Equations of Lines

Slope-intercept	Point-slope	Standard
$y = mx + b$	$y - y_1 = m(x - x_1)$	$Ax + By = C$
where m is slope and b is the y-intercept	where m is slope and (x_1, y_1) is a point on the line	where A, B, and C are constants

Let's look at the line going through the points

$(-2,-1)$ and $(4,3)$
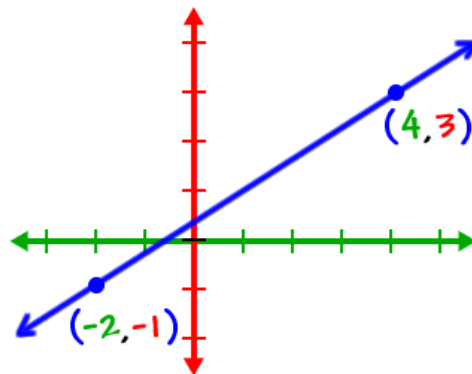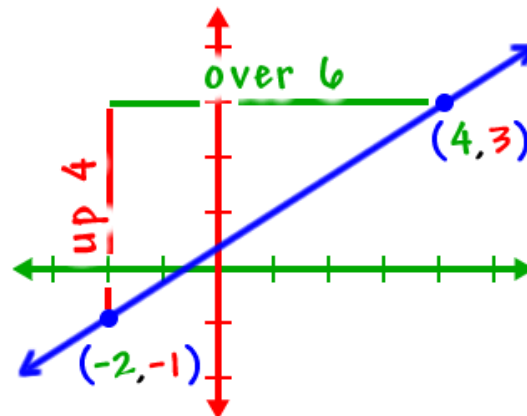
The simplest way to look at the slope is

$$\frac{\text{rise}}{\text{run}}$$

(**rise** over **run**)

To get from the point **(-2, -1)** to the point **(4, 3)**, you rise **up 4**... and **run 6**.

The slope is

$$\frac{\text{rise}}{\text{run}} = \frac{4}{6} = \frac{2}{3}$$
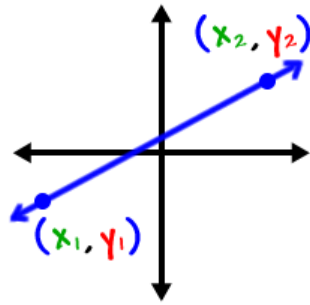
over 6

up 4

(Notice that the slope goes uphill and $\frac{2}{3}$ is a positive number)

For $\frac{\text{rise}}{\text{run}}$, you can "rise" up or down... but, you ALWAYS "run" to the right. ALWAYS!
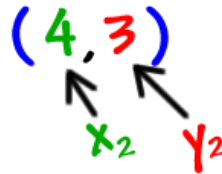
If you have to go down then the fraction is a negative but always start at the left point

(x_2, y_2)

If you're given two points

(x_1, y_1) **and** (x_2, y_2)

(x_1, y_1)

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

$(-2, -1)$ $(4, 3)$

x_1 y_1 x_2 y_2

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - (-1)}{4 - (-2)} = \frac{4}{6} = \frac{2}{3}$$

If you are given:
Two points

- Finding the equation of the line in y= mx + b form. **Given: Two points.** First find the slope (m) and then substitute one of the points x and y values into y = mx+b along with the slope.

Point (-2, -4) & Point (2, -2)

Find the:
- **Slope** $= \dfrac{\text{rise}}{\text{run}} = m = \dfrac{\text{change in y's}}{\text{change in x's}}$

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

- Slope $= \frac{1}{2}$ and point (**2, -2**)

$$y = mx + b$$
$$-2 = \tfrac{1}{2}(2) + b$$
$$-2 = 1 + b$$
$$\underline{-1 \quad | \quad -1}$$
$$-3 = b \qquad \text{So!}$$

$$m = \tfrac{1}{2} \text{ and } b = -3$$

$$y = \tfrac{1}{2}x - 3$$

$$Y - Y_1 = m(X - X_1)$$

It's called the point-slope formula

Let's find the equation of the line that passes through the point (4 , -3) with a slope of -2:

$$Y - Y_1 = m(X - X_1)$$

$$m = -2 \qquad (4, -3)$$

$$\qquad\qquad X_1 \qquad Y_1$$

$$Y - (-3) = -2(X - 4)$$
$$Y + 3 = -2X + 8$$
$$\underline{-3 \qquad\qquad -3}$$
$$Y = -2X + 5$$