FAR BEYOND

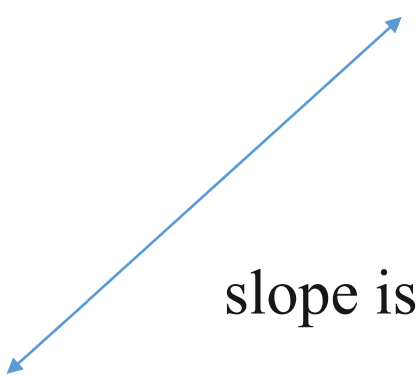
MAT122

Linear Functions

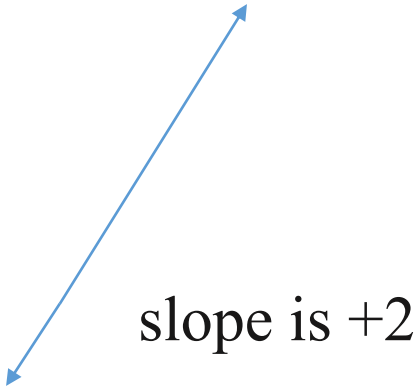
Stony Brook University

Slope - Intro

Slope measures the **steepness** of a line

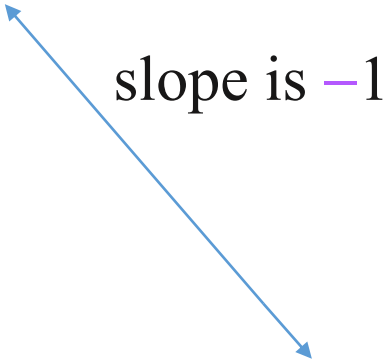


slope is +1



slope is +2

steeper slope => higher number



slope is −1

slope is 0

NO steepness

In General:
Slope of a line is positive when…
x-values and *y*-values are both increasing

In General:
Slope of a line is negative when…
as *x*-values are increasing, *y*-values are decreasing

Slope Formula

If (x_1, y_1) and (x_2, y_2) are ordered pairs on a line then the slope of the line is:

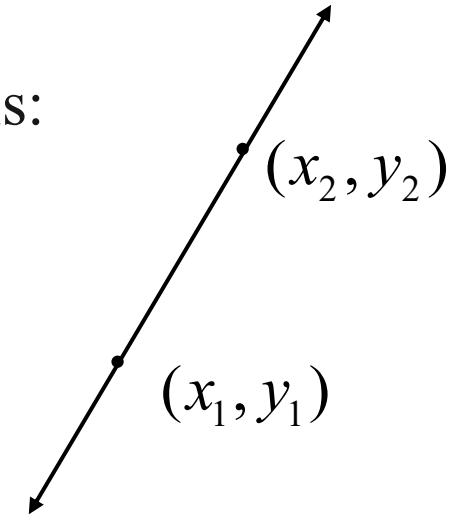
$$m = \frac{y_2 - y_1}{x_2 - x_1} \qquad (x_1 \neq x_2)$$

symbol for slope

$\frac{\text{change in } y}{\text{change in } x}$ over

sometimes abbreviated as: "delta" → $\frac{\Delta y}{\Delta x}$

"rise over run"

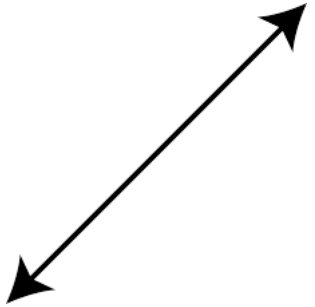


ex. Find the slope of the line containing $(2,1)$ and $(5,3)$.

x_1 y_1 x_2 y_2

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-1}{5-2} = \boxed{\frac{2}{3}}$$

positive slope



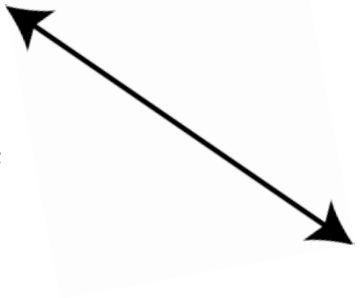
ex. Find the slope of the line containing $(4,-2)$ and $(-1,5)$.

careful w signs

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5-(-2)}{-1-4} = \frac{5+2}{-1-4} = \frac{7}{-5} = \boxed{-\frac{7}{5}}$$

move negative to front

negative slope



Slope Example

ex. Find t such that the line containing $(\underset{x_1}{-7},\underset{y_1}{t})$ and $(\underset{x_2}{4},\underset{y_2}{8})$ with a slope is $\frac{2}{7}$.

$$m = \frac{2}{7} = \frac{8-t}{4-(-7)}$$

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

$$= \frac{8-t}{4+7}$$

$$\frac{2}{7} = \frac{8-t}{11}$$ cross multiply

$$22 = 7(8-t)$$

$$22 = 56 - 7t$$

$$-56 \quad -56$$

$$\frac{-34}{-7} = \frac{-7t}{-7}$$

$$t = \frac{34}{7}$$

Find Equation of a Line given Slope and One Point

Slope-Intercept Format of a Line

$y = mx + b$

where m is slope

b is y-intercept

Point-Slope Format of a Line

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

where m is slope

(x_1, y_1) is on the line

m x_1 y_1

ex. Find the equation of a line that has a slope of 4 and contains (2 , 3).

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

$y - 3 = 4(x - 2)$

put into $y = mx + b$ format

$y - 3 = 4x - 8$

$+3 \qquad +3$

$y = 4x - 5$

Identify Slope from Equation

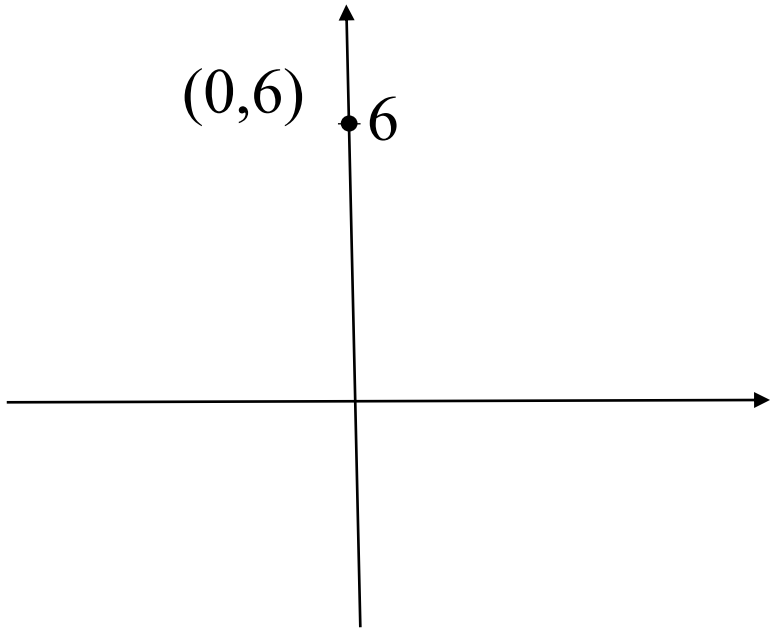
ex. Identify slope and y-intercept from $4x + y - 6 = 0$.

Put equation in $y = mx + b$ format: $y = -4x + 6$

y-intercept = 6

$m = -4$

can also be written as an ordered pair:



Equation of a Line - Do

Do: Write the equation of a line passing through $(-2,-4)$ and $(1,-1)$. (First, calculate the slope.)
Express answer in slope-intercept format.

x_1 y_1

$$y = x - 2$$

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

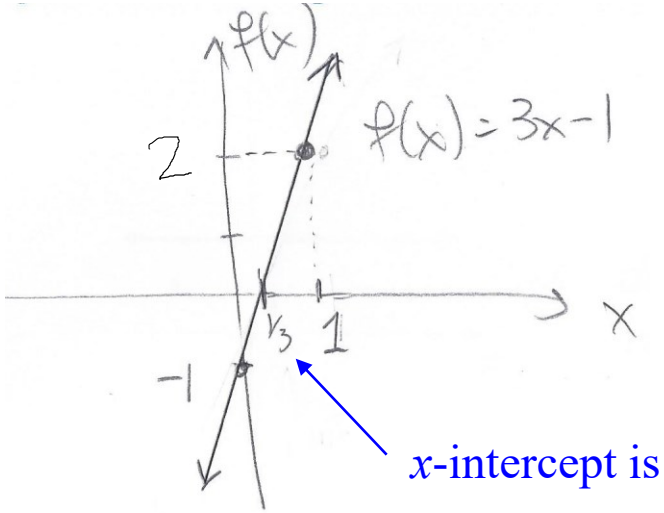
Graph a Line given Slope and y-Intercept

ex. Graph linear function $f(x) = 3x - 1$.

slope: $m = 3 = \frac{3}{1}$ rise / run

x-intercept:

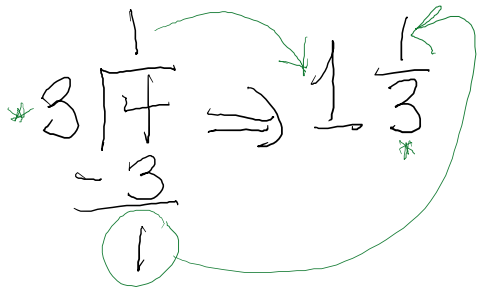
$$0 = 3x - 1$$
$$1 = 3x$$
$$\frac{1}{3} = x$$



x-intercept is $\left(\frac{1}{3}, 0\right)$

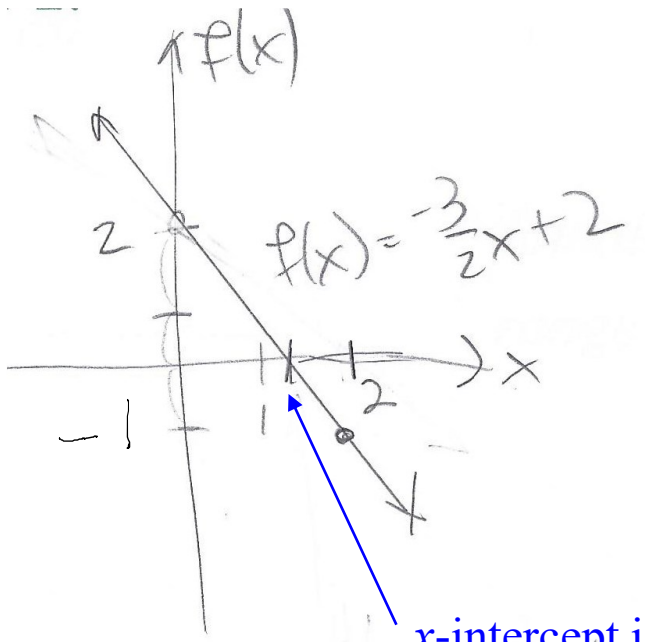
ex. Graph linear function $f(x) = -\frac{3}{2}x + 2$.

slope: $m = -\frac{3}{2} = \frac{-3}{2}$ 'rise' / run



x-intercept:

$$0 = -\frac{3}{2}x + 2$$
$$-2 = -\frac{3}{2}x$$
$$-(-2) = -\left(-\frac{3}{2}x\right)$$
$$2 = \frac{3}{2}x \quad \Rightarrow x = \frac{4}{3}$$



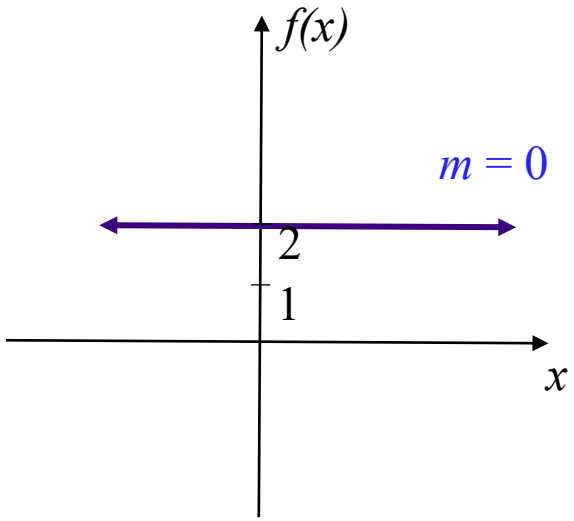
x-intercept is $\left(1\frac{1}{3}, 0\right)$

Graph Horizontal and Vertical Lines

Horizontal line is called a "constant" function.

$f(x) = 2$

"$y = 2$" regardless of x

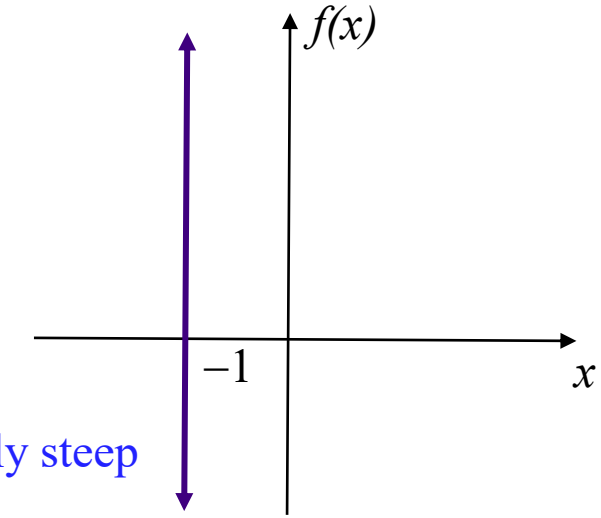


$domain : \mathbb{R}$

$range : \{2\}$

Vertical line is <u>not</u> a function.

$x = -1$



slope is infinitely steep

$domain : \{-1\}$

$range : \mathbb{R}$