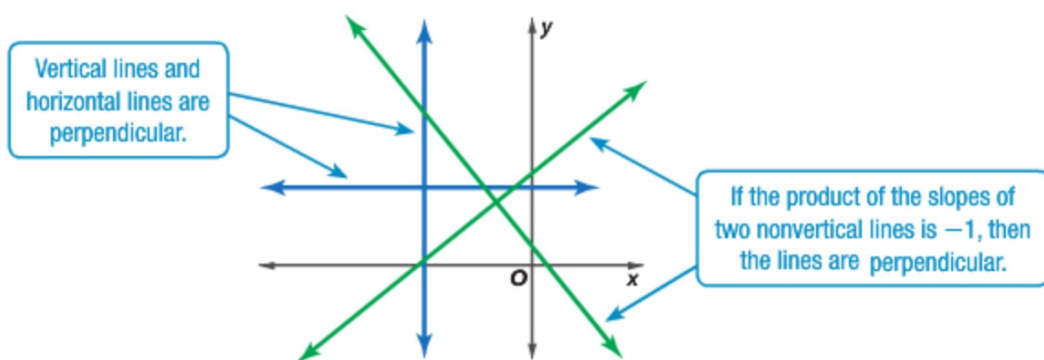$\frac{2y}{2} = \frac{-3x}{2} + \frac{7}{2}$

$y = \frac{-3}{2}x + 3.5$

What does it look like when 2 lines are perpendicular?

If 2 lines are perpendicular...
(what?)

2 Perpendicular Lines Lines that intersect at right angles are called **perpendicular lines**. The slopes of nonvertical perpendicular lines are opposite reciprocals. That is, if the slope of a line is 4, the slope of the line perpendicular to it is $-\frac{1}{4}$.

Vertical lines and horizontal lines are perpendicular.

If the product of the slopes of two nonvertical lines is -1, then the lines are perpendicular.

Partners:
One person write a slope.
Other person writes the perpendicular to the slope.

Eyeball is not enough...

2. **CONSTRUCTION** On the plans for a treehouse, a beam represented by $\overline{QR}$ has endpoints $Q(-6, 2)$ and $R(-1, 8)$. A connecting beam represented by $\overline{ST}$ has endpoints $S(-3, 6)$ and $T(-8, 5)$. Are the beams perpendicular? Explain.
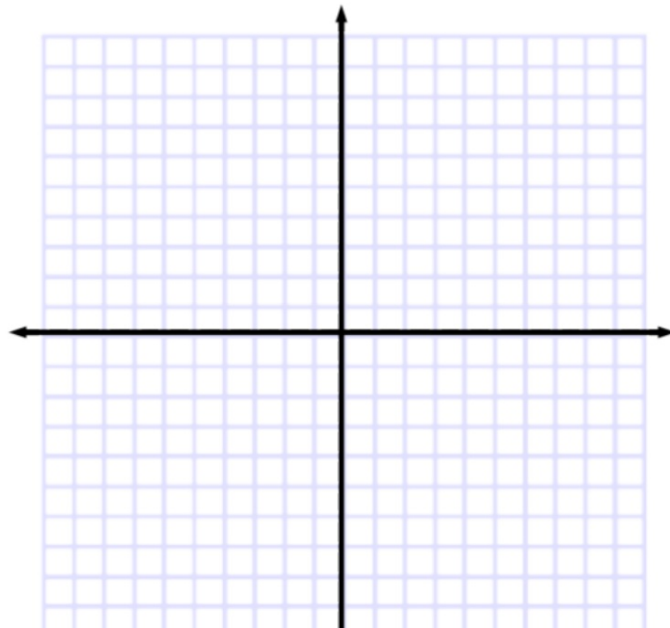
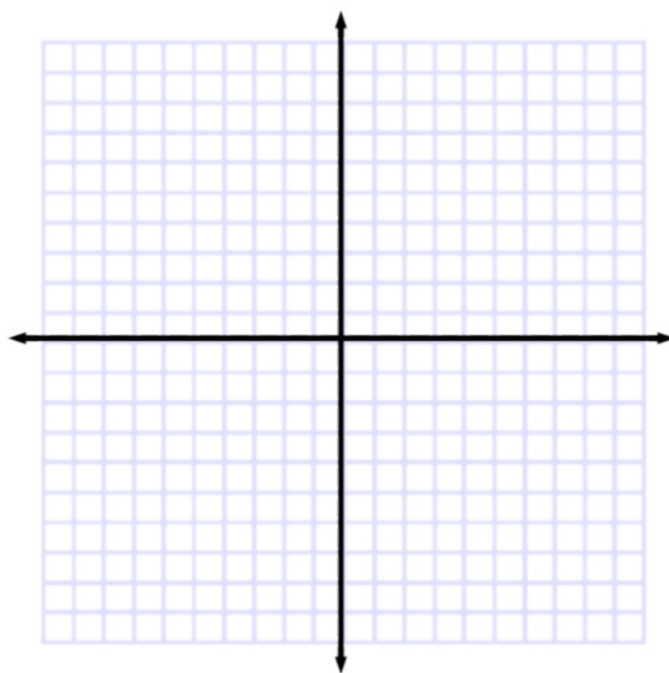**Example 3** Parallel or Perpendicular Lines

Determine whether the graphs of $y = 5$, $x = 3$, and $y = -2x + 1$ are *parallel* or *perpendicular*. Explain.

What do we need to know so that we can answer the question?
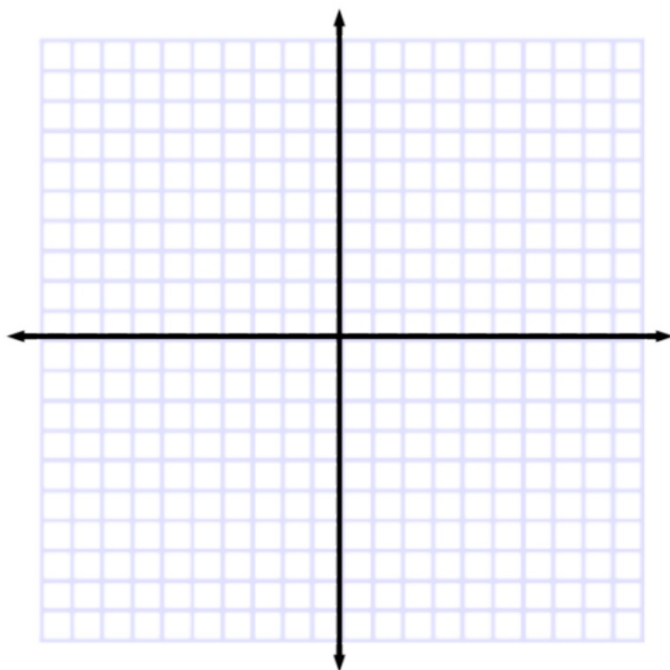
3. Determine whether the graphs of $6x - 2y = -2$, $y = 3x - 4$, and $y = 4$ are ==parallel or perpendicular.== Explain.
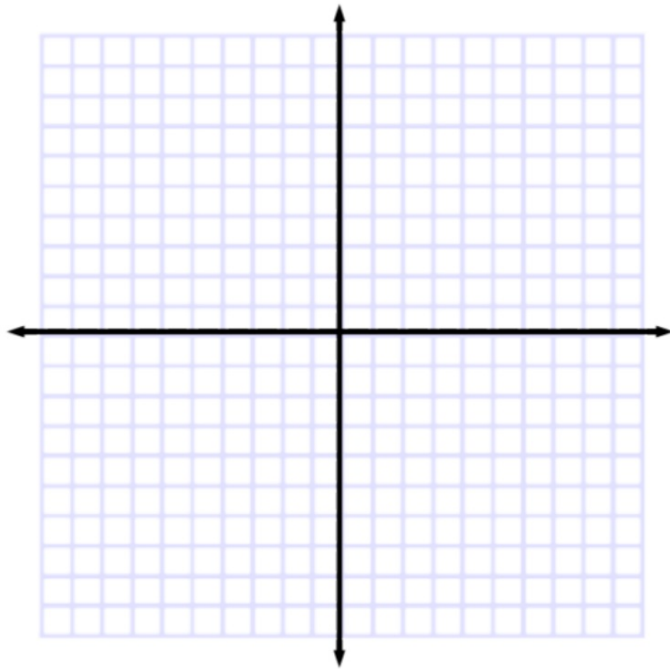
What do we need to know?

Example 4 Perpendicular Line Through a Given Point

Write an equation in slope-intercept form for the line that passes through
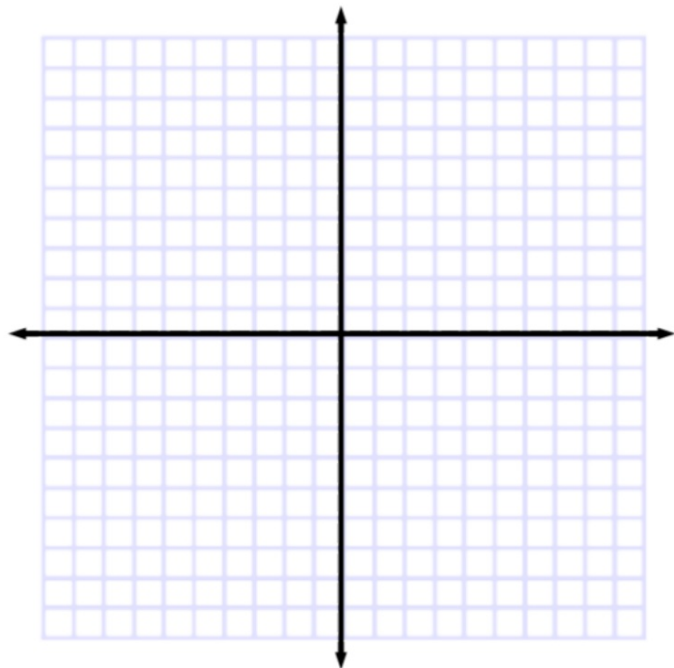$(-4, 6)$ and is <mark>perpendicular</mark> to the graph of $2x + 3y = 12$.

What do we need to know?

What do we need to know?

4. Write an equation in slope-intercept form for the line that passes through $(4,7)$ and is <mark>perpendicular</mark> to the graph of $y = \frac{2}{3}x - 1$.

Write an equation in slope-intercept form for the line that passes through the given point and is <mark>perpendicular</mark> to the graph of the equation.

7. $(-2, 3), y = -\frac{1}{2}x - 4$

8. $(-1, 4), y = 3x + 5$

What do we need to know?