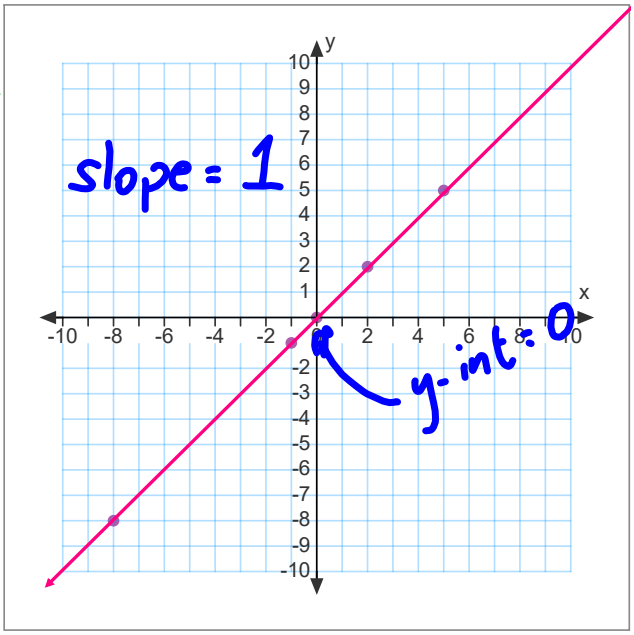
Basic Linear Function

Rule: $y = x$

x	y
-5	-5
½	½
$\sqrt{3}$	$\sqrt{3}$
2	2
9	9

Dom: $\mathbb{R}$



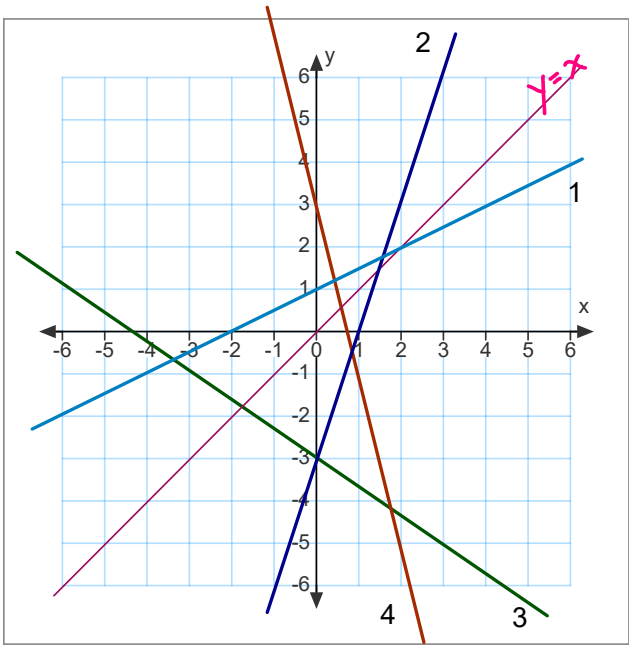
Parameter m (rate of change)

The value of m determines the slope, or steepness of the line. The bigger $|m|$ is, the steeper the line.

1) $m = \frac{1}{2}$ 2) $m = 3$

If m is positive, then the line is increasing.
If m is negative, then the line is decreasing.

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



Equation of a Line

When we know the y-intercept and the slope we can determine the equation of the line.

Equation of a line: $y = mx + b$

independent variable

dependent variable

where
m is the slope or rate of change, and
b is the y-intercept or initial value

This form of a line is known as standard or functional form.

Also: $f(x) = mx + b$

Find the Rule

- Given two points

Example: Determine the equation of the line that passes through the points A(-2, 7) and B(2, 9).

Step 1: Determine the slope (m)

A(-2, 7) B(2, 9)

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

$$= \frac{9 - 7}{2 - (-2)}$$

$$= \frac{2}{4} \text{ or } 0.5 \text{ or } \frac{1}{2}$$

$y = 0.5x + b$

Step 2: Determine the value of b, the initial value.

-- Choose one of the points, A or B.

A(-2, 7) B(2, 9)

A: $x = -2$ and $y = 7$

B: $x = 2$ and $y = 9$

-- Fill in x, y and m in the equation and solve for b.

$$y = mx + b$$

$$y = 0.5x + b$$

$$9 = 0.5(2) + b$$

$$9 = 1 + b$$

$$8 = b$$

Step 3: Put your m and b into the equation.

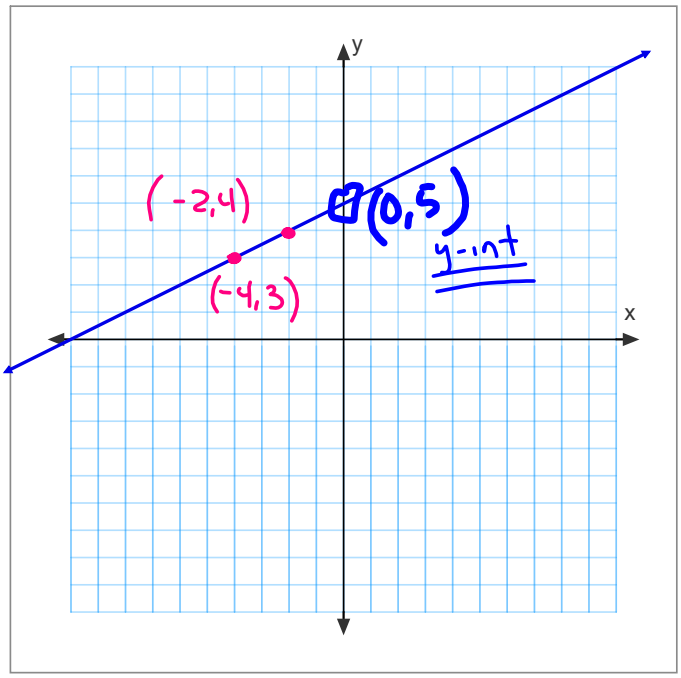
$$y = 0.5x + 8$$

Example: Determine the equation of the line shown below.

① slope: $m = \frac{3-4}{-4-(-2)} = \frac{-1}{-2} = +\frac{1}{2}$

② y-int : $b = 5$

③ $y = \frac{1}{2}x + 5$



Example: Determine the equation of the line that passes through points $K(1,12)$ and $L(9,2)$.

① $m = \frac{12-2}{1-9}$

$= \frac{10}{-8}$

$= -\frac{5}{4}$ or -1.25

② $12 = -1.25(1) + b$

$12 = -1.25 + b$

$13.25 = b$

$f(x) = -1.25x + 13.25$

Example: Last week, John worked 30 hours and earned $600. This week, he worked 22 hours and earned $480. How much will John earn if he works **40** hours next week?

x: time y: salary

This story provides 2 points: $(30, 600)$ and $(22, 480)$.

1) Determine m
2) Determine b

1

$$m = \frac{600 - 480}{30 - 22}$$

$$m = \frac{120}{8}$$

$$m = 15$$

2

$$y = mx + b$$

$$600 = 15(30) + b$$

$$600 = 450 + b$$

$$600 - 450 = 450 - 450 + b$$

$$150 = b$$

$$y = 15x + 150$$

John's earnings next week:

Let $x = 40$

$$y = 15(40) + 150$$
$$y = 600 + 150$$
$$y = 750$$

John will earn $\$750$.

Graphing a Linear Function

Given an equation $y = mx + b$

Method 1: Make a table of values

Choose a value for x. Calculate the value of y for this x.

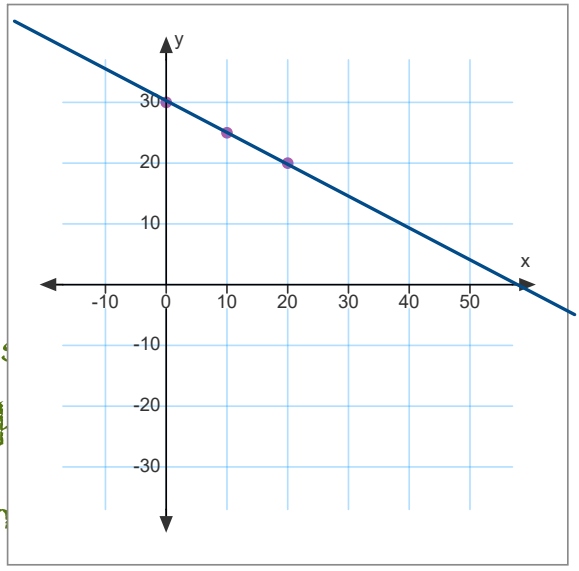
Repeat for another two values of x.

Plot the points on the Cartesian plane.

Example: $y = -\frac{1}{2}x + 30$

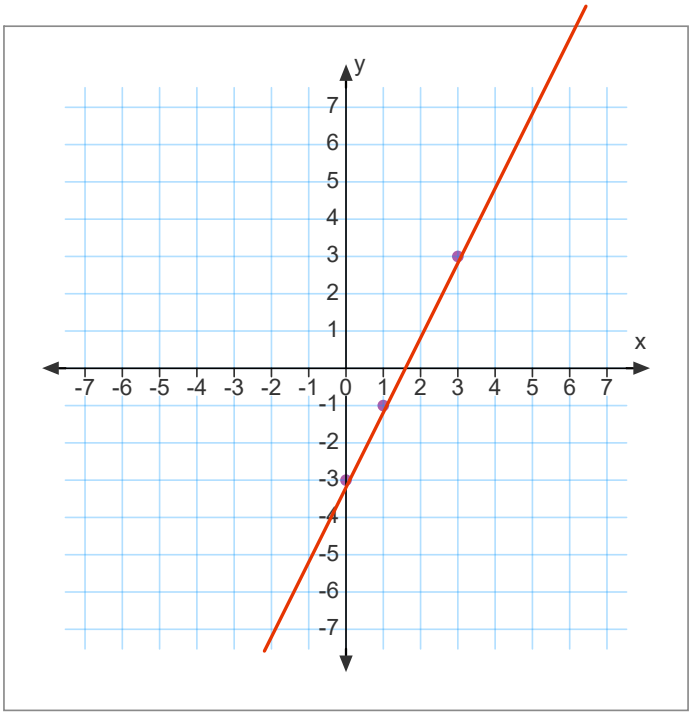
x	y
0	30
10	25
20	20

Each pair of values represents a point. Plot each point on a Cartesian plane and connect the points.



Example: $y = 2x - 3$

x	y
0	-3
1	-1
3	3



b) Method 2: Using the slope and y-intercept

$$y = mx + b$$

In the equation, b represents the y-intercept, so we already know a point on the graph: $(0, b)$.
Plot it on the Cartesian plane.

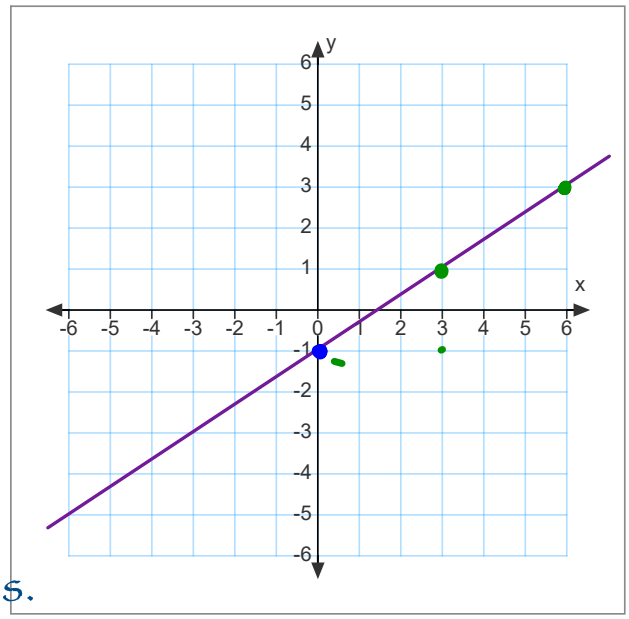
Next, use the rate of change (or slope) - how it tells us how y moves when x moves - to generate more points.

$$m = \frac{rise}{run} \quad \text{or} \quad \frac{\Delta y}{\Delta x}$$

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

$b = -1$, so $(0,-1)$ is our first point.

The slope $\frac{2}{3}$ tells us that if x moves 3 places to the right then y should move up 2 places.



Do this, starting at b, to find a second point.

Continue the pattern until you have a few points.

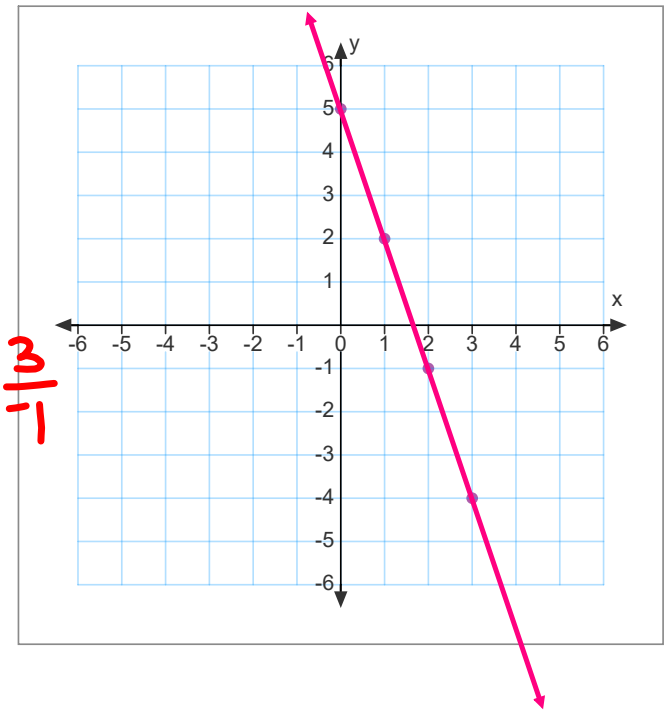
Example: $y = -3x + 5$

$b = 5 \Rightarrow (0, 5)$

$m = -3 \rightarrow \frac{-3}{1}$ or $\frac{3}{-1}$

1 →

3 ↓



Example: $y = -0.6x + 4$

$b =$ 4 $\Rightarrow (0,4)$

$m =$ $-0.6 = -\frac{6}{10} = -\frac{3}{5}$

$\frac{-3}{5}$ or $\frac{3}{-5}$