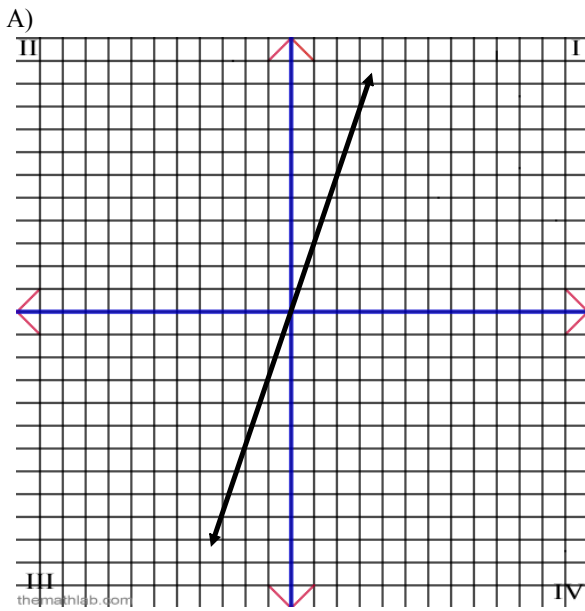# Linear Equations: $y = mx + b$

A linear relation can be defined by its slope and any point on the line.

Examine the graphs of the linear relations shown on the next page.

Write the equation of each line: Hint: Look for the y-intercept and use <u>rise</u>   to closest point
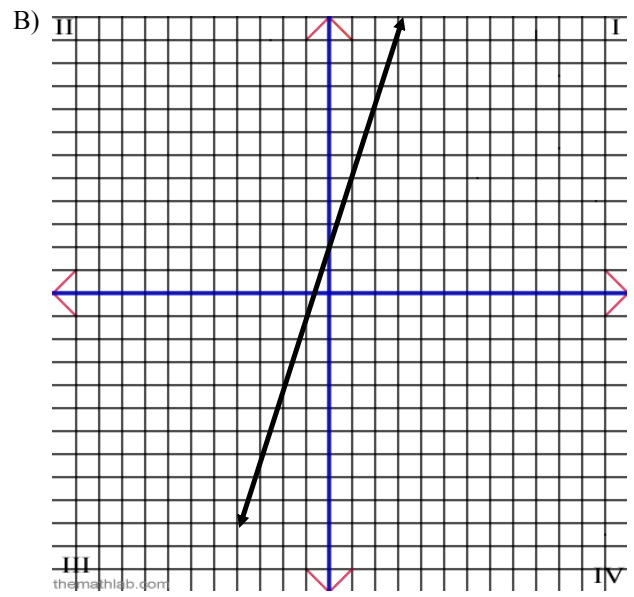   run
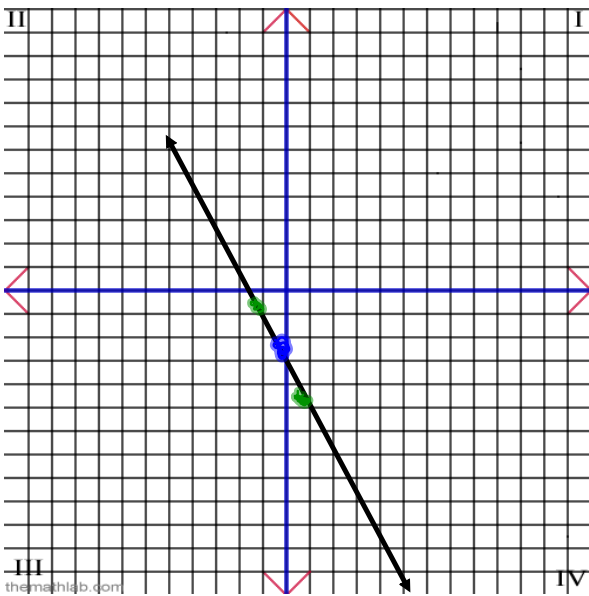
A)

$y = mx + b$

Solution

y-intercept = 0

slope = $\dfrac{3}{1} = 3$

equation: $y = 3x$

B)

Solution

y-intercept = 2

slope = $3/1 = 3$

equation: $y = 3x + 2$

2

Solutions:

y-intercept = −3

slope = −2

equation: $y = -2x - 3$

Notice how the slope and the y-intercept relate to the equation.

$y = mx + b$

Slope intercept form of a line

Any linear relation can be expressed as $y = mx + b$, where m is the slope of the relation and b is the y-intercept.

This is called the **slope y-intercept form** of an equation.

Example 1:

Determine the slope and y-intercept of the line given by 3x − 4y = 12.
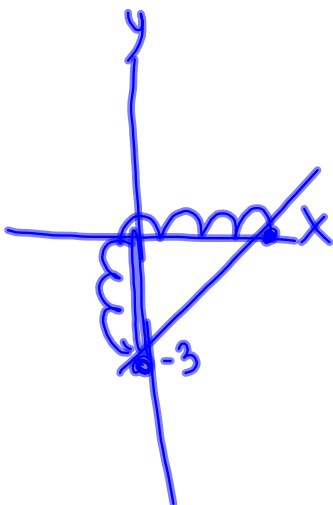
Solution:

$$3x - 4y = 12$$

$$3x \overset{-3x}{-} 4y = 12 \, \overset{-3x}{}$$ y-intercept

$$-4y = -3x + 12$$

$$\frac{-4y}{-4} = \frac{-3x}{-4} + \frac{12}{-4}$$

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

$$\underset{m}{\uparrow} \qquad \underset{b}{\uparrow}$$

5

Example 2: ****

The lines represented by
$y + 2 = 2(x - 3) + kx$ and $3(x + 2) = 3 + y$
have equal slopes. Find the value of "k".

$$y = mx + b$$

Solution:

(less)HINT
Write each equation in the slope y-intercept form and compare the slopes.

$$y + 2 = 2(x - 3) + kx$$

$$y + 2 = 2x - 6 + kx$$

pull like terms together

$$y + 2 = 2x + kx - 6$$

factor out the common term

$$y + 2 = x(2 + k) - 6$$

$$y + 2 = x(2 + k) - 6 - 2$$

$$y + 2 = x(2 + k) - 8$$

$$y = x \underbrace{(2 + k)}_{m} - 8$$

equal slopes

$$2 + k = 3$$

$$2 + k = 3 \quad -2$$

$$\boxed{k = 1}$$

$$3(x + 2) = 3 + y$$

$$3x + 6 = 3 + y$$

$$3x + 6 - 3 = 3 + y$$

$$3x + 3 = y$$

$$m = 3$$

Example 3:

very important

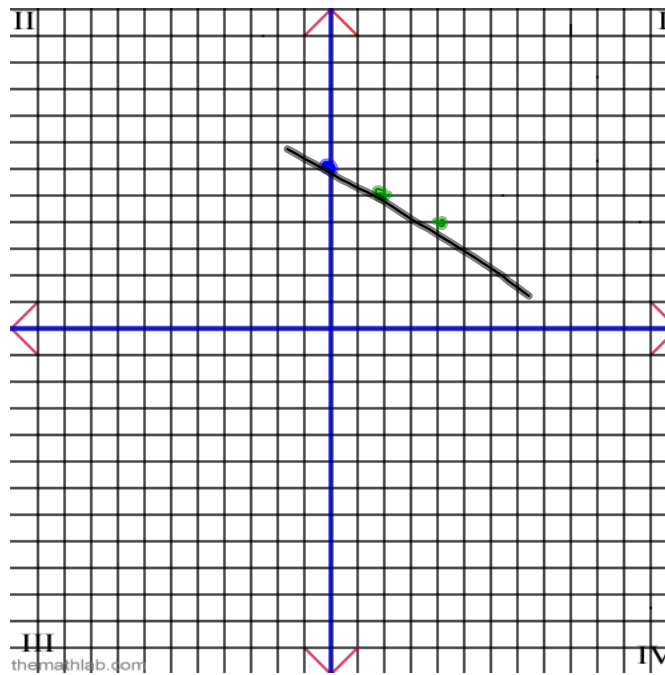# Sketch the line which has: m = 2, b = -3

$\overset{rise}{\underset{run}{}}$
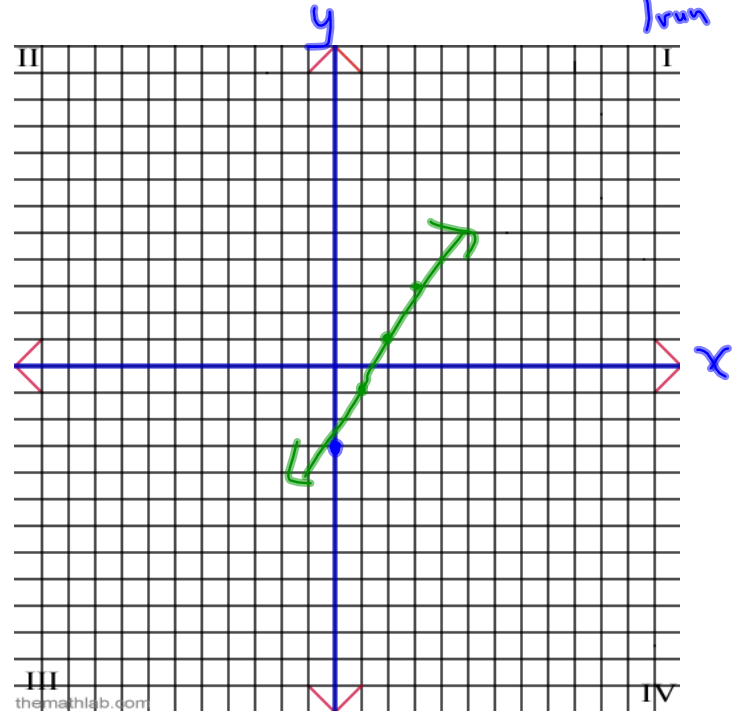
m = $\frac{2}{1}$

Example 4:

Sketch the line which has: m = -$\frac{1}{2}$, b = 6

$M = \frac{-1}{2}$ $\frac{rise}{run}$

$\frac{down1}{Right\ 2}$

Example 5)

Find the value of k if the endpoints of a line are (1,k) & (11, -11) with m = $\frac{1}{5}$

$x\, y_1 \quad x_2\, y_2$

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

$$\frac{1}{5} = \frac{(-11 - k)}{(11 - 1)}$$

$$\frac{1}{5} = \frac{(-11 - k)}{10}$$

cross multiply

$$5(-11 - k) = 1(10)$$

$$-55 - 5k = 10$$

$$-55 - 5k = 10 + 55$$

$$-5k = 65$$

$$\frac{-5k}{-5} = \frac{65}{-5}$$

$$\boxed{k = -13}$$

Linear Equations

#1 ad

#2 a d

#4 ad   c f

#5 abc

#7 b

#8 a