

Chapter 1 : Functions

1.1 Mappings

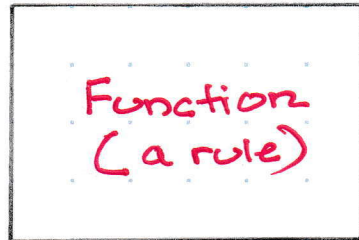
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Function

- is a rule that takes in input
- and produces output

- Input
- object
- domain
- x -values



- output
- Image
- range
- y -value (single value)

Function Notation

- is common way of writing
- and naming function.

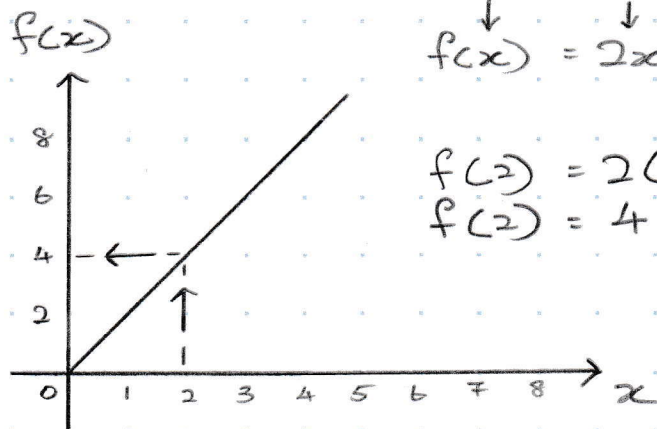
$$f(x) = 2x$$
$$f : x \rightarrow 2x$$

(f of x equals $2x$)
(f maps x to $2x$)

Function Example

y -value is known :

- output
- image
- range



input output

$$f(x) = 2x$$

$$f(2) = 2(2)$$
$$f(2) = 4$$

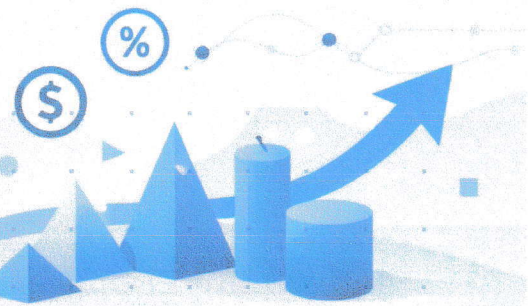
x -value is known :

- input
- object
- domain

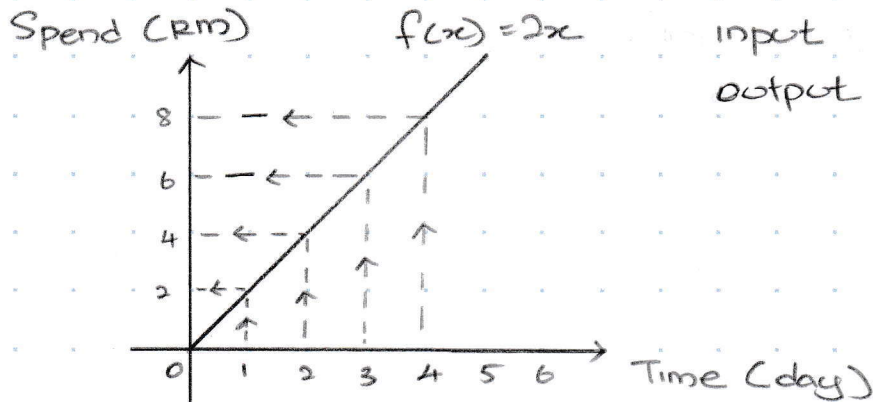
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Example : Spending Function.



input = x -value
output = y -value

- input = 1, output = 2 $\rightarrow$ day = 1, spend RM 2
- input = 2, output = 4 $\rightarrow$ day = 2, spend RM 4
- input = 3, output = 6 $\rightarrow$ day = 3, spend RM 6
- input = 4, output = 8 $\rightarrow$ day = 4, spend RM 8

Mapping Diagram

- shows the relation between elements
- in the input set and output set.

- i) **One** to **One** $\rightarrow$ one x -value to one y -value
- ii) **Many** to **One** $\rightarrow$ many x to one y
- iii) **One** to **Many** $\rightarrow$ one x to many y
- iv) **Many** to **Many** $\rightarrow$ many x to many y

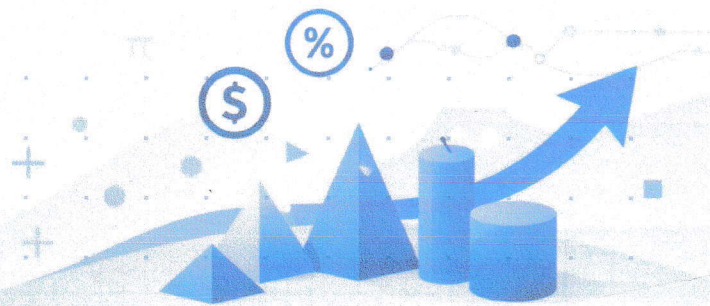
- the mapping can be understood as :

Input	to	Output
x	to	y
object	to	Image
(LEFT)		(RIGHT)

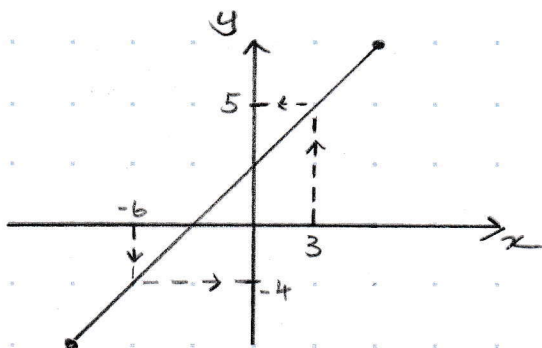
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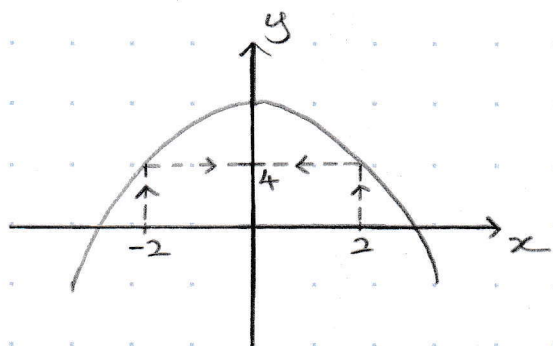


Graph

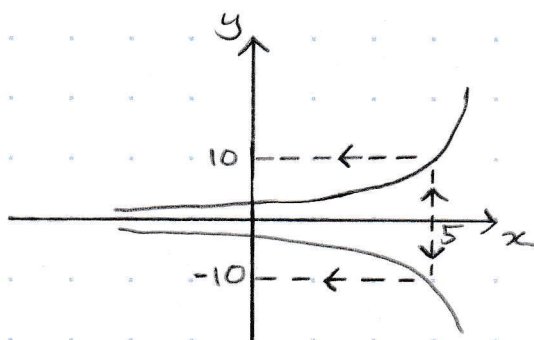


Explanation

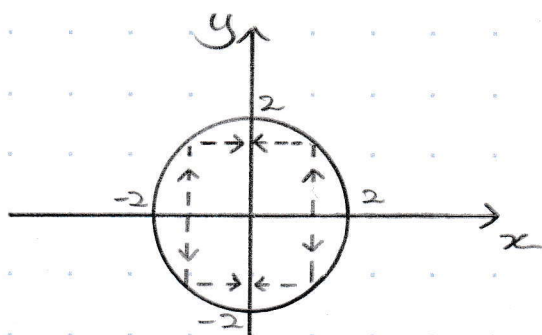
- **one to one relation**
- one x produces one y
- it is a **function**
↳ produces only one y



- **many to one relation**
- many x produces one y
- it is a **function**
↳ produces only one y



- one to many relation
- one x produces many y
- it is not a function
↳ y has 2 possible values

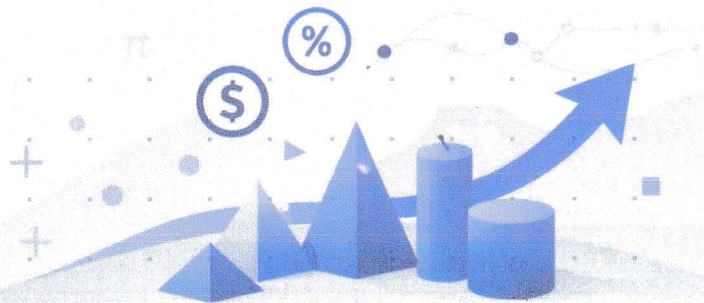


- many to many relation
- many x produces many y
- it is not a function
↳ y has 2 possible values (outputs)

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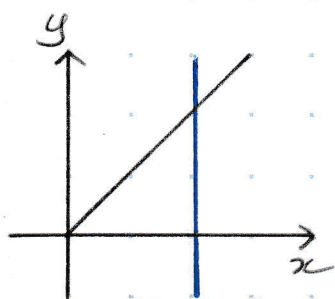
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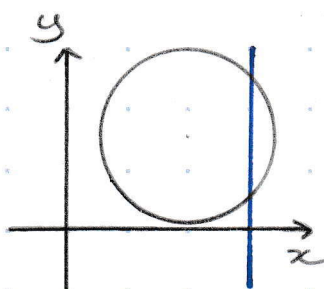
Function Tests

Vertical Line Test (VLT)

- Determines whether a graph is a **function**
- Draw a vertical line anywhere ($x = a$) that crosses the graph
- If intersect more than once, **not a function**
 - ↳ not one-to-one
 - ↳ not many-to-one
- Passes if, only if the line **intersects once**
 - ↳ it is a function
 - ↳ one-to-one or
 - ↳ many-to-one



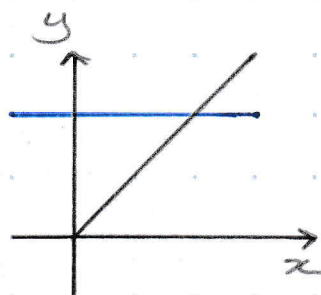
pass
(a function)



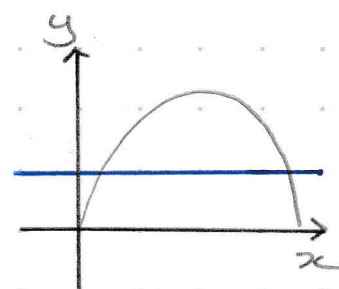
fail

Horizontal Line Test (HLT)

- Determines whether a graph has an **inverse**
- Draw a horizontal line anywhere ($y = b$) that crosses the graph
- If intersect more than once, the graph **does not have an inverse**
 - ↳ not one-to-one
- Passes if, only if the line **intersects once**
 - ↳ it has an inverse
 - ↳ one-to-one



pass
(has inverse)

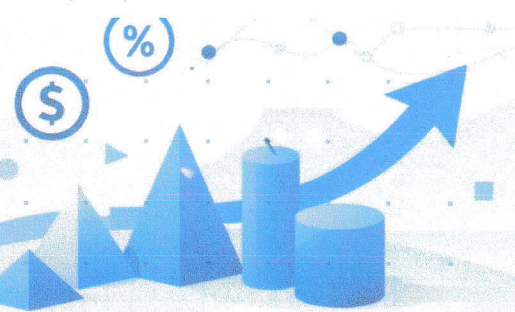


fail

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1.2 Domain and Range of Function

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	Domain	Range
Meaning	set of input values	set of output values
Represented by	x	y or $f(x)$
On graph	values along x -axis	values along y -axis
	$1 \leq x \leq 3$	$10 \leq y \leq 50$ $10 \leq f(x) \leq 50$
		Linear func.
	$x \in \mathbb{R}$ $\hookrightarrow x$ is defined everywhere $\hookrightarrow x$ is all real number	$y \geq 7$ $f(x) \geq 7$
		Quadratic func.
	$x \in \mathbb{R}, x \neq 4$ $\hookrightarrow x$ is defined everywhere, except 4	$y \in \mathbb{R}, y \neq 0$ $\hookrightarrow y$ is defined everywhere, except 0
		Reciprocal func.
	$x \in \mathbb{R}$	$y > 0$ $f(x) > 0$
		Exponential func.