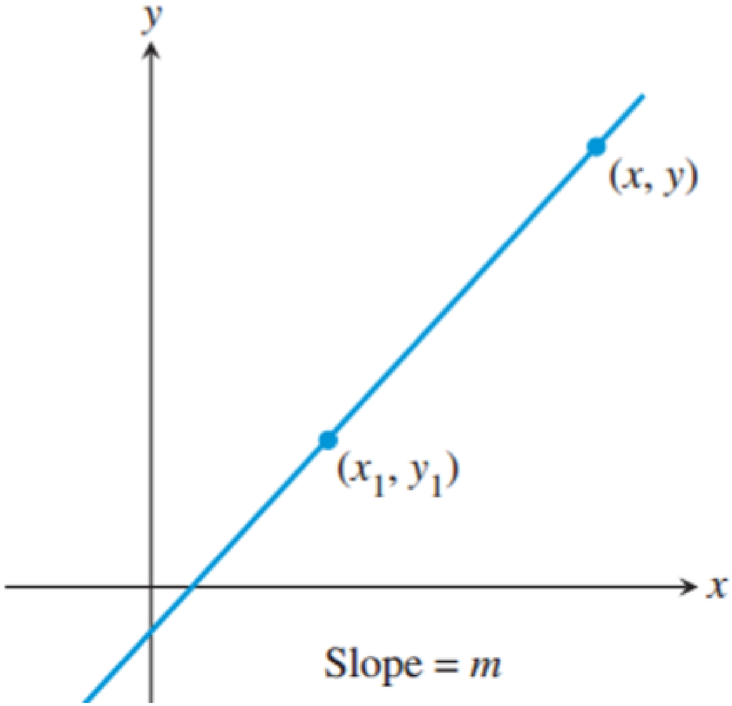
DEFINITION Slope of a Line

The **slope** of the nonvertical line through the points (x_1, y_1) and (x_2, y_2) is

delta "change"

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}.$$

If the line is vertical, then $x_1 = x_2$ and the slope is undefined.



Slope = m

DEFINITION Point-Slope Form of an Equation of a Line

The **point-slope form** of an equation of a line that passes through the point (x_1, y_1) and has slope m is

$(-2, 6)$

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

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

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

DEFINITION **Slope-Intercept Form of an Equation of a Line**

The **slope-intercept form** of an equation of a line with slope m and y-intercept $(0, b)$ is

$$y = mx + b.$$

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

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

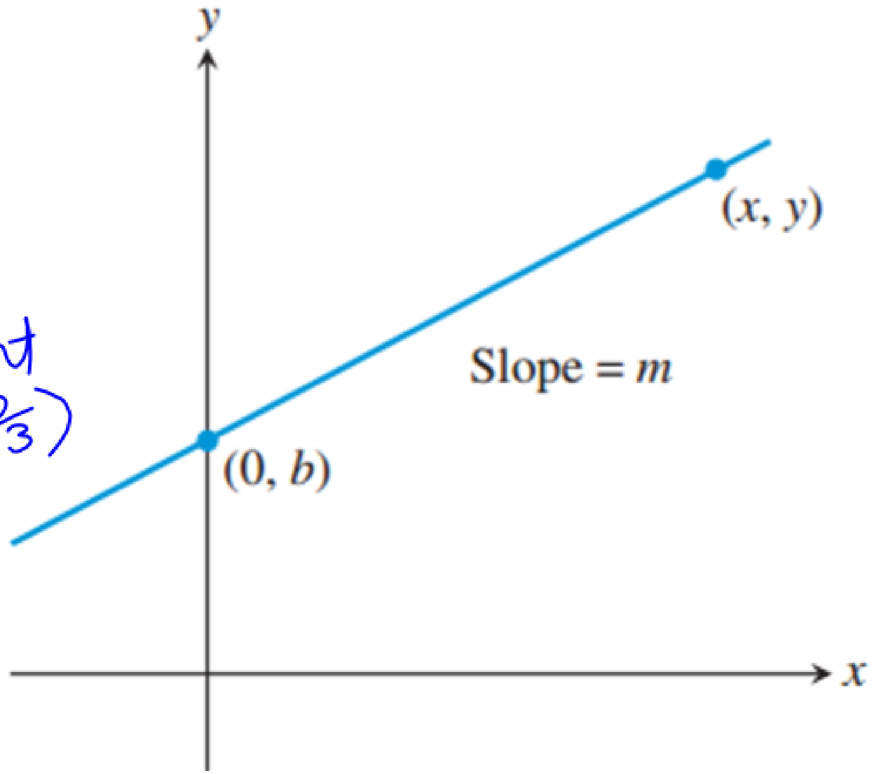
$+6 \qquad +6$

$$y = \frac{1}{3}x + \frac{20}{3}$$

m

y-int

$(0, 20/3)$



Forms of Equations of Lines

General form:	$Ax + By + C = 0$, A and B not both zero
Slope-intercept form:	$y = mx + b$
Point-slope form:	$y - y_1 = m(x - x_1)$
Vertical line:	$x = a$
Horizontal line:	$y = b$

$3\left(y = \frac{1}{3}x + \frac{20}{3}\right)$

$3y = x + 20$

$-x + 3y - 20 = 0$

or $x - 3y + 20 = 0$

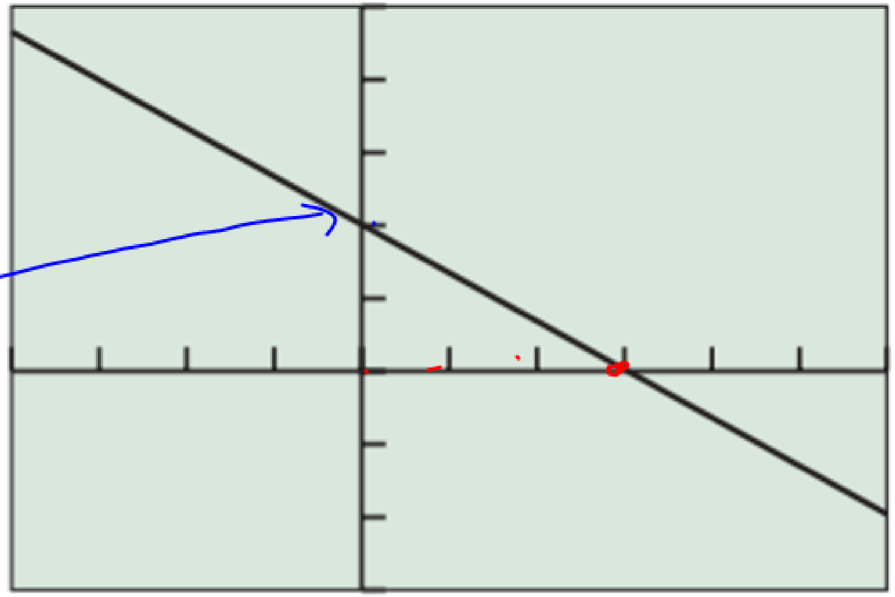
Use a Graphing Utility

Draw the graph of $2x + 3y = 6$.

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

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

$$m = -\frac{2}{3}$$



[–4, 6] by [–3, 5]

Parallel and Perpendicular Lines

$m_1 = m_2$

1. Two nonvertical lines are parallel if and only if their slopes are equal.
2. Two nonvertical lines are perpendicular if and only if their slopes m_1 and m_2 are opposite reciprocals. That is, if and only if

$$m_1 = -\frac{1}{m_2}.$$

$m_1 = -\frac{2}{3}$

$m_2 = \frac{3}{2}$

Finding an Equation of a Perpendicular Line

Find an equation of the line through $P(2, -3)$ that is perpendicular to the line L with equation $4x + y = 3$. Support the result with a grapher.

$y = -4x + 3$

$m_1 = -4$

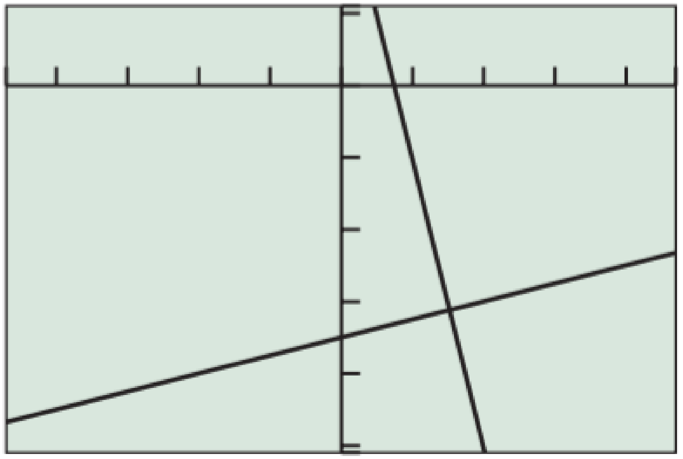
$\therefore m_2 = \frac{1}{4}$

$y + 3 = \frac{1}{4}(x - 2)$

$y + 3 = \frac{1}{4}x - \frac{1}{2}$

$-3 \qquad -3$

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



[–4.7, 4.7] by [–5.1, 1.1]