

3.8 Slopes of Parallel & Perpendicular lines.

Slopes of Parallel lines

ARE EQUAL

<u>Starting equation</u>	→	<u>Parallel equation</u> <small>write</small>
ex: $y-2 = \frac{3}{2}(x+1)$	→	$y-3 = \frac{3}{2}(x+7)$
$y = -3x+4$	→	$y = -3x+5$

Ex 1) Line m has points $(-3, 3)$ & $(-1, -4)$ and line l has points $(-1, 5)$ & $(2, -4)$. Are line l & line m parallel?

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{-4 - 3}{-1 - (-3)} = \frac{-7}{-1 + 3} = \frac{-7}{2}$$

not parallel

$$m = \frac{-4 - 5}{2 - (-1)} = \frac{-9}{3} = -3$$

$2 \left\langle \begin{matrix} (-3, 3) \\ (-1, -4) \end{matrix} \right\rangle \rightarrow \frac{-7}{2}$
 $3 \left\langle \begin{matrix} (-1, 5) \\ (2, -4) \end{matrix} \right\rangle \rightarrow \frac{-9}{3} = -3$

fractions and signs

$\frac{7}{-2}$ same	$\frac{-7}{2}$ same	$-\frac{7}{2}$	$\frac{-7}{-2}$ same	$\frac{7}{2}$
		$\frac{-7}{2}$		$\frac{7}{-2}$

Ex 2)

a) What is an equation of a line parallel to $y = -3x - 5$ and contains the point $(-1, 8)$?
 $m = -3$

$m = -3$ $(-1, 8)$ $x \quad y$	$y = mx + b$ $8 = -3(-1) + b$ $8 = 3 + b$ $\frac{-3 \quad -3}{5 = b}$ $y = -3x + 5$	$y - y_1 = m(x - x_1)$ $y - 8 = -3(x + 1)$ $\frac{y - 8 = -3x - 3}{+8 \quad +8}$ $y = -3x + 5$
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b) Write the equation in slope-intercept form.

$$\frac{y - 8 = -3x - 3}{+8 \quad +8}$$

$$y = -3x + 5$$

Slopes of Perpendicular lines

$$m_1 = -\frac{1}{2}$$

$$m_2 = \frac{2}{1} = 2$$

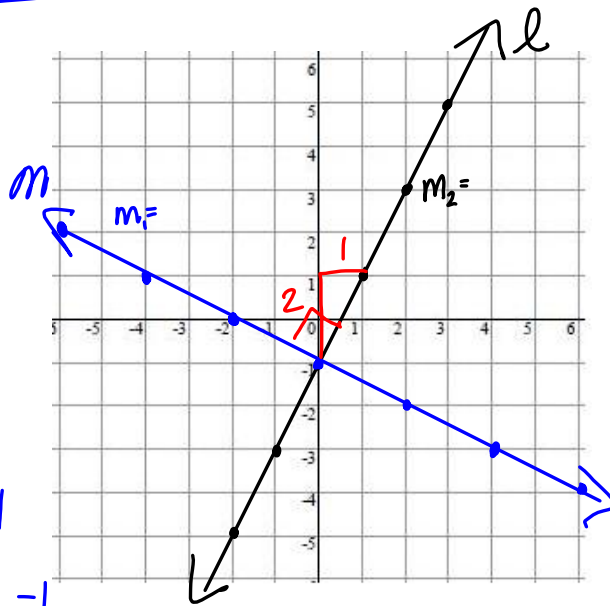
$$m \perp l$$

Slopes

opposite
reciprocals

multiply to -1

$$\frac{a}{b} \cdot -\frac{b}{a} = -1$$



Examples of perpendicular lines Slopes.

$$l \perp m$$

line l slope	line m slope
$\frac{2}{3}$	$-\frac{3}{2}$
$-\frac{1}{8}$	8
$-\frac{5}{7}$	$\frac{7}{5}$
3	$-\frac{1}{3}$

Ex 3 | What is an equation of a line perpendicular to $y = \frac{1}{5}x + 2$ and passes through point $(15, 4)$? $\rightarrow m = \frac{1}{5}$
 $m_{\perp} = -5$

$$m = -5$$

$$(15, 4)$$

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

$$y - 4 = -5(x - 15)$$

b) Write the equation in slope-intercept form.

$$\begin{array}{r} y - 4 = -5x + 75 \\ + 4 \qquad \qquad + 4 \\ \hline y = -5x + 79 \end{array}$$

Ex 4 Write each equation in slope-intercept form, and determine if they are \parallel or \perp or neither.

$$\boxed{y} = mx + b$$

$$a) \quad \frac{y+7}{-7} = \frac{-x}{-7}$$

$$y = -x - 7$$

$$m = -1$$

$$\frac{y-x}{+x} = \frac{20}{+x}$$

$$y = x + 20$$

$$m = 1$$

perpendicular

$$b) \quad \frac{2x-7y}{-2x} = \frac{-42}{-2x}$$

$$\frac{-7y}{-7} = \frac{-2x-42}{-7}$$

$$y = \boxed{\frac{2}{7}}x + 6$$

$$\frac{4y}{4} = \frac{-7x-2}{4}$$

$$y = \boxed{-\frac{7}{4}}x - \frac{1}{2}$$

neither

$$c) \quad \frac{6y}{6} = \frac{4x+24}{6}$$

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

parallel

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

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

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