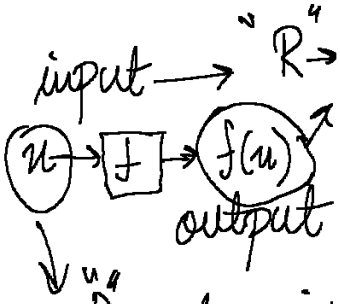
Math 1A: lecture:

8/24/23

Introduction 1.1: 5 ways to represent a function



A function is a rule that assigns to each element "x" to a set D exactly one element $f(x)$ of another set.

Write: $f: D \to R$ [Each input has exactly 1 output]

① Representation 1: Verbal

Ex 1:

x = time — $D \nrightarrow f(x) \to (-\infty, \infty) = \mathbb{R}$

$f(x)$ = tide level — $R \nrightarrow f(x) \to [0, 100]$ ← max tide level in history

↑ min tide lvl

Ex 2:

x = search term — $D \nrightarrow f(x) \to$ set of all words

$f(x)$ = Google hits — $R \nrightarrow f(x) \to \{0 \ldots$ all webpages$\}$

Ex 3:

x = # of quarters — $D \nrightarrow f(x) \to \{0, 1, 2, 3, 4\}$

$f(x)$ = delay time — $R \nrightarrow f(x) \to \{0, 15, 30, 45\}$

[The description specifies a unique output, depending only on the input]

Representation 2: Table

Ex1:

Time	Tide level (ft)
1am	2.1345
2am	5.2345
3am	17.3456

Ex2:

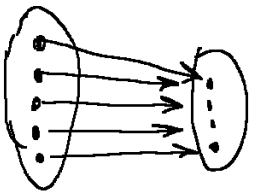
#quarter	elapsing time
0	0
1	15
2	30
3	45
4	

← domain; elapsing time = Range

Note: No repetitions of domains.

Representation 3: Arrow Diagram

Ex1:



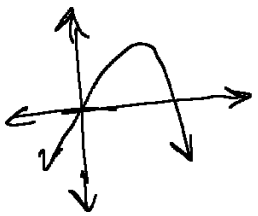
Notice that 2 data can have one range value then there is exactly one arrow emanating from every dot on the left.

Representation 4: Formulaic (Algebraic)

Ex1:

x = time Dom $f(x) \to [0,4]$

$f(x) = 20-(x-2)^2$ Ran $f(x) \to [0,20]$

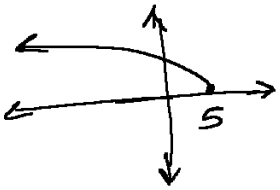


Ex2:

$f(x) = \sqrt{5-x}$

Dom $f(x) = (-\infty, 5]$

Ran $f(x) = [0, \infty)$



Ex3: $f(x) = x^2 + 2x$

$x(x+2)$

Dom $f(x) = (-\infty, \infty)$ or $\mathbb{R}$

Ran $\in (-1, \infty)$

1'

For which numbers y is $y = f(x)$ for one $x \in \mathbb{R}$

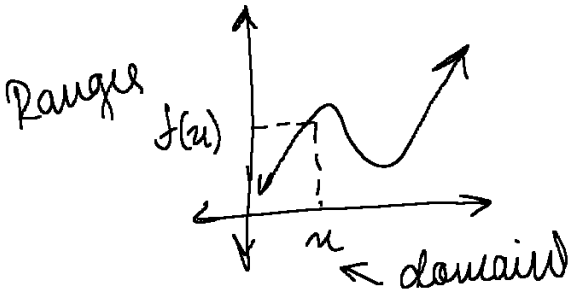
Representation 4 continued:

Another way look it graphically where you are essentially finding the mid point of the graph.

For every $x \in D$, the formula needs to make sense and produce $f(x)$.

Representation 5:

Ex: graphical

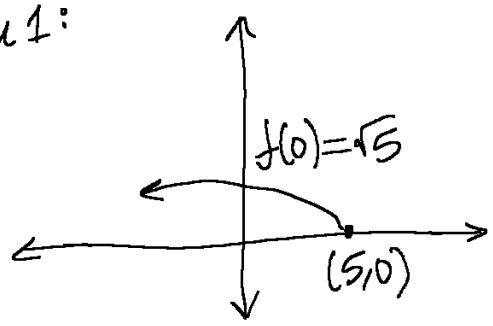


Every vertical line intersects the graph at most once [vertical line test]

Domain D: set of all the x-coordinates for which the vertical line intersects the line

Range R: set of y-coordinates for which the horizontal line intersects the graph.

Ex 1:



$f(x)=\sqrt{5-x}$

$f(0)=5$

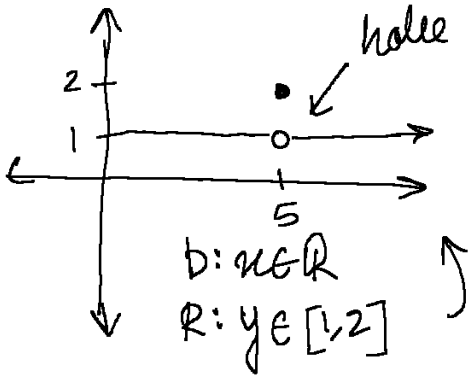
domain: $x \in (-\infty, 5]$

Range: $y \in [0, \infty)$

Other important functions:

① Piecewise functions

$$f(x)=\begin{cases}1 \text{ if } x\neq 5\\ 2 \text{ if } x=5\end{cases}$$

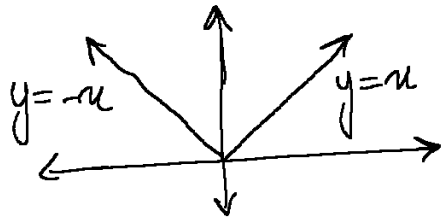


D: $x\in\mathbb{R}$

R: $y\in[1,2]$

② Absolute Value function

$$f(x)=|x|=\begin{cases}x \text{ if } x>0\\ -x \text{ if } x<0\end{cases}$$



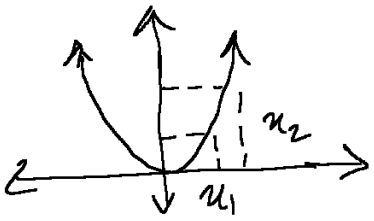
Domain: $x\in\mathbb{R}$

Range: $y\in[0,\infty)$

Increasing / decreasing functions:

$f(x_1)<f(x_2)$ whenever $x_1<x_2$

$f(x_2)<f(x_1)$ whenever $x_2<x_2$



$\uparrow \forall x\in(0,\infty)$

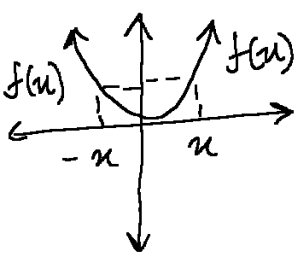
$\downarrow \forall x\in(-\infty,0)$

Even / odd functions:

Even: $f(-x)=f(x)$

Odd: $f(-x)=-f(x)$

Ex: $f(x)=x^2$



$f(x)=x^3$