

1.4 Slope of a Line

$$y = \textcircled{m}x + \textcircled{b}$$

↑ ↑
slope y-intercept

Ex: Find the slope

a) $2x + 3y = 3$

$$3y = -2x + 3$$

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

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

b) $y = 3$

$$y = 0x + 3$$

$$m = 0$$

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

Ex: Find slope of line through

$(-1, 4)$ and $(2, 10)$

↑
 (x_1, y_1)

↑
 (x_2, y_2)

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

$$= \frac{10 - 4}{2 - (-1)}$$

$$= \frac{6}{3}$$

$$= 2$$

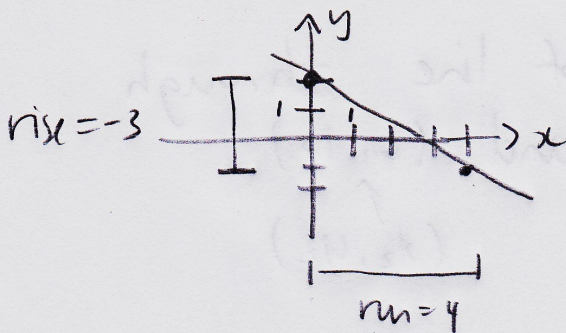
$$m = \frac{\text{rise}}{\text{run}}$$

"steepness property"

Ex: Graph the line $y = -\frac{3}{4}x + 2$

y-intercept = 2

$$\frac{\text{rise}}{\text{run}} = -\frac{3}{4}$$



Ex: Equation of line with $m = \frac{4}{5}$
passing through $(-1, 2)$?

$$y = mx + b$$

$$\boxed{y = \frac{4}{5}x + b}$$

Sub $x = -1$

$$y = 2 : 2 = \frac{4}{5}(-1) + b$$

$$2 = -\frac{4}{5} + b$$

$$2 + \frac{4}{5} = b$$

$$\frac{14}{5} = b$$

$$\boxed{y = \frac{4}{5}x + \frac{14}{5}}$$

Ex: Equation of line through
 $(2, 7)$ and $(-3, 15)$?

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{15 - 7}{-3 - 2} = \frac{8}{-5} = -\frac{8}{5}$$

Pick either point, say $(x, y) = (2, 7)$

$$y = mx + b$$

$$\boxed{y = -\frac{8}{5}x + b}$$

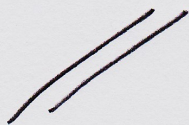
Sub $y = 7$
 $x = 2$:

$$7 = -\frac{16}{5} + b$$

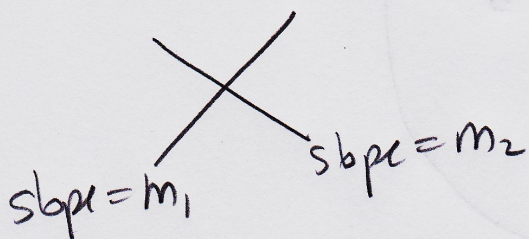
$$b = \frac{51}{5}$$

$$\boxed{y = -\frac{8}{5}x + \frac{51}{5}}$$

Parallel lines have the same slope



Perpendicular lines have $m_2 = \frac{-1}{m_1}$



Ex: Equation of line passing through $(-2, 5)$

a) parallel to $y = \frac{-4}{3}x + 1$

$y = \frac{-4}{3}x + 1$ has $m = \frac{-4}{3}$
desired line " "

$$y = mx + b$$

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

Sub $x = -2$
 $y = 5$:

$$5 = \frac{8}{3} + b$$

$$\frac{7}{3} = b$$

$$y = \frac{-4}{3}x + \frac{7}{3}$$

b) perpendicular to $y = -\frac{4}{3}x + 1$

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

desired line has $m = +\frac{3}{4}$

$$y = mx + b$$

$$y = \frac{3}{4}x + b$$

Sub $y=5$
 $x=-2$: $5 = -\frac{6}{4} + b$

$$b = \frac{26}{4} = \frac{13}{2}$$

$$y = \frac{3}{4}x + \frac{13}{2}$$

Quick Ex: x : # units produced
 y : cost in \$

$$y = 3x + 1000$$

marginal cost (cost per item) fixed cost (initial cost)

Ex: For each dollar of advertising, sales increase by \$4. With no advertising, sales are \$8000. Find equation of line.

y : sales (\$)

x : advertising (\$)

$$m = 4$$

$$(x, y) = (0, 8000)$$

$$y = mx + b$$

$$y = 4x + b$$

Sub $x = 0$
 $y = 8000$

$$8000 = b$$

$$y = 4x + 8000$$

Ex: Cost of making 300 laptops is \$126500.

Cost of making 750 laptops is \$306500.

Find equation of line.

x : # laptops made

y : cost (\$)

Two points: $(x, y) = (300, 126500)$

and $(750, 306500)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{306500 - 126500}{750 - 300} = 400$$

$$y = mx + b$$

$$y = 400x + b$$

Sub either point

$$x = 300$$

$$y = 126500$$

$$: \quad 126500 = 120000 + b$$

$$b = 6500$$

$$y = 400x + 6500$$