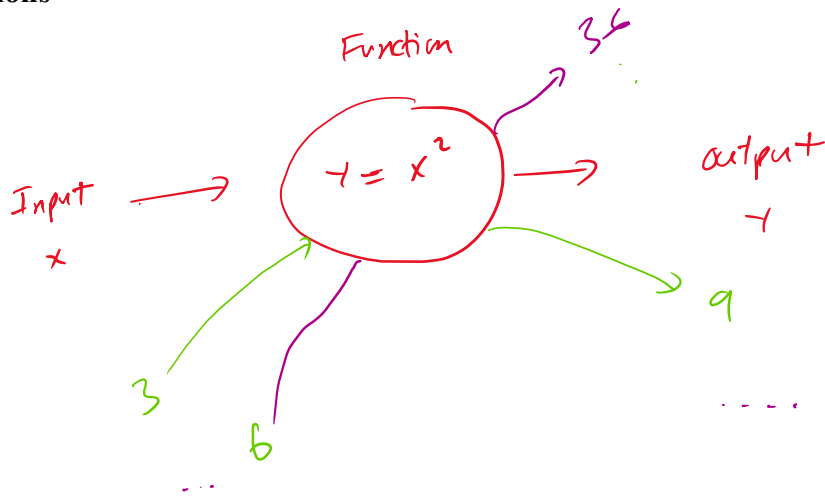
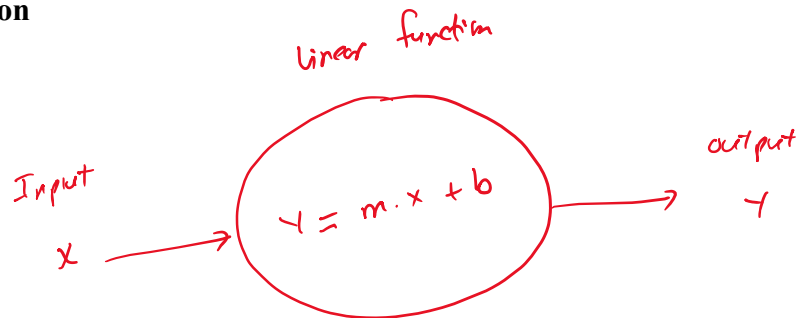


# Linear Functions

## Functions



## Linear Function



⑩  $m$  and  $b$  are some known constants / numbers.

Example :  $y = 3x + 4$

Input $x$	output
$x = 2$	$\rightarrow y = 3 * 2 + 4 = 10$
$x = 7$	$\rightarrow y = 3 * 7 + 4 = 25$

.....

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

$$y = 2x + 1$$

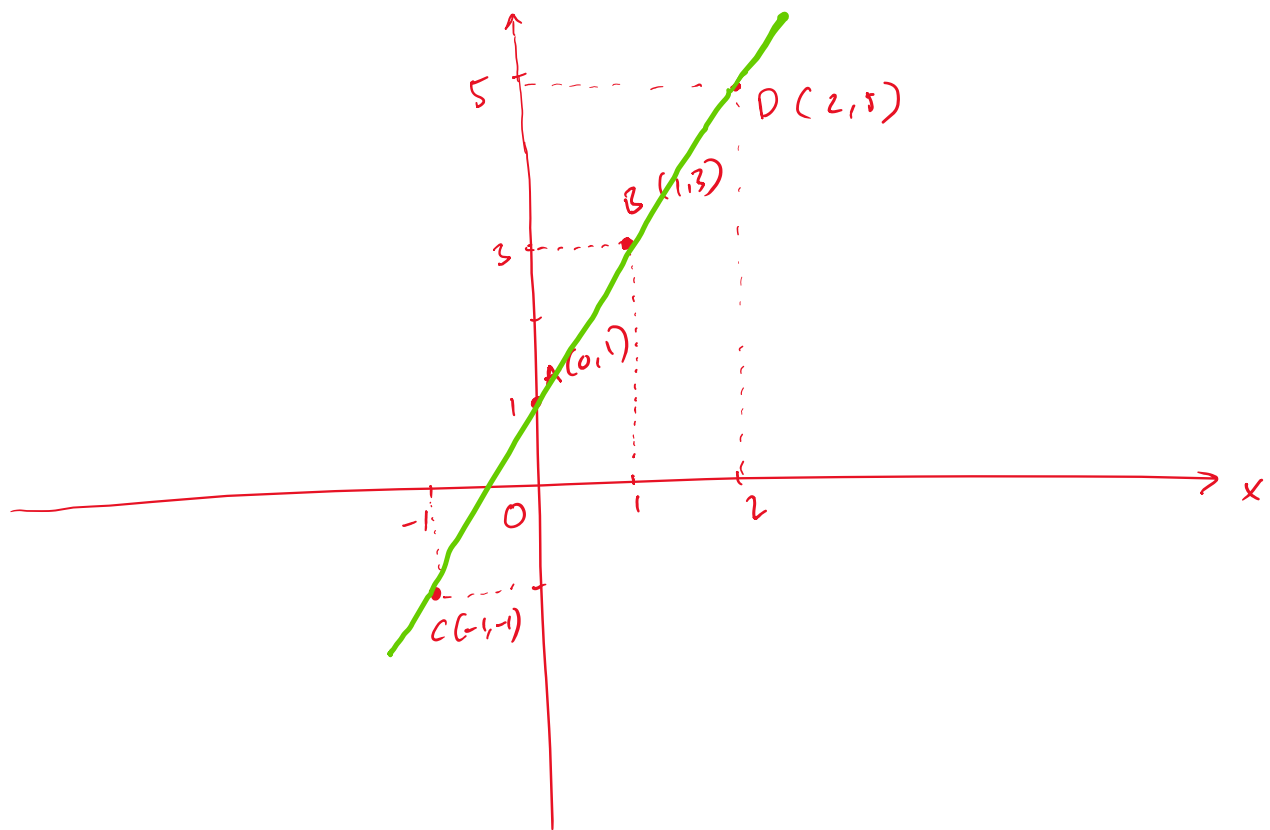
Lets collect a few pairs of (input, output)

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

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

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

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



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.

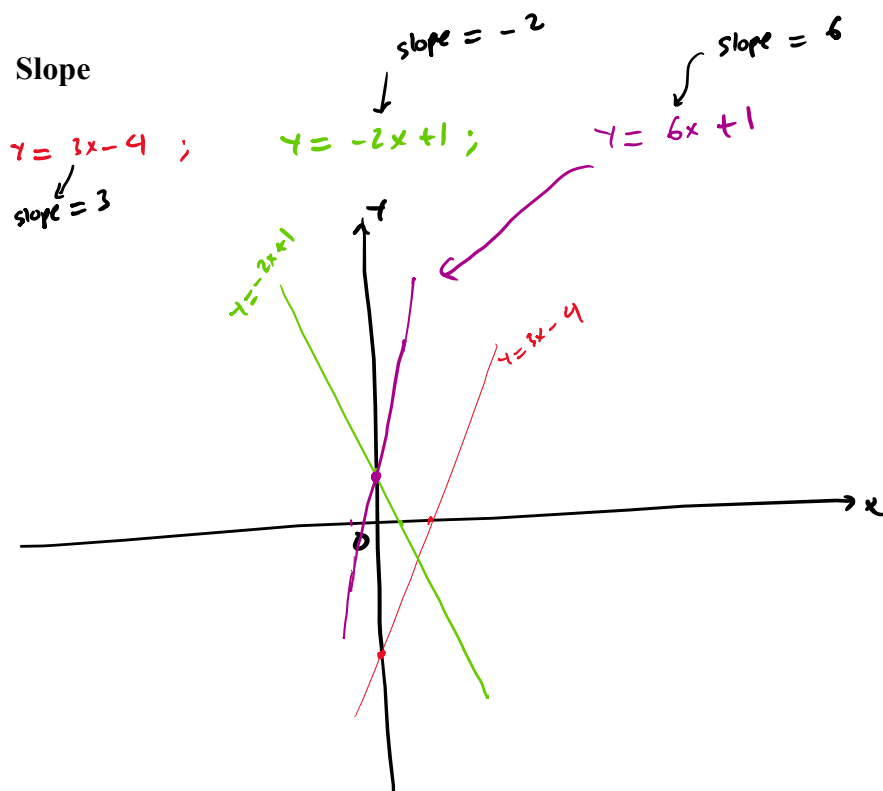
## Practice

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.  $y = -2x + 1$

Slope

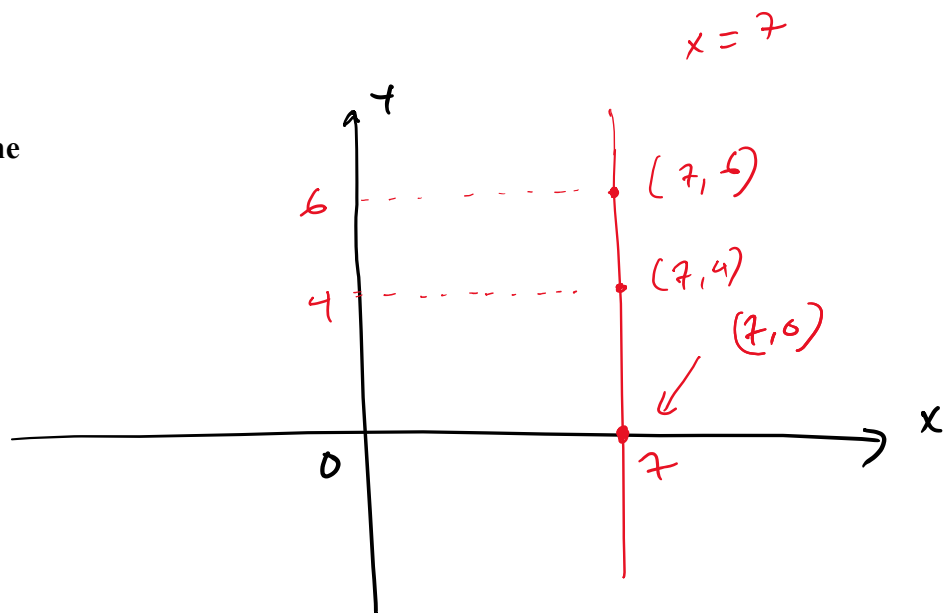


① positive slope  $\Rightarrow$  line goes up.  
(from left to right)

② negative slope  $\Rightarrow$  line goes down.

③ line with greater positive slope will go up faster.

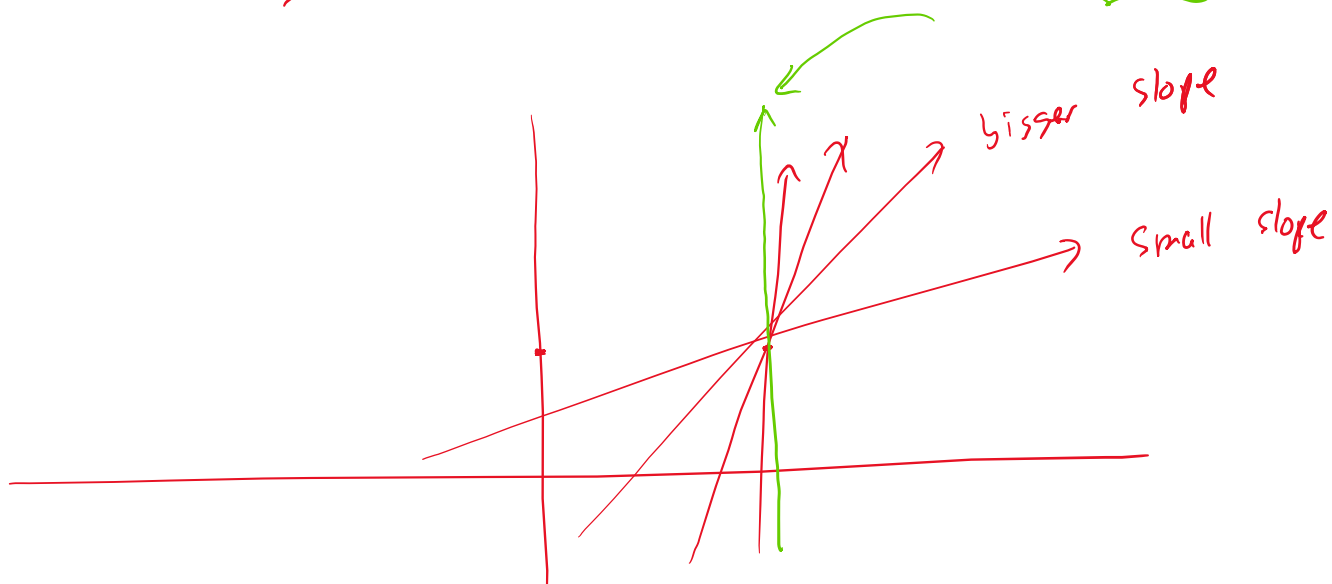
## Vertical Line



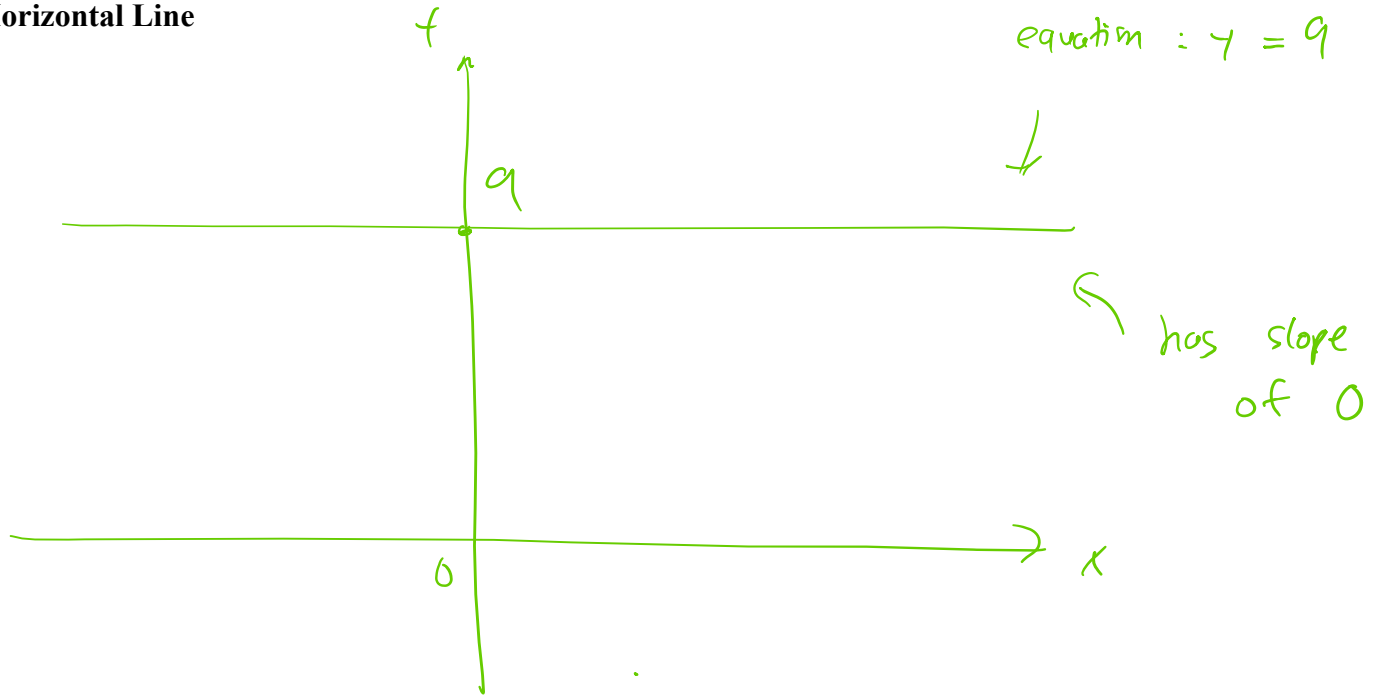
① This is not a function due to too many outputs for one input ( $x=7$ )

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  $\longrightarrow$  make the graph

now : Given some information  $\longrightarrow$  write the equation

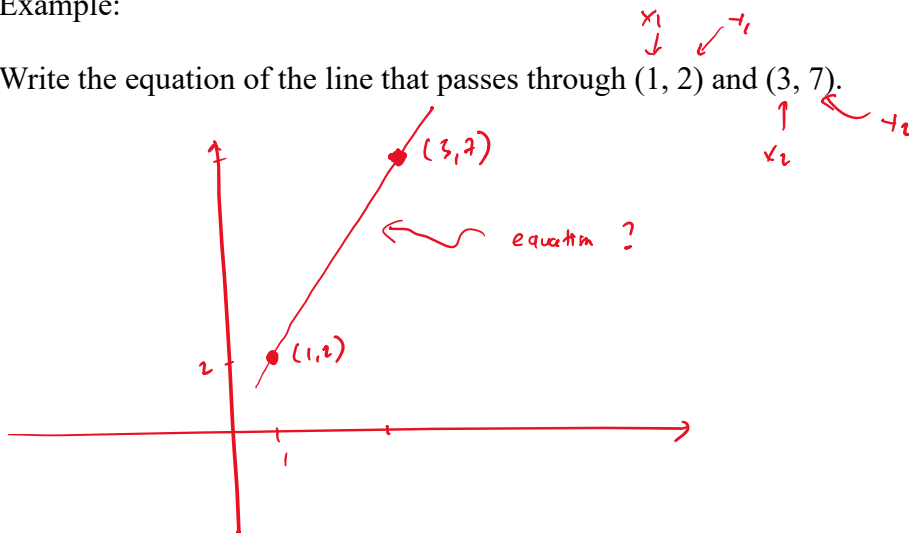
- ① write the equation of the line that passes through  
2 given points  $(x_1, y_1)$  and  $(x_2, y_2)$

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).



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

plug 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**

$\swarrow m$   $\downarrow x_1$   $\swarrow y_1$

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

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

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

$$y = 7x - 9$$

**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)