

Lesson 3.3: Parallel and Perpendicular Lines

By the end of the lesson, we will be able to:

- ~ Define Parallel lines.
- ~ Find equations of Parallel lines.
- ~ Define Perpendicular lines.
- ~ Find equations of Perpendicular lines.

Quick Reminder!

Slope-Intercept Form:

$$y = mx + b$$

Point-Slope Form:

$$y - y_1 = m(x - x_1)$$

Definition

Parallel lines are lines that have exactly the same slope – but different y-intercepts.

Note: Vertical lines are parallel only if the x-intercepts are different.

Note: If two lines have the same slope and the same y-intercept, then they are the SAME line.

Lesson 3.3: Parallel and Perpendicular Lines

Determine whether the given lines are parallel.

a.) $4x + y = 8$

$6x + 2y = 12$

$4x + y = 8$

$y = -4x + 8$

$6x + 2y = 12$

$\frac{2y}{2} = \frac{-6x + 12}{2}$

$y = -3x + 6$

Not parallel

b.) $-3x + 2y = 6$

$6x - 4y = 8$

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

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

$\frac{4y}{-4} = \frac{-6x + 8}{-4}$

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

Parallel

Lesson 3.3: Parallel and Perpendicular Lines

Example 1:

Find the equation of the line that is parallel to

$4x + 2y = 2$ and goes through $(-2, 3)$. Graph.

Hint: Remember Point-Slope Form.

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

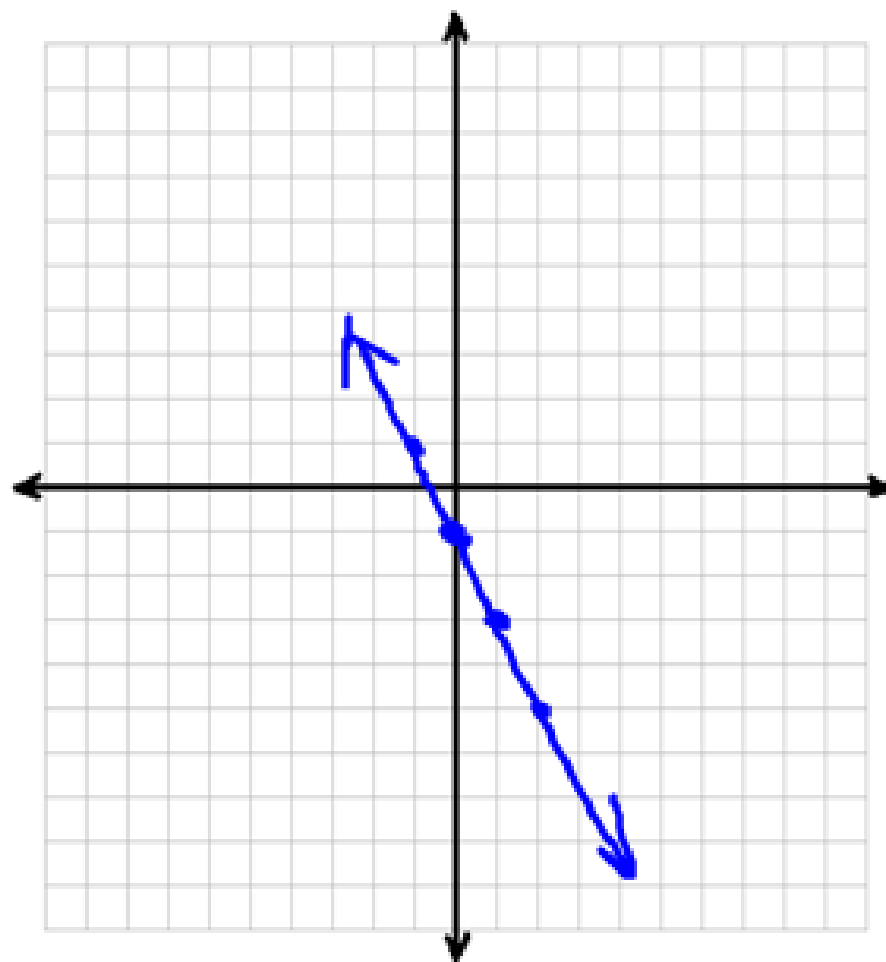
$$y = -2x + 1$$

$$m = -2$$

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

$$\begin{array}{r} y - 3 = -2x - 4 \\ \downarrow +3 \qquad \downarrow +3 \\ \hline \end{array}$$

$$y = -2x - 1$$



Lesson 3.3: Parallel and Perpendicular Lines

Example 2:

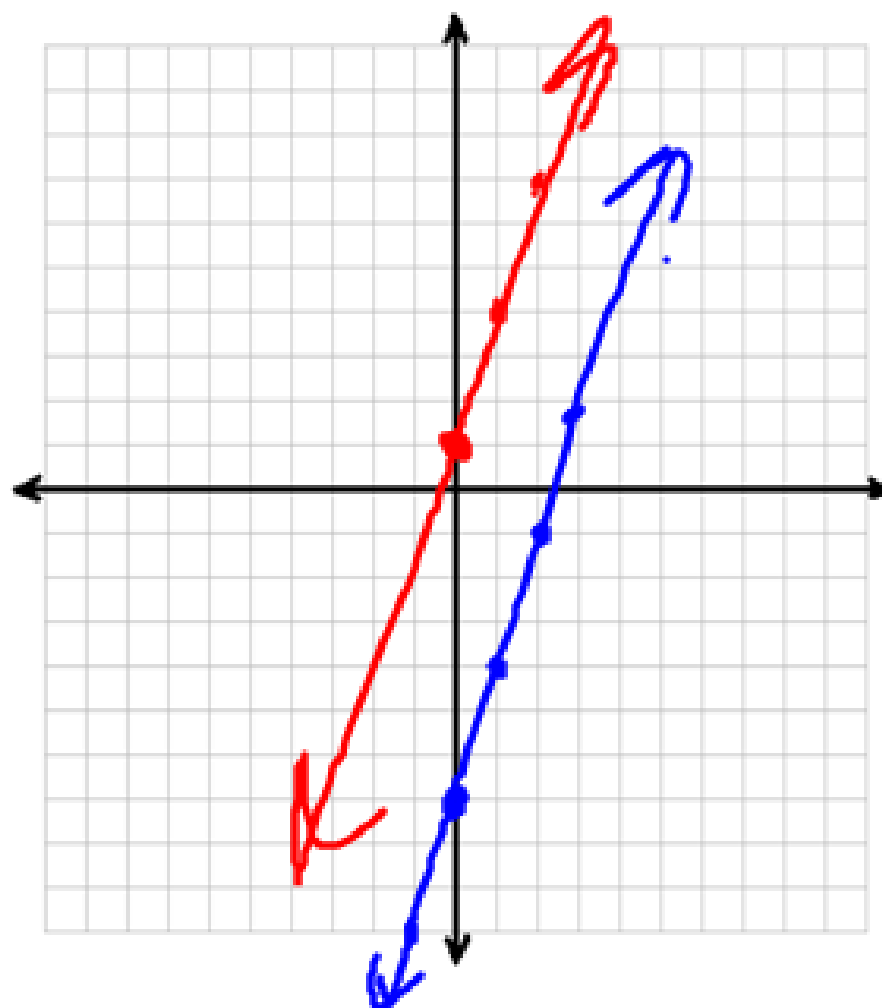
Find the equation of the line that is parallel to $y = 3x + 1$ and goes through $(5, 8)$. Graph both lines.

$$m = 3$$

$$y - 8 = 3(x - 5)$$

$$\begin{array}{r} y - 8 = 3x - 15 \\ +8 \qquad +8 \end{array}$$

$$y = 3x - 7$$

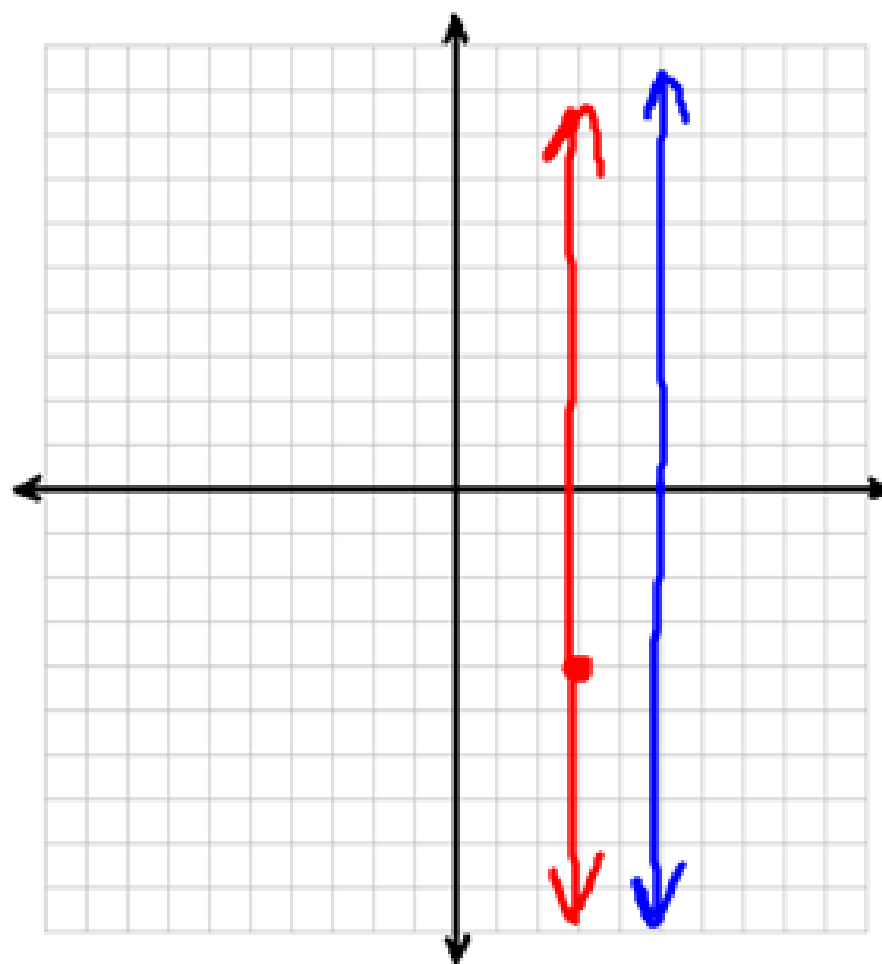


Lesson 3.3: Parallel and Perpendicular Lines

Example 3:

Write the equation of the line parallel to $x=5$, and passing through the point $(3, -4)$. Graph both lines.

$$x = 3$$



Definition

Perpendicular lines: Lines are ^(mult) perpendicular if and only if the product of their slopes is -1 . (Which means if the slopes are negative reciprocals of one another, then the lines are perpendicular.)

Note: Any vertical line is perpendicular to a horizontal line.

Lesson 3.3: Parallel and Perpendicular Lines

Example 4:

Find the slope of the line perpendicular to a line whose slope is -3 .

$$m = \frac{1}{3}$$

check: $\frac{-3}{1} \cdot \frac{1}{3} = -1$

Example 5:

Find the slope of the line perpendicular to a line whose slope is $4/5$.

$$m = -\frac{5}{4}$$

check: $\frac{4}{5} \cdot -\frac{5}{4} = -1$

Lesson 3.3: Parallel and Perpendicular Lines

Example 6:

Determine whether the given lines are perpendicular.

a.) $y = 4x + 1$
 $y = -4x - 3$

NO, not \perp
(perpendicular)

b.) $y = (2/3)x - 5$
 $y = (-3/2)x + 2$

Yes, \perp

Lesson 3.3: Parallel and Perpendicular Lines

Example 7:

Find the equation of the line that is Perpendicular to

$2x + 5y = 10$ and goes through $(4, -1)$. Graph both lines.

Hint: Remember Point-Slope Form.

$$\rightarrow \frac{5y}{5} = \frac{-2x + 10}{5}$$

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

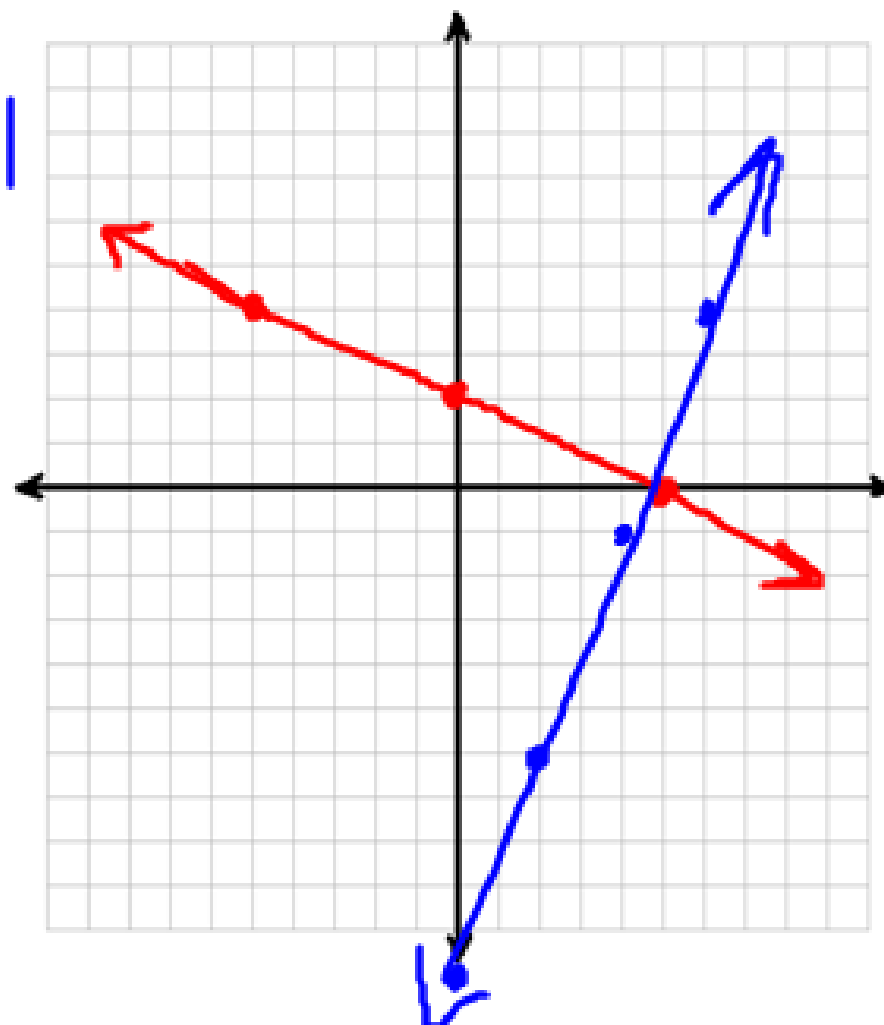
$$y = -\frac{2}{5}x + 2$$

$$m = \frac{5}{2}$$

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

$$y + 1 = \frac{5}{2}x - 10$$

$$\boxed{y = \frac{5}{2}x - 11}$$



Lesson 3.3: Parallel and Perpendicular Lines

Example 8:

Find the equation of the line that is Perpendicular to $y = 2x + 1$ and goes through $(-4, 2)$. Graph both lines.

Hint: Remember Point-Slope Form.

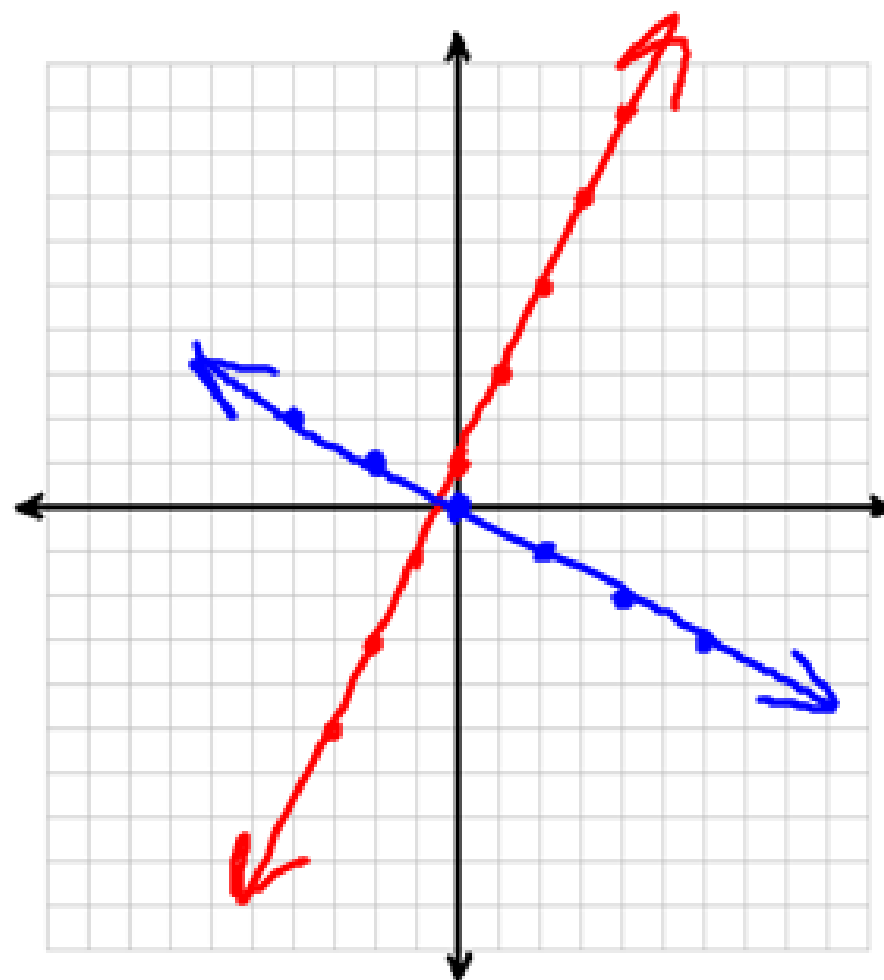
$$m = -\frac{1}{2}$$

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

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

+2 +2

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

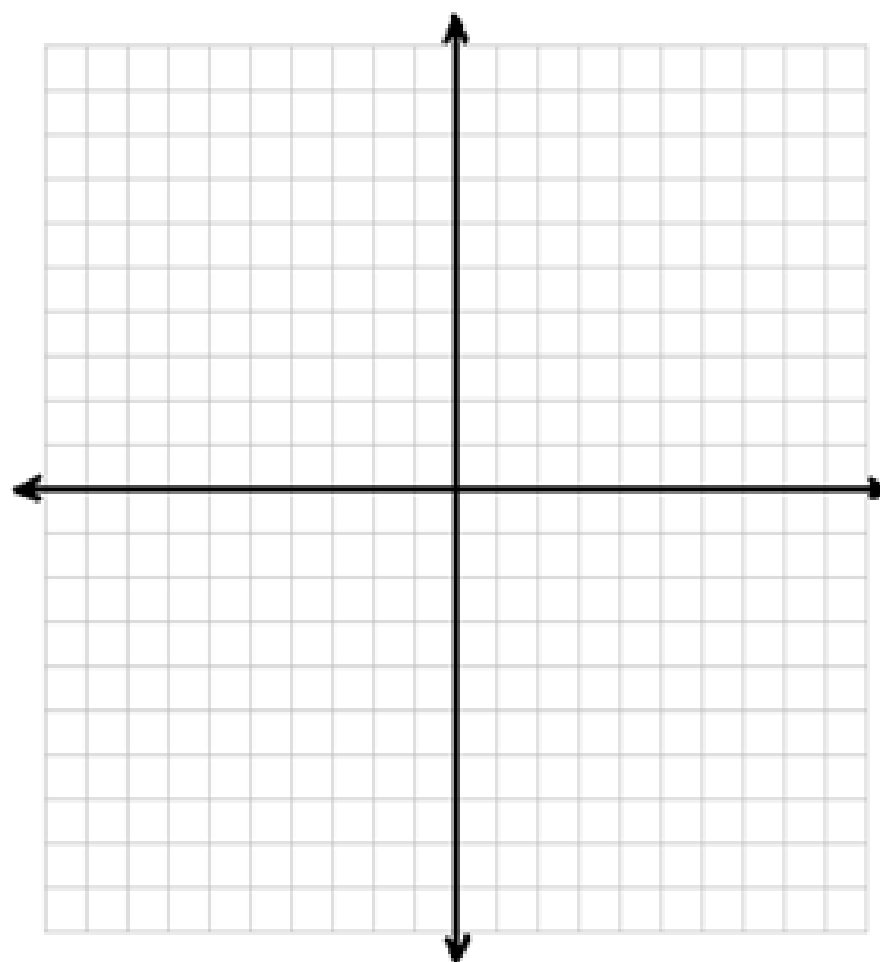


Lesson 3.3: Parallel and Perpendicular Lines

Example 9:

Find the equation of the line that is Perpendicular to $3x = 4y = 8$ and goes through $(-3, -4)$. Graph both lines.

Hint: Remember Point-Slope Form.

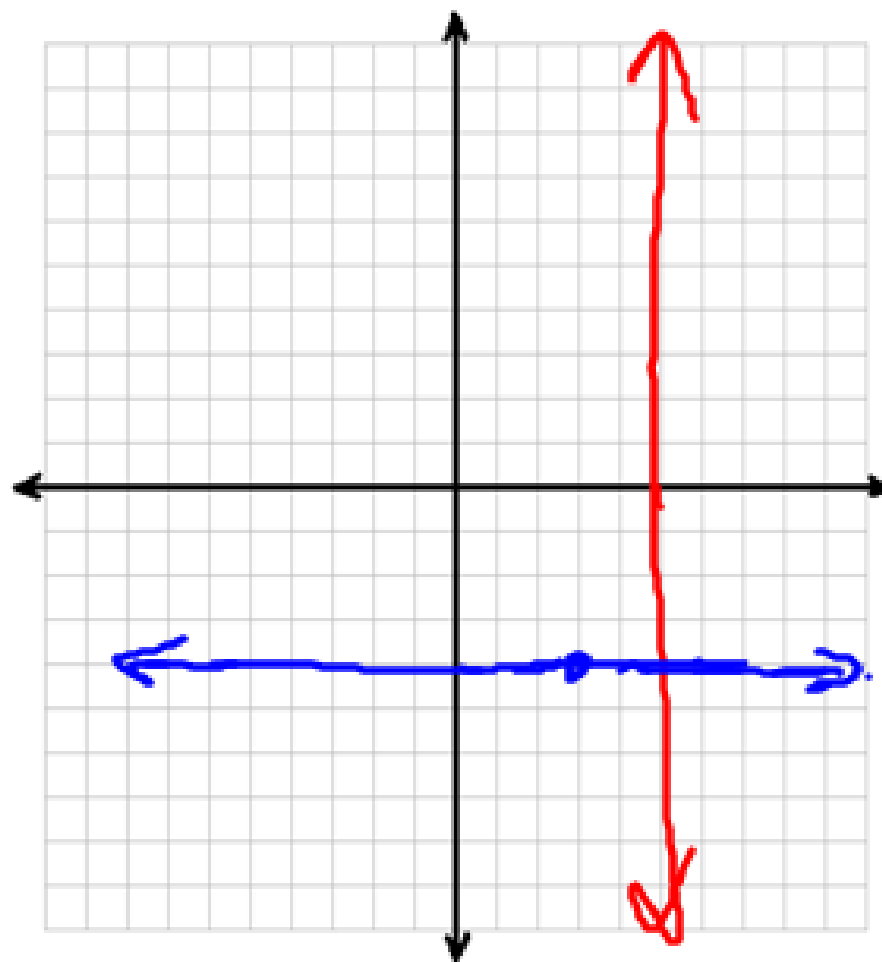


Lesson 3.3: Parallel and Perpendicular Lines

Example 10:

Write the equation of the line Perpendicular to $x=5$, and passing through the point $(3, -4)$. Graph both lines.

$$y = -4$$



Homework:

Pg. 220: 1-5 all, 11, 15, 21, 25,
27, 29, 31-37 odds, 47

&

QUIZ Pg. 223: 1-16 all