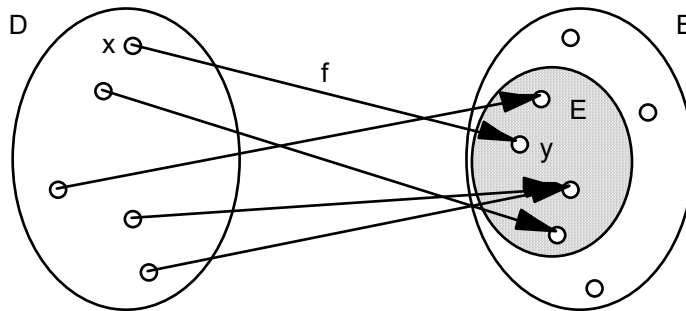


# Function

## Definition and examples

Def.: A **function**  $f$  is a rule that associates to **each** element  $x$  in a set  $D$  **exactly one** element  $y$  in a set  $B$ .

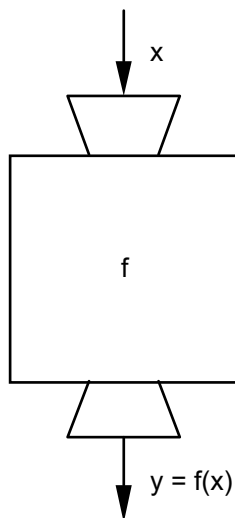


The function  $f$  **maps** the set  $D$  onto the set  $B$ .

$$f: D \rightarrow B$$
$$x \mapsto y = f(x) \quad (\text{"f of x"})$$

The set  $D$  is the **domain**, the set  $B$  is the **codomain**, and the set  $E$  is the **range** of the function  $f$ .

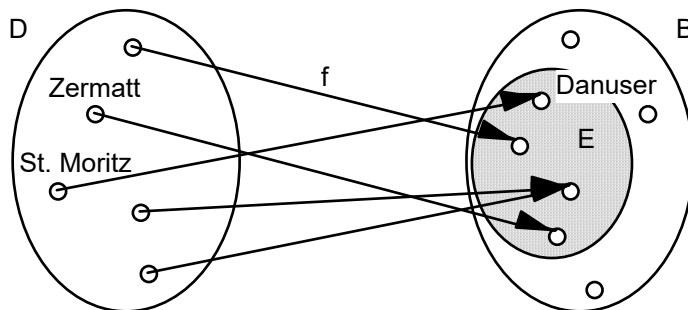
The element  $y$  is the **image** of the element  $x$ .  
or (if  $D$  and  $B$  are number sets):  $y$  is the **value** of  $f$  at  $x$ .



- Ex.: 1. D = set of all Swiss holiday resorts  
 B = set of all human beings

$$f: D \rightarrow B$$

$$r \mapsto d = f(r) = \text{director of holiday resort } r \text{ in 2000}$$



2. D = set of all countries of the world  
 B = set of all cities of the world

$$f: D \rightarrow B$$

$$a \mapsto b = f(a) = \text{capital of country } a$$

3. Cable car company

$$D = \mathbb{N} \quad (= \text{set of natural numbers})$$

$$B = \mathbb{R} \quad (= \text{set of real numbers})$$

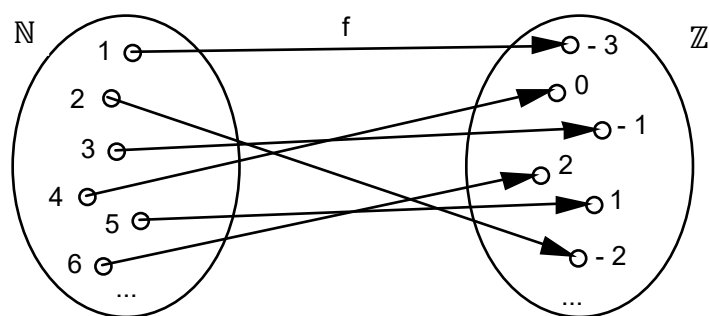
$$f: D \rightarrow B$$

$$n \mapsto r = f(n) = \text{revenue (e.g. in CHF) when } n \text{ tickets are sold}$$

4. D =  $\mathbb{N}$   
 B =  $\mathbb{Z}$

$$f: \mathbb{N} \rightarrow \mathbb{Z}$$

$$n \mapsto y = f(n) = n - 4$$



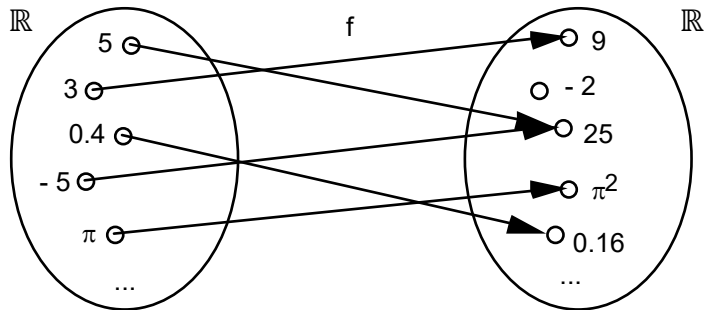
5. D = B =  $\mathbb{R}$

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

$$x \mapsto y = p(x) = \frac{x^3 - 3}{2x^2 + 1}$$

## Representation of a function

### Arrow diagram



### Table of values

x	y
1	1
3	9
5	25
-5	25
0.4	0.16
...	...

### Equation

$$f: \mathbb{R} \rightarrow \mathbb{R}$$
$$x \mapsto y = f(x) = x^2$$

### Graph

