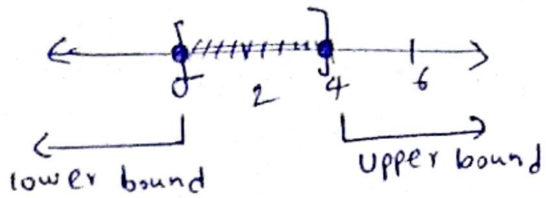
DS 1103 Calcular   Chapter 2

Pge number 7 - 18

The interval $[0,4]$ has a maximum of 4 and minimum of 0



* Smallest upper bound (4) called the Supremum

* greatest/highest lower bound (0) called the infimum

* $(0,4)$ and $[0,4]$ supremum and infimum are same to same. $(0,4)$ has no max and min.

examples :-

- $T = [q \in \mathbb{Q} : 0 \leq q \leq \sqrt{2}\}$

min (T) = 0

max (T) = does not exit because $\sqrt{2}$ is not a rational number.

- $A = \left\{\frac{1}{n^2} : n \in \mathbb{N} \text{ and } n \geq 3\right\}$ $A = \left\{\dots \frac{1}{25}, \frac{1}{16}, \frac{1}{9}\right\}$

A (max) = $1/9$

A (min) = 0 $\rightarrow$ $\boxed{\lim_{n \to \infty} \frac{1}{n^2} = 0}$ $\frac{1}{\infty} = 0$

A (supremum) = $1/9$

A (infimum) = 0

- $D = \{x \in \mathbb{R} \text{ and } x^2 < 10\}$

$-\sqrt{10} < x < \sqrt{10}$

D (max) = Deos not exit

D (min) = Does not exit

D (supreme) = $\sqrt{10}$

D (infimum) = $-\sqrt{10}$

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- $\mathbb{N} = \{1, 2, 3, 4, 5, 6, \dots\}$ $\qquad \mathbb{Z} = \{\dots -2, -1, 0, 1, 2, 3 \dots\}$

$\mathbb{N}$ (max) = Does not exit $\qquad \mathbb{Z}$ (max) = Does not exit.

$\mathbb{N}$ (min) = 1 $\qquad \mathbb{Z}$ (min) = Does not exit.

$\mathbb{N}$ supremum = Does not exit $\qquad \mathbb{Z}$ (supremum) = Does not exit.

$\mathbb{N}$ infimum = 1 $\qquad \mathbb{Z}$ (infimum) = Does not exit.

$\mathbb{Q} = \{ -5/6, -1, 0, 1/2, 3/4, 2 \}$

$\mathbb{Q}$ (max) = does not exit.

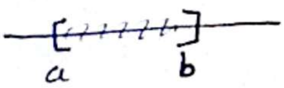
$\mathbb{Q}$ (min) = does not exit.

$\mathbb{Q}$ supremum = does not exit.

$\mathbb{Q}$ infimum = does not exit.

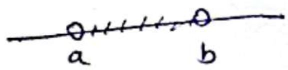
$$|x| = \begin{cases} x & \text{if } x \geq 0, \\ -x & \text{if } x < 0, \end{cases}$$

Standard notation for intervals



Closed interval $[a,b]$
(endpoint included)

$[a,b] = \{x \in \mathbb{R} : a \leq x \leq b\}$

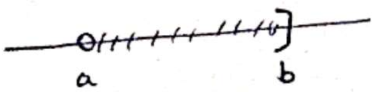


open interval (a,b)
endpoint excluded

$(a,b) = \{x : a < x < b\}$

Half open interval
$[a,b)$

$[a,b) = \{x : a \leq x < b\}$



Half open interval $(a,b]$

$(a,b] = \{x : a < x \leq b\}$

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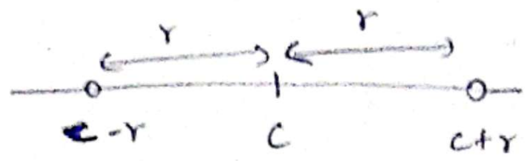
$|x-c| < r \Rightarrow$ ~~[illegible]~~ $\Rightarrow c-r < x < c+r$

$-r < x-c < r$

$x \in (c-r, c+r)$



~~r as radius~~ r as radius (අරය)

C as center (මධ්‍ය ලක්ෂ්‍යය)

$(a,b) = (c-r, c+r)$

$\boxed{c = \frac{a+b}{2}}$ $\boxed{r = \frac{b-a}{2}}$ අරය (radious)

- example (center)

① what is the midpoint and radious $[7, 13]$

Ans. $c = \frac{7+13}{2} = 10$ // $r = \frac{13-7}{2} = 3$ //

② $S = \{x : |\frac{1}{2}x - 3| > 4\}$

$|\frac{1}{2}x-3| > 4$ සොයන ගැටලුව වෙනුවට $|\frac{1}{2}x-3| \leq 4$ ලෙස සලකා ලැබෙන විසඳුම හැර ඉතිරි තාත්වික සංඛ්‍යා කුලකය ගත යුතු ~~[illegible]~~. සාධාරණ කරගත හැක

~~$\frac{1}{2}x - 3$~~ $-4 \leq \frac{1}{2}x - 3 \leq 4$

$-1 \leq \frac{1}{2}x \leq 7$

$-2 \leq x \leq 14$

$S = (-\infty, 2) \cup (14, \infty)$

- The set S is the complement consisting of all numbers x not in $[-2, 14]$. we can describe S as a union of two intervals.

example :-

Find the roots and Sketch the graph of

$$f(x) = x^3 - 2x$$

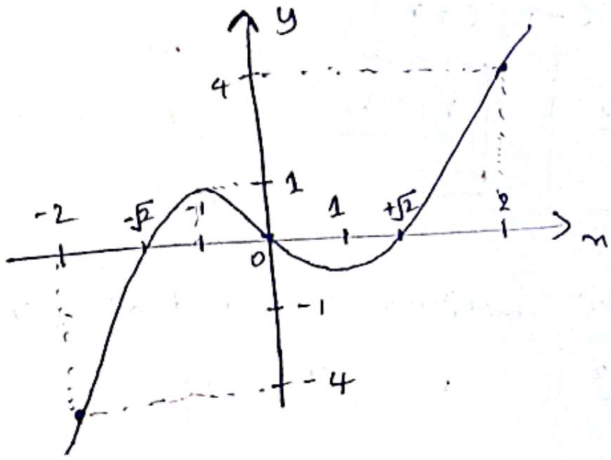
$$\cancel{= x(x(x-}$$

$$f(x) = x(x^2-2)$$

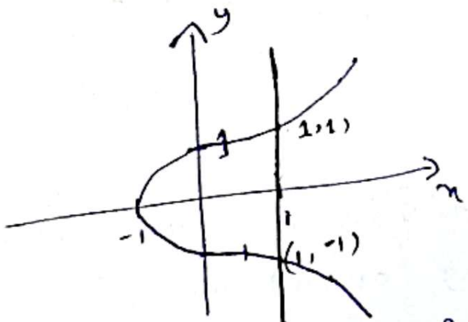
මූල (y=0 වන විට)

The roots of $f(x)$ are $x=0$ and $x=\pm\sqrt{2}$. To sketch the graph, we plot the roots and a few values listed in table. and join them by curve figure.

x	x^3-2x
-2	-4
-1	1
0	0
1	-1
2	4



① Vertical line test :- If you can draw a verticle line (parallel to the y-axis) anywhere on the graph and it intersects the graph at more than one point, then the graph is not a function



$$4y^2 - x^3 = 3$$

This graph fill the vertical line test. So it is not the graph of a function

why? because in a function every input x can have only ~~out~~ one output y.

~~② What is function~~

② What is function?

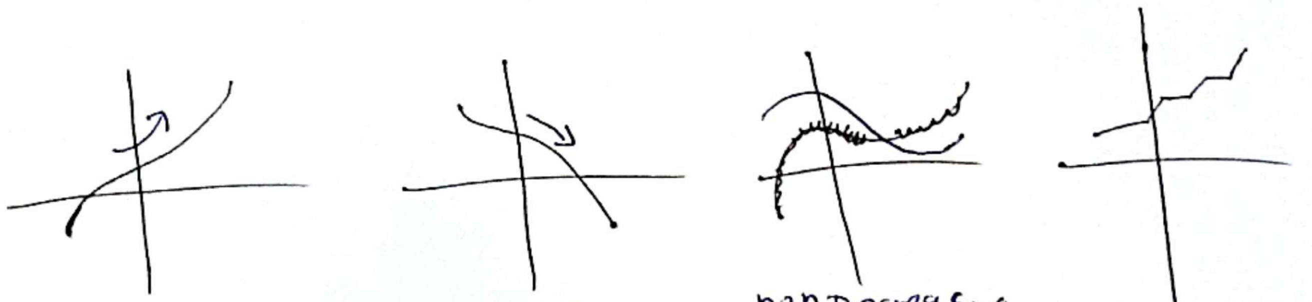
Special kind of relationship between two set.

- each input has exatly one output.
- ~~more~~ one input has more than one output it is not a function (vertical line test)

$f(x) = x+2$	$x^2 + y^2 = 4$
if $x = 3$	if $x = 0$
$f(3) = 3+2$	$y = \pm 2$
$f(3) = 5$	two output
one output	not a function
• function	

Increasing and Decreasing function.

Ⓐ Increasing	$f(x_1) < f(x_2)$	$x_1 > x_2$
Ⓑ Nondecreasing	$f(x_1) \leq f(x_2)$	$x_1 > x_2$
Ⓒ Decreasing	$f(x_1) > f(x_2)$	$x_1 > x_2$
Ⓓ Non Increasing	$f(x_1) \geq f(x_2)$	$x_1 > x_2$



increasing Decreasion nonDecreasing nonincreasing

(ඒකාකාරී)

we say that $f(x)$ is Monotonic if it is either increasing or decreasing