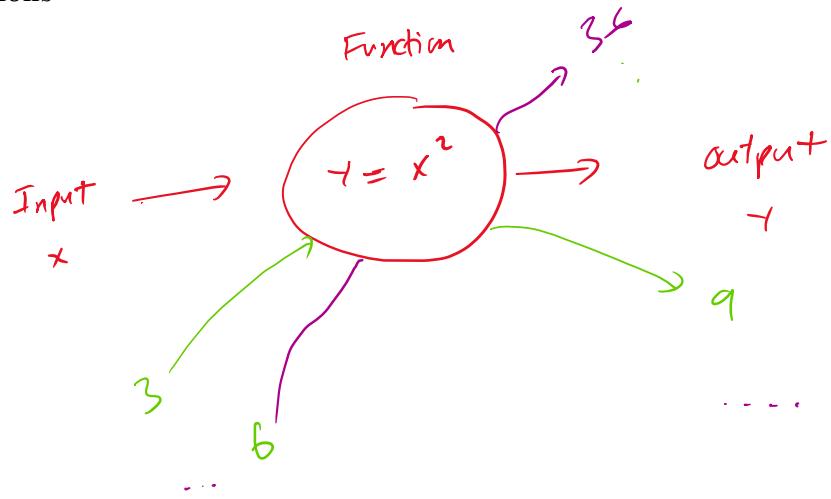
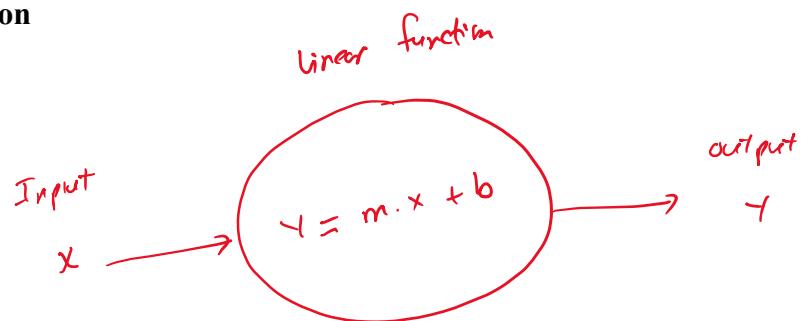


Linear Functions

Functions



Linear Function



④ m and b are some known constants / numbers.

Example : $y = 3x + 4$

$$\begin{array}{ll} \text{Input } x & \text{output} \\ x = 2 & \rightarrow y = 3 + 2 + 4 = 10 \\ x = 7 & \rightarrow y = 3 * 7 + 4 = 25 \end{array}$$

Linear:

$$y = 20x - 6$$

$$y = \frac{x}{6} + 7$$

$$[\text{ b/c } y = \frac{1}{6} \cdot x + 7]$$

Non - Linear

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

$$y = x^2 + 7$$

Graphs of Functions

The graph of a function is the collection of ALL the pairs (input, output) presented on the "x-y plane".

Graphs of Linear Functions

Given the function

$$y = 2x + 1$$

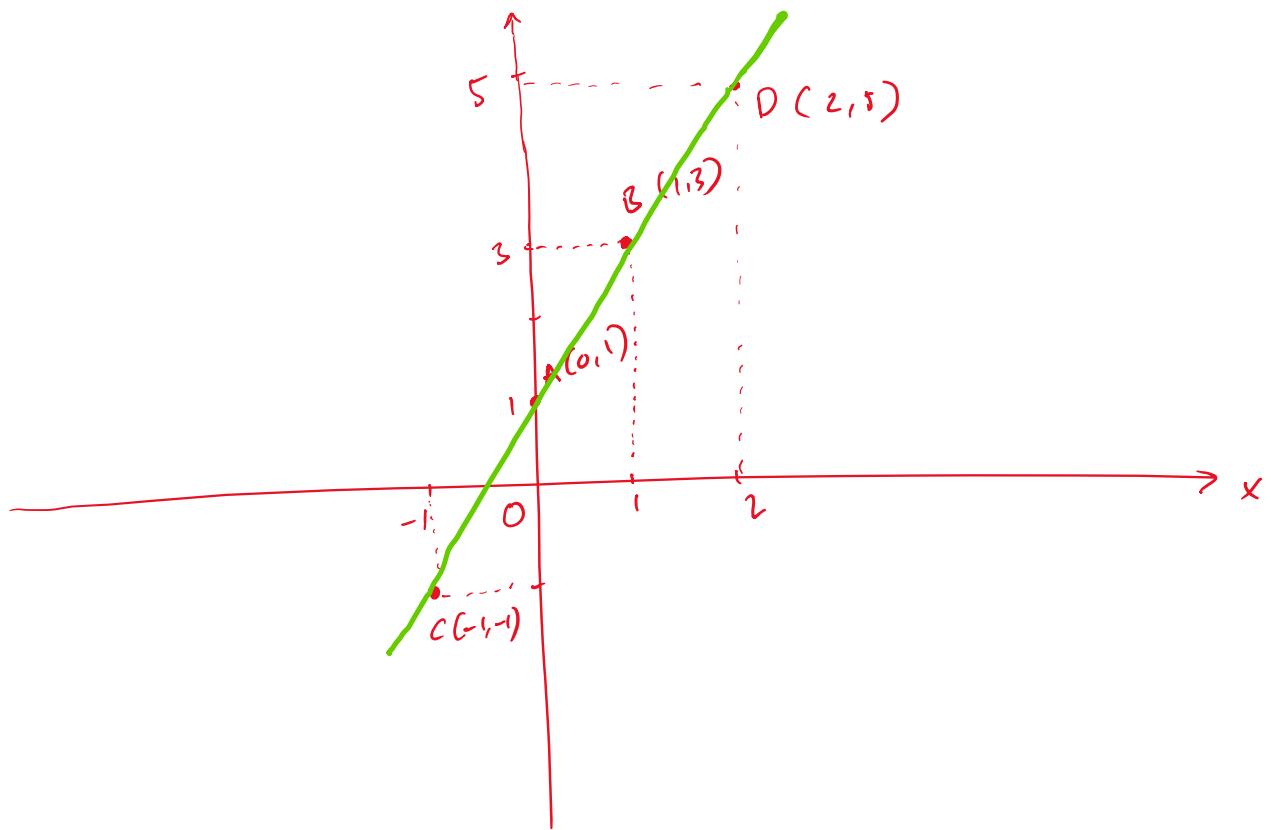
Let's collect a few pairs of (input, output)

$$\textcircled{1} \quad x=0, \quad y = 2+0+1 \Rightarrow \boxed{(x,y) = (0,1)} \quad A$$

$$\textcircled{2} \quad x=1, \quad \Rightarrow \quad y = 2*1+1=3 \Rightarrow \boxed{(x,y) = (1,3)}$$

$$\textcircled{3} \quad x=-1 \quad \Rightarrow \quad y = 2*(-1)+1 = -1 \\ \Rightarrow \boxed{(x,y) = (-1,-1)} \quad C$$

$$\textcircled{4} \quad x=2 \quad \Rightarrow \quad y = 2*2+1 = 5 \Rightarrow \boxed{(x,y) = (2,5)} \quad D$$



We observe that the graph of $y = 2x + 1$ is a line.

In general, the graph of a linear function is a line.

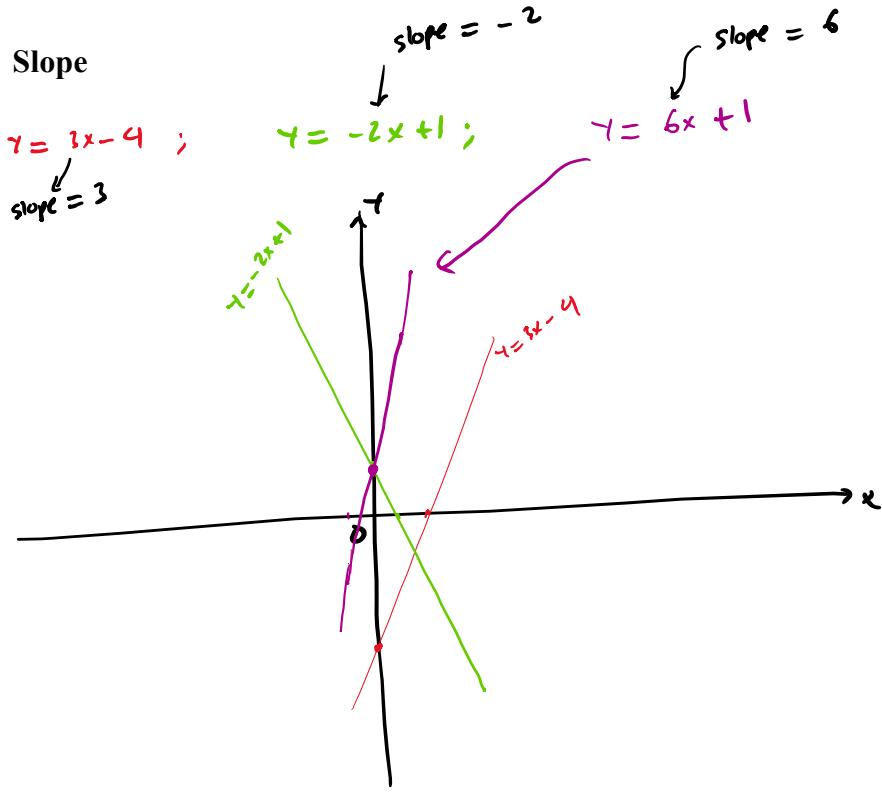
so we just need to plot 2 points and connect them to graph a linear function.

Practice

Graph the below linear function. Make sure to show the calculations for the points (just need to points to make the graph).

$$1. \ y = 3x - 4$$

$$2. \ y = -2x + 1$$

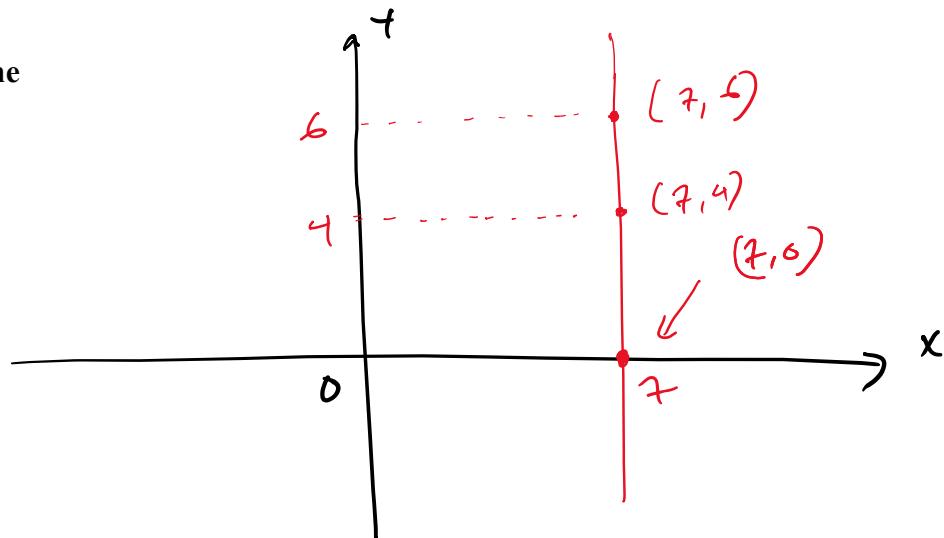


① positive slope \Rightarrow line goes up.
(from left to right)

② negative slope
 \Rightarrow line goes down.

③ line with greater positive slope will go up faster.

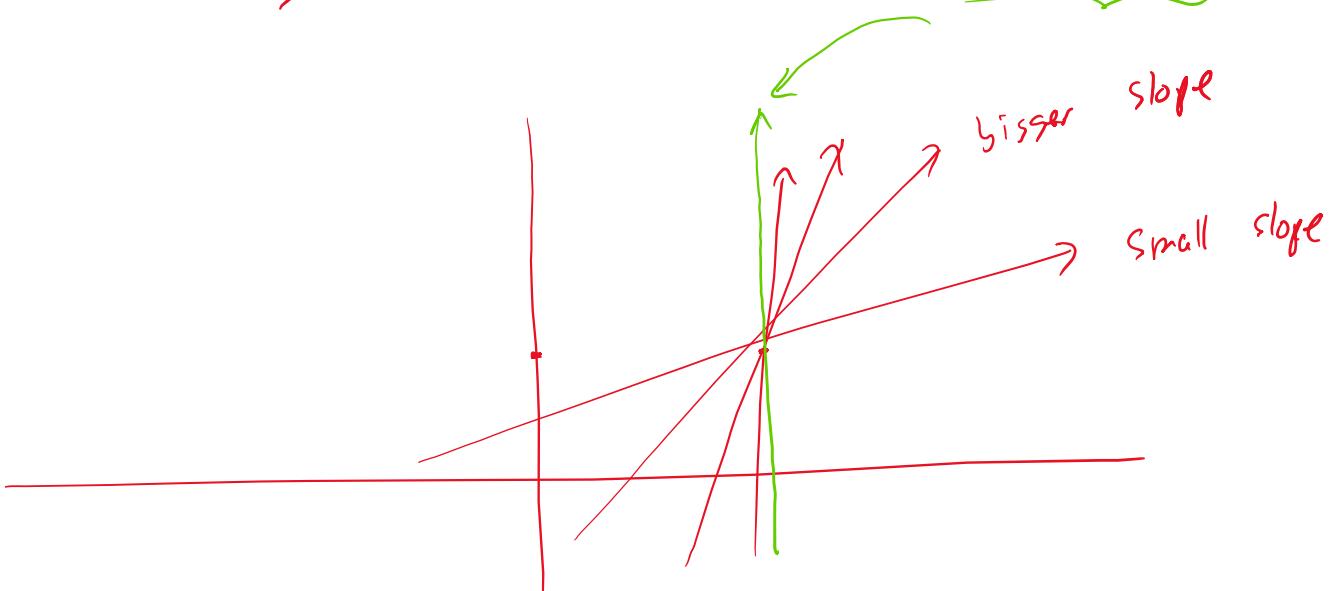
Vertical Line



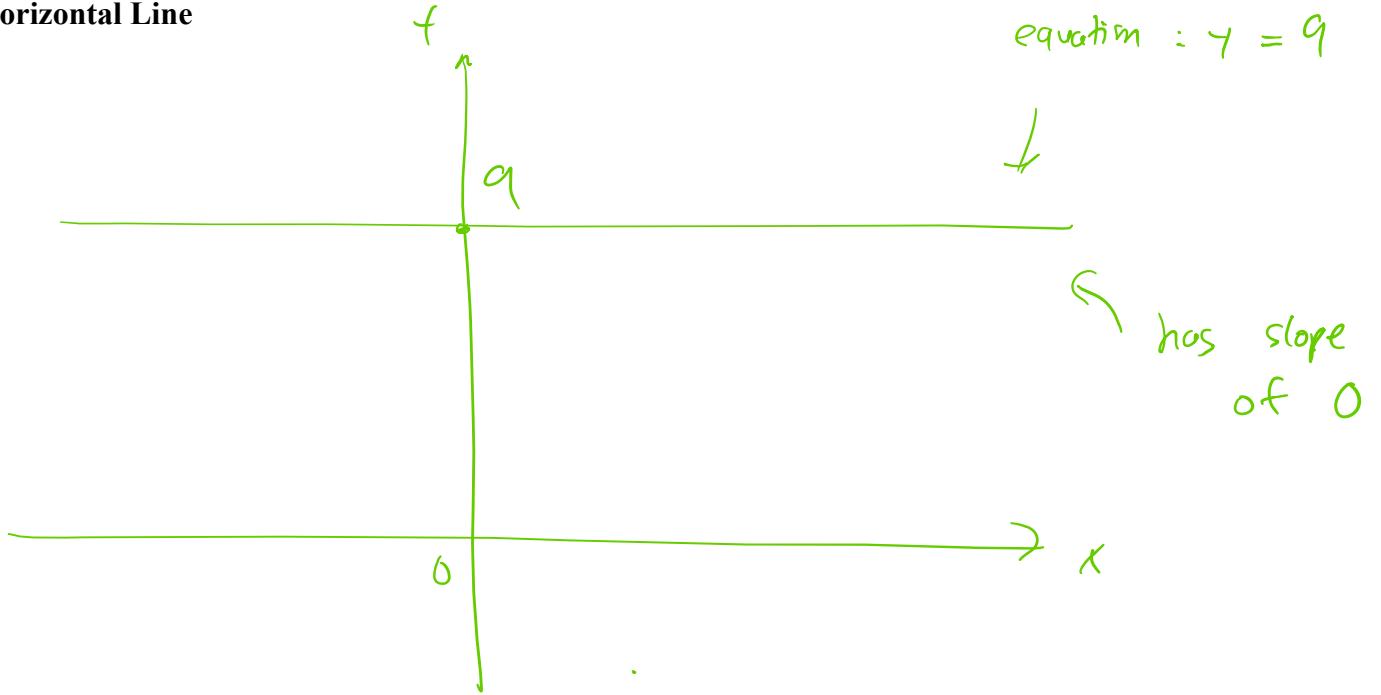
① This is not a function due to too many outputs for one input ($x = 7$)

② The equation of this vertical line is $x = 7$

③ The vertical line can be classified as having undefined slope or infinity slope.



Horizontal Line



Write the Equation of a Line

Previously : Given the equation \rightarrow make the graph

Now : Given some information \rightarrow write the equation

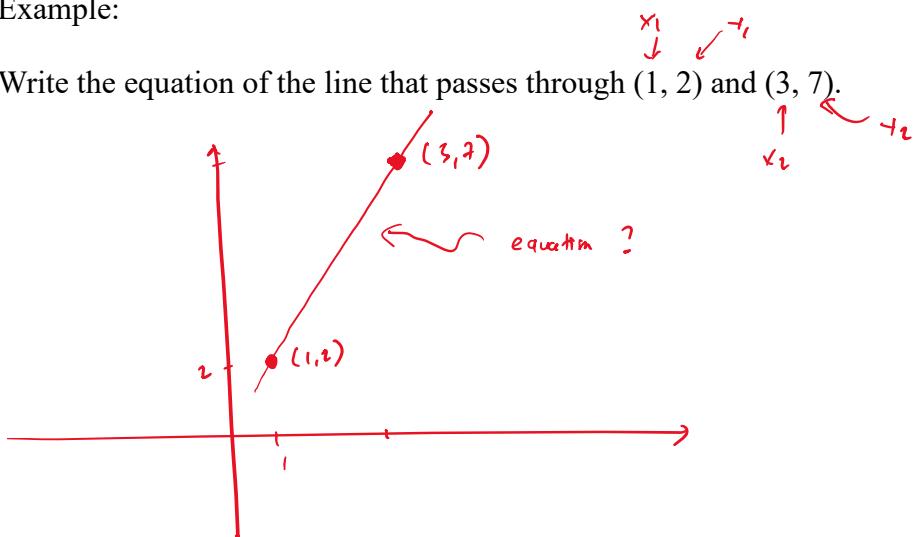
- ① Write the equation of the line that passes through 2 given points (x_1, y_1) and (x_2, y_2)

The equation is

$$y = \frac{y_2 - y_1}{x_2 - x_1} \cdot (x - x_1) + y_1$$

Example:

Write the equation of the line that passes through $(1, 2)$ and $(3, 7)$.



$$y = \frac{y_2 - y_1}{x_2 - x_1} \cdot (x - x_1) + y_1$$

plus in : $y = \frac{7-2}{3-1} \cdot (x - 1) + 2$

$$y = \frac{5}{2} (x - 1) + 2$$

$$y = \frac{5}{2}x - \frac{5}{2} + 2$$

$$y = \frac{5}{2}x - \frac{5}{2} + \frac{4}{2}$$

$$y = \frac{5}{2}x + \frac{-5+4}{2} = \frac{5}{2}x - \frac{1}{2}$$

② The equation of the line with the slope m and passes through the point (x_1, y_1) is

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

Example

$$\checkmark \quad m \quad \downarrow \quad y_1 \quad \checkmark \quad + y_1$$

Write the equation of the line with slope 7 and passes through (2, 5).

$$y = 7 \cdot (x - 2) + 5$$

$$y = 7x - 14 + 5$$

$$\boxed{y = 7x - 9}$$

Practice Problem (Assignment)

1. Write and simplify the equation of the line that passes through (1, 6) and (2, 1)

2. Write and simplify the equation of the line with slope -3 and passes through (-1, 0)