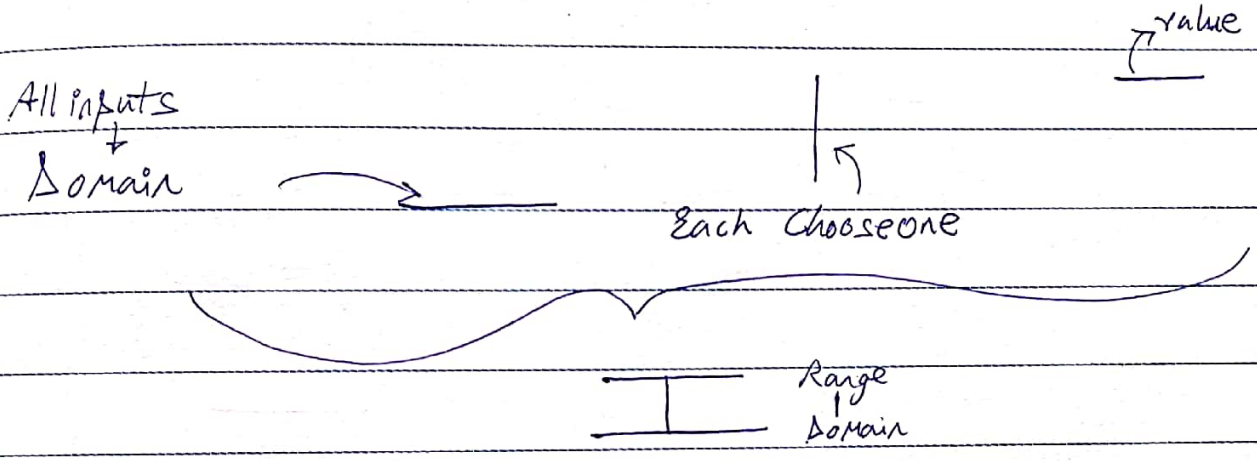
1.1 Function

Function is I



Function: Each in (I) chooses one out (O)

Each input number ⟼ one value

Collect: Domain — Collect: Range.

Introducing Functions: One thing

My name is Function, I am located in Domain, I follow a rule of giving one value to each input in my domain and explore my range

A child is characterized by its name and one thing it becomes.
A function is characterized by its domain and its range.
Identity: Name – One Thing. Set: Domain – Range.

Function: output one number for each input number

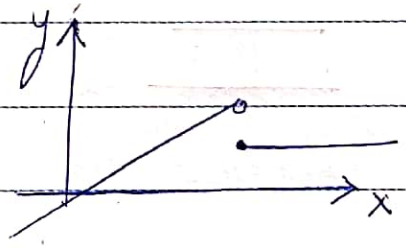
Example:

(i) The rule that sends every non-zero number to its square and sends 0 to 1.

(ii) The rule that sends every number to 42.

(iii) The rule that, given the weight of an envelope, decides the least number of stamps needed.

(iv)



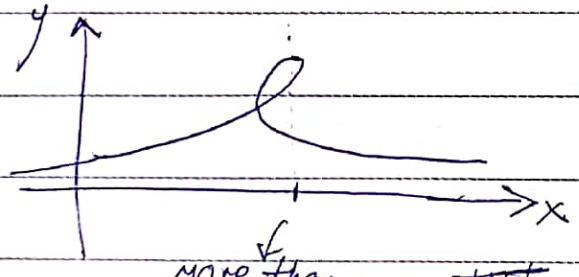
(v)

x	y
1	5
2	3
3	3

(vi) $y = x^2$

Non-Example: The following are not functions:

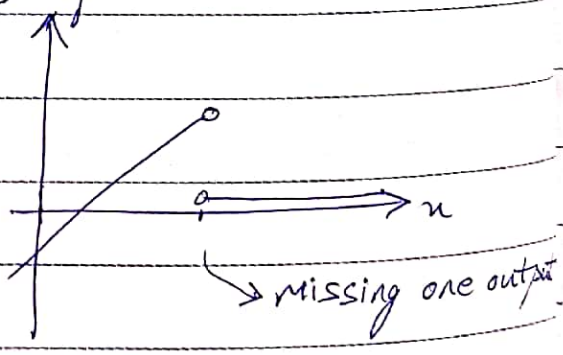
(a)



more than one output

$x^2 + y^2 = 1$

(b)

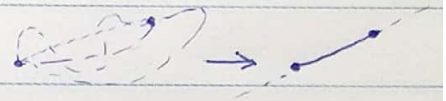


missing one output

x	y
1	5
1	2
2	3

Line ——•——•——

'simple' combination of two points.

'simplest way' to join two points 

two independent parameters: m, c

Simplest combination: $m \cdot x^1 + c \cdot x^0$

Linear function: $y = m \cdot x^1 + c \cdot x^0$

Notation: $x^1 \mapsto x$, $x^0 \mapsto 1$

$$y = m \cdot x + c \cdot 1$$

Choose i) $x = x_1$, $y = y_1 \Rightarrow y_1 = m \cdot x_1 + c \cdot 1$

ii) $x = x_2$, $y = y_2 \Rightarrow y_2 = m \cdot x_2 + c \cdot 1$

Balance i) and ii)

$$c \cdot 1 = y_2 - m \cdot x_2 = y_1 - m \cdot x_1 \quad \odot$$

$$\Rightarrow y_2 - y_1 = m \cdot x_2 - m \cdot x_1$$

$$y_2 - y_1 = m \cdot (x_2 - x_1)$$

$$\frac{y_2 - y_1}{x_2 - x_1} = m \quad \text{(Slope)}$$

By $\odot$ $c \cdot 1 = y_2 - \frac{y_2 - y_1}{x_2 - x_1} \cdot x_2$ (vertical intercept)

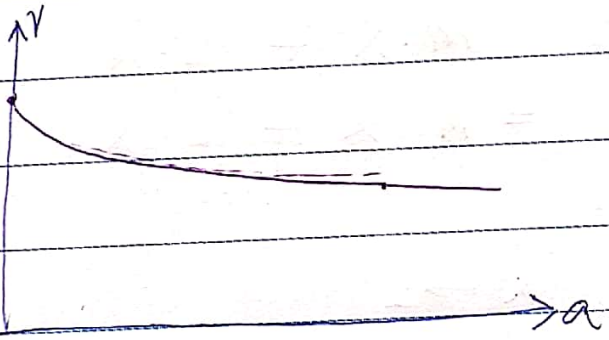
Jamboard 1.1 5

33. $V = f(a)$ → V: value in thousands of dollars, a: age of car in years

a) If the age of the car is 5 years, its value is $6000

$f(5) = 6$

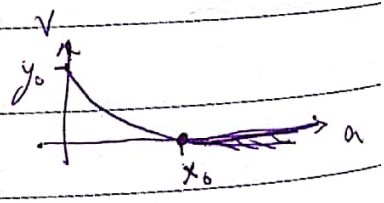
b)



f is a decreasing function.

As the car gets old, its value falls.

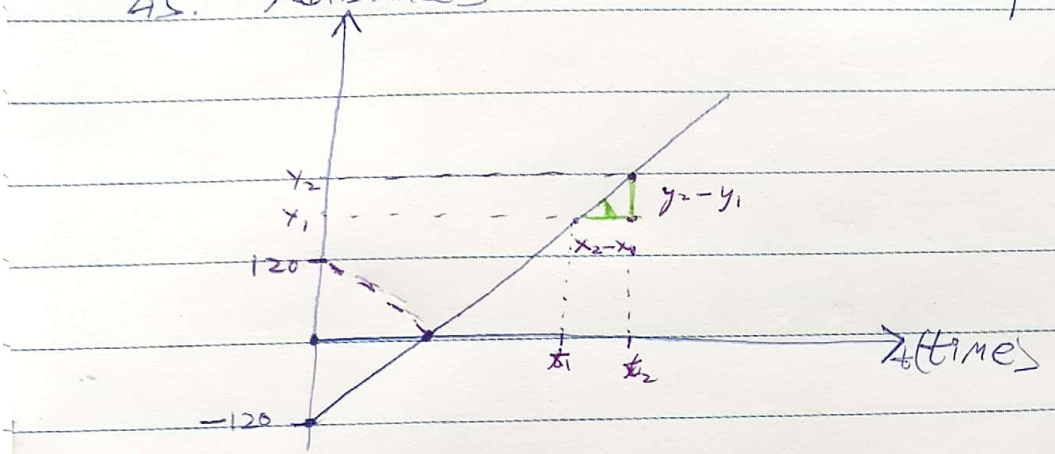
c) The horizontal intercept (x_0) is the age when the value of the car has fallen to zero. (i.e. the car has no value)



The vertical intercept (y_0) is the value when the car is newly made.

Tamboard 1.1 6/8

45. X(distance)



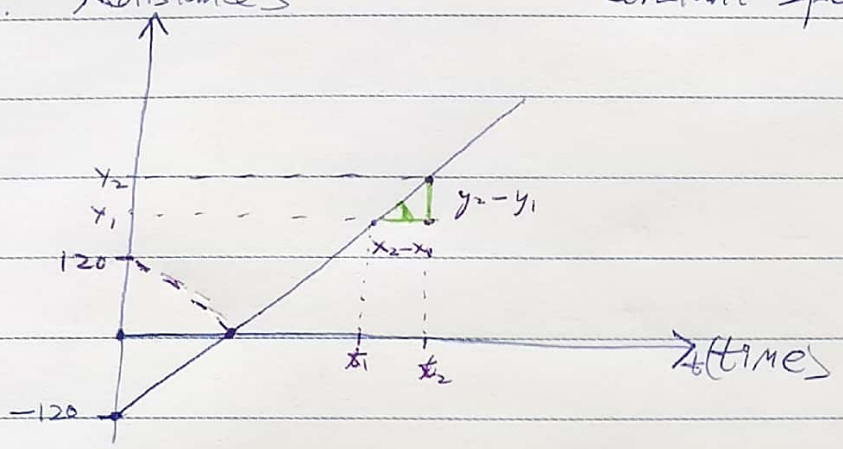
constant speed : $\frac{\Delta \text{distance}}{\Delta \text{time}} = m$ (Slope)

(Here y is X)

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{X_2 - X_1}{t_2 - t_1}$$

Tamboard 1.1 6/8

45. X (distance)



constant speed: $\frac{\Delta \text{distance}}{\Delta \text{time}} = m$ (slope)

(Here y is X)

$$m = \frac{y_2 - y_1}{t_2 - t_1} = \frac{X_2 - X_1}{t_2 - t_1}$$

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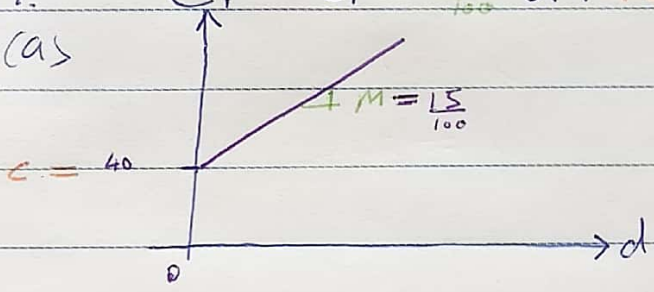
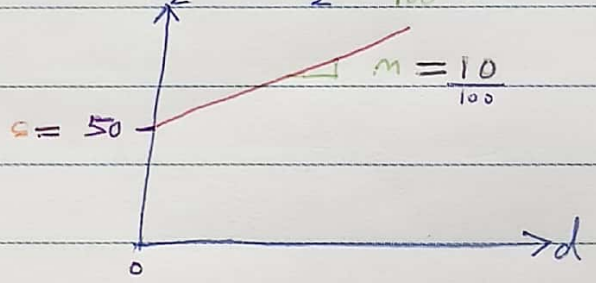
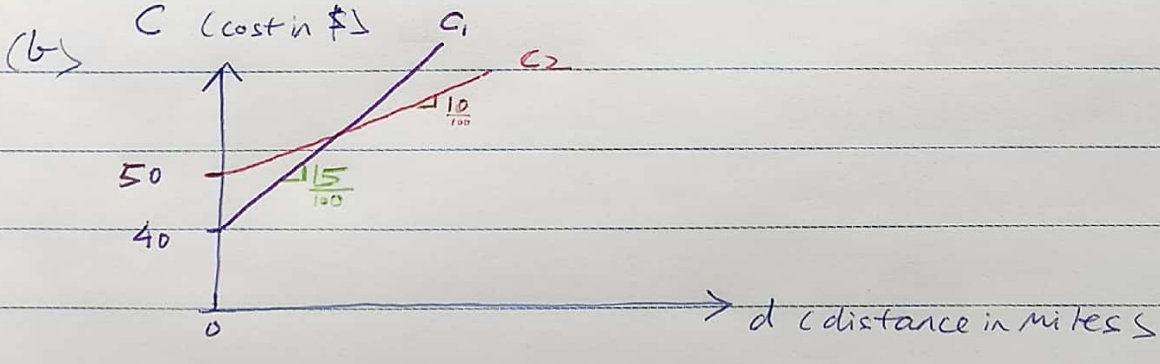
67. (a)





(b)



(c) Balance: $\frac{15}{100} d^* + 40 = \frac{10}{100} d^* + 50 = C^* = C_1 = C_2$

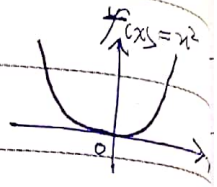
$$\frac{15}{100} d^* - \frac{10}{100} d^* = 50 - 40 \Leftrightarrow \frac{5}{100} d^* = 10 \Leftrightarrow d^* = 200$$

(in miles)

For $d \leq 200$: choose C_1 (cheaper), For $d > 200$ choose C_2

Jamboard 1.1 8/8

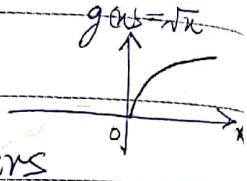
85. (a) $f(x) = x^2$



Domain: All real numbers ($\mathbb{R}$)

Range: All non-negative real numbers ($\mathbb{R}^+ \cup \{0\}$)

(b) $g(x) = \sqrt{x}$

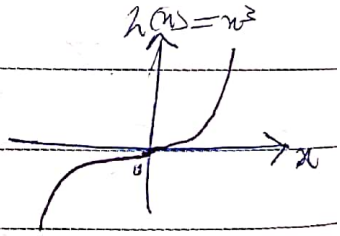


Domain: All non-negative real numbers

Range: All non-negative real numbers.

(For any $y \geq 0$, $x = y^2$ is the input required)

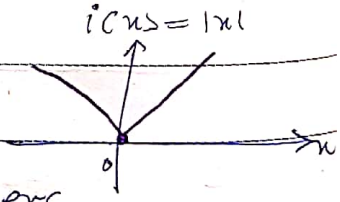
(c) $h(x) = x^3$



Domain: All real numbers

Range: All real numbers

(d) $i(x) = |x|$



Domain: All real numbers

Range: All non-negative real numbers