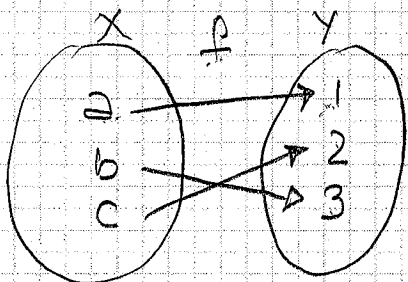


FUNCTIONS

Let X and Y be two non-empty sets. A Function from X into Y is a relation that associates with each element of X exactly one element of Y

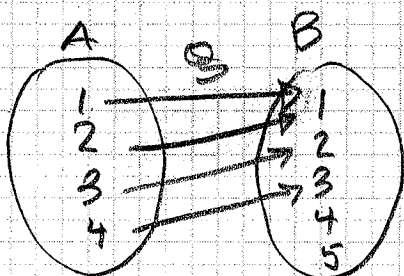


Venn Diagram

$$f = \{ (a, 1), (b, 2), (c, 3) \}$$

$$X = \text{domain} = \{ a, b, c \}$$

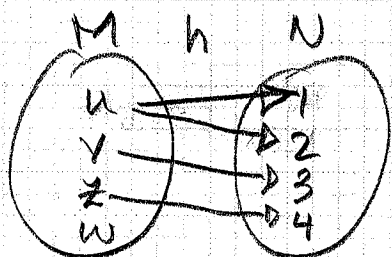
$$\text{Range} = \{ 1, 2, 3 \}$$



$$g = \{ (1, 1), (2, 2), (3, 2), (4, 3) \}$$

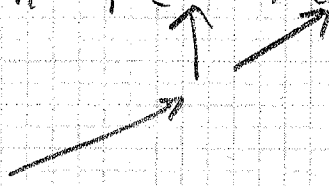
$$\text{Domain} = A = \{ 1, 2, 3, 4 \}$$

$$\text{Range} = \{ 1, 2, 3 \}$$



NOT A FUNCTION

$$h = \{ (u, 1), (v, 2), (z, 3), (w, 2) \}$$

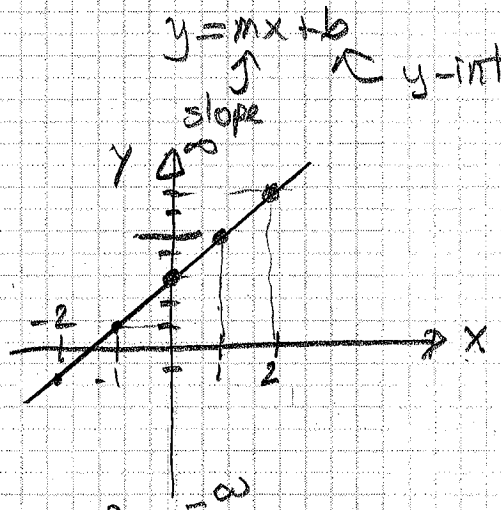


Example:

$$f: \mathbb{R} \rightarrow \mathbb{R}$$

$$f(x) = 2x + 3$$

x	y
-2	-1
-1	1
0	3
1	5
2	7



"OK"

$$\text{Domain} = \mathbb{R} = (-\infty, \infty)$$

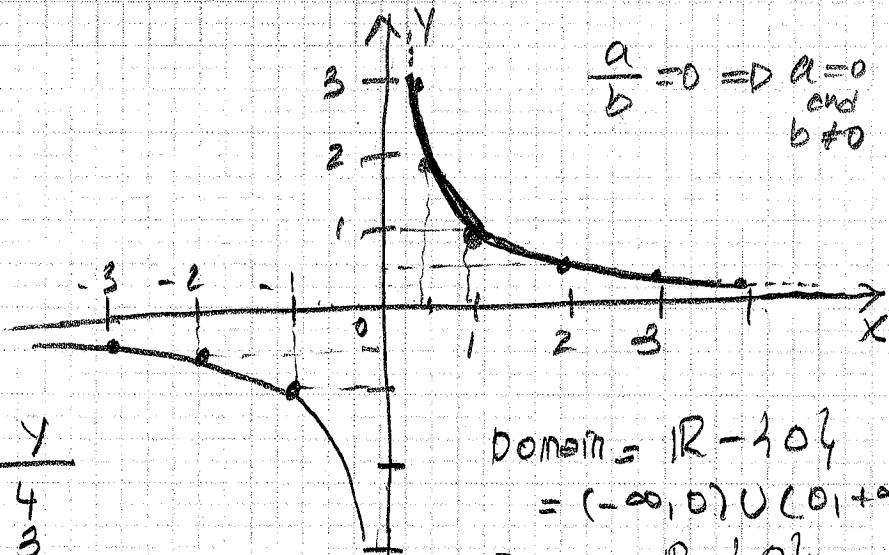
$$\text{Range} = \mathbb{R} = (-\infty, \infty)$$

Example: $f: \mathbb{R} \rightarrow \mathbb{R}$

$$f(x) = \frac{1}{x}$$

$$f(0) = \frac{1}{0} = ? \text{ undefined}$$

x	y
-4	-1/4
-3	-1/3
-2	-1/2
-1	-1
~	
1	1
2	1/2
3	1/3
4	1/4



x	y
1/4	4
1/3	3
1/2	2
1	1

$$\text{Domain} = \mathbb{R} - \{0\}$$

$$= (-\infty, 0) \cup (0, +\infty)$$

$$\text{Range} = \mathbb{R} - \{0\}$$

$$f(1/2) = \frac{1}{1/2} = 1 \cdot \frac{2}{1} = 2$$

$$f(1/3) = \frac{1}{1/3} = 3$$

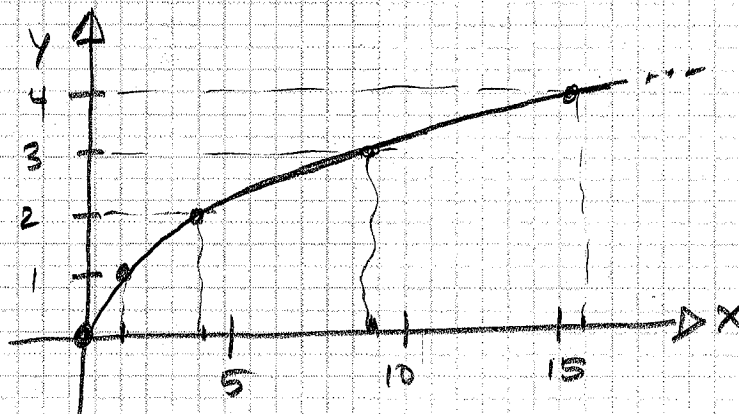
Example

$f: \mathbb{R} \rightarrow \mathbb{R}$

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

$f(-1) = \sqrt{-1}$ not a real number

x	y
0	$\sqrt{0} = 0$
1	$\sqrt{1} = 1$
4	$\sqrt{4} = 2$
9	$\sqrt{9} = 3$
16	$\sqrt{16} = 4$



Domain = $\mathbb{R}^+ \cup \{0\} = [0, +\infty)$

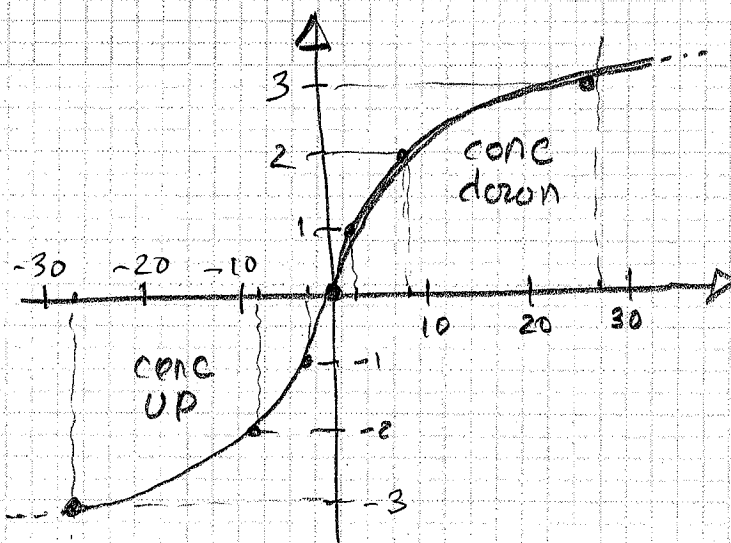
Range = $[0, +\infty)$

Example: $f: \mathbb{R} \rightarrow \mathbb{R}$

$f(x) = \sqrt[3]{x}$

$f(-8) = \sqrt[3]{-8} = -2$

x	y
-27	$= -3$
-8	$= -2$
-1	$= -1$
0	$\sqrt[3]{0} = 0$
1	$\sqrt[3]{1} = 1$
8	$\sqrt[3]{8} = 2$
27	$\sqrt[3]{27} = 3$



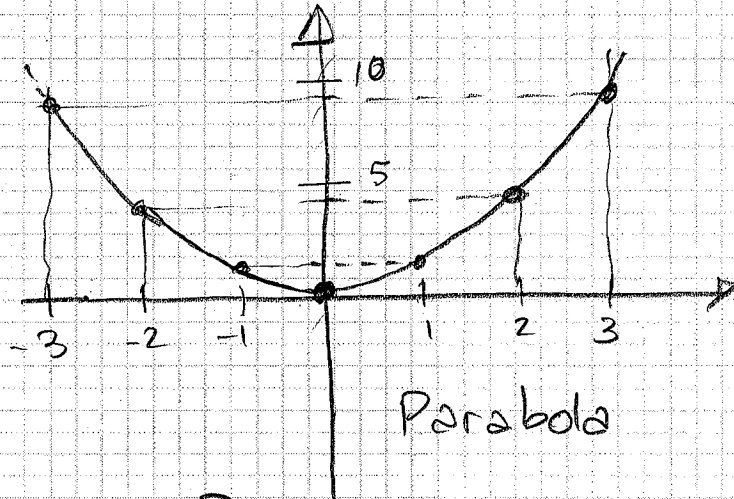
Domain = $\mathbb{R} = (-\infty, +\infty)$

Range = $\mathbb{R} = (-\infty, +\infty)$

Example:

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

x	y
-3	$(-3)^2 = 9$
-2	$(-2)^2 = 4$
-1	$(-1)^2 = 1$
0	$0^2 = 0$
1	$1^2 = 1$
2	$2^2 = 4$
3	$3^2 = 9$

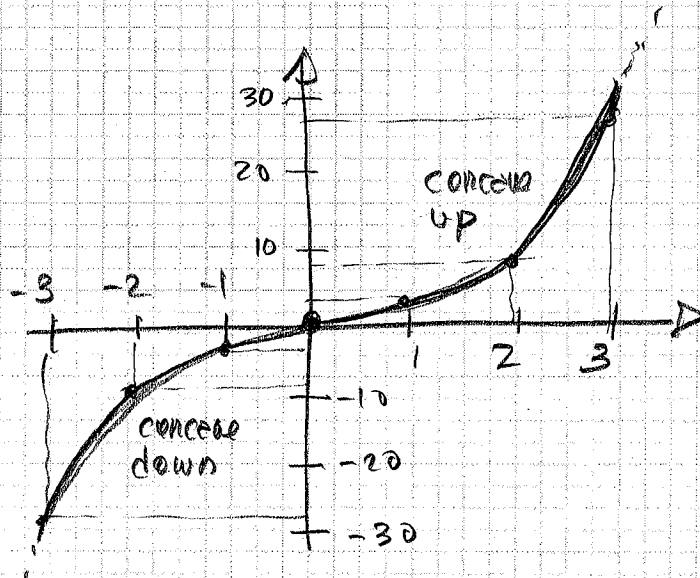


$$\text{Domain} = (-\infty, \infty) = \mathbb{R}$$

$$\text{Range} = [0, +\infty)$$

Example $f(x) = x^3$

x	y
-3	-27
-2	-8
-1	-1
0	0
1	1
2	8
3	27



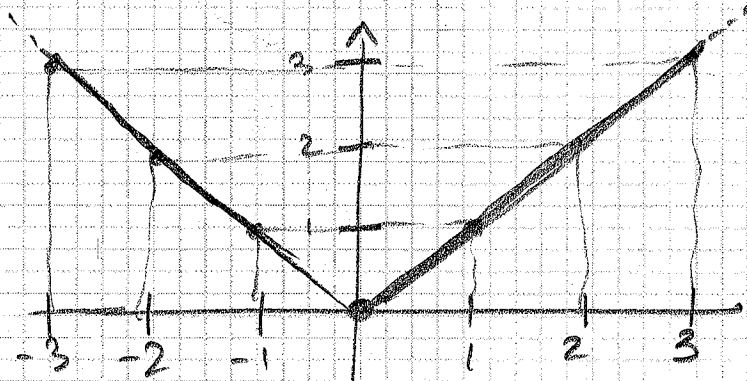
$$\text{Domain} = \mathbb{R} = (-\infty, +\infty)$$

$$\text{Range} = \mathbb{R} = (-\infty, +\infty)$$

Example:

$$f(x) = |x|$$

x	$ x $
-3	3
-2	2
-1	1
0	0
1	1
2	2
3	3



$$\text{Domain} = (-\infty, +\infty) = \mathbb{R}$$

$$\text{Range} = [0, +\infty)$$