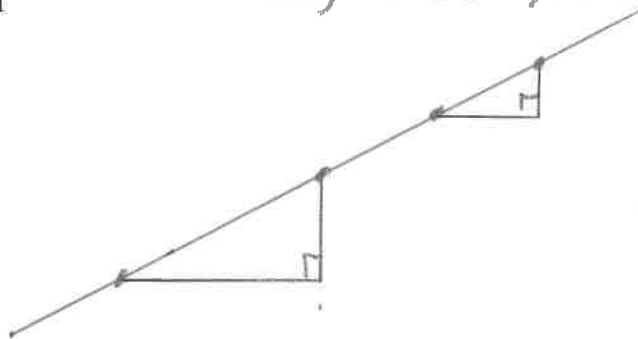# Section 2.3 and 2.4 Forms of Linear Equations
Parallel and Perpendicular Lines

Slope of a line:

The slope m of the line that contains the points (x_1, y_1) and (x_2, y_2) is given by:

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

Any two points will do.

similar $\triangle$ s

Example:

Find the slope of the line that contains the points $(2, -3)$ and $(-4, -1)$.

$$m = \frac{-3 - (-1)}{2 - (-4)} = \frac{-2}{6} = -\frac{1}{3}$$

The equation of the horizontal line that contains the point (a, b) is $y = b$. The slope of a horizontal line is 0.

The equation of the vertical line that contains the point (a, b) is $x = a$. The slope of a vertical line is undefined. In other words, a vertical line has no slope.

Point-Slope equation for a line:

The line that contains the point (a, b) and has a slope of m is given by the equation:

$$y - b = m(x - a)$$

point (x_1, y_1) slope $= m$

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

Slope-Intercept equation for a line:

The line that has a slope m and a y-intercept of b is given by the equation:

$$y = mx + b$$

Note: If you take any equation of a line and you solve for y and simplify you will get the slope-intercept equation.

when $x = 0$, $y = b$.

$(0, b)$ is the y intercept.

Example:
Find the slope-intercept equation for the line that contains the points $(2, -1)$ and $(4, -6)$

$$m = \frac{-6 - (-1)}{4 - 2} = \frac{-5}{2}$$

suppose $(x_1, y_1) = (2, -1)$

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

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

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

Two lines are <u>parallel</u> if and only if they have the same slope.

Two lines are <u>perpendicular</u> if and only if their slopes are opposite reciprocals.

Find the equation of the line in slope-intercept form for the line that contains the point $(3, -2)$ and is perpendicular to the line $2y + 3x = 4$.

$$2y + 3x = 4, \qquad 2y = -3x + 4$$

$$y = -\frac{3}{2}x + 2 \qquad\qquad m_1 = slope = -\frac{3}{2}$$

$$m_2 = \frac{-1}{m_1} = \frac{-1}{-\frac{3}{2}} = \frac{2}{3}$$

$$point = (3, 2) \qquad slope = \frac{2}{3}$$

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

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

Find the equation of the line in slope-intercept form for the line that contains the point $(\frac{1}{4}, -\frac{5}{8})$ and is parallel to the line $x = -3$

slope is not defined

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

The line whose equation is $x = \frac{1}{4}$ is parallel to the line with equation $x = -3$