

## Chapter 2: Relations and Functions

### **Concept:**

Cartesian products of sets – equality of ordered pairs- triple product- relations- functions- domain- range- different types of functions- algebra of functions.

### **Notes:**

- If  $(a,b) = (c,d)$  then  $a = c$  and  $b = d$ .
- $A \times B = \{ (x,y) / x \in A, y \in B \}$
- $A \times A \times A = \{ (x,y,z) / x, y, z \in A \}$
- A relation R is a subset of the Cartesian product.
- A function is a relation with every element of first set has one only one image in second set.
- The set of all first elements of the ordered pairs in a function is called domain.
- The set of all second elements of the ordered pairs in a function is called the range.
- Second set itself is known as co-domain.

### **Text book questions**

Ex: 2.1

Questions:  $1, 2^*, 5^*, 7^*$

Ex: 2.2

Questions:  $1, 2, 6, 7^*$

Ex: 2.3

Questions:  $2^*, 5^*$

Misc. Ex:

Questions:  $3^*, 4, 6, 8, 11, 12$

Example

Question:  $22^*$

### **Extra/HOT questions**

1. Find x and y if  $(x^2-3x, y^2-5y) = (-2, -6)$ .
2. Draw the graph of the following functions:
  - a) Modulus function in  $[-4, 4]$
  - b) Signum function in  $[-6, 6]$
  - c) Greatest integer function in  $[-3, 4]$

3. Find the domain of the following functions:

$$\begin{aligned} \text{a) } f(x) &= \frac{x^2-1}{x-1} \\ \text{b) } f(x) &= \frac{3x+1}{x^2-5x+6} \\ \text{c) } f(x) &= \frac{2x-3}{(x-1)(x+2)} \end{aligned}$$

4. Find the domain and range of the following functions:

$$\begin{aligned} \text{a) } f(x) &= \frac{1}{9-x^2} \\ \text{b) } f(x) &= \sqrt{x^2-1} \\ \text{c) } f(x) &= \frac{1}{x^2+4} \\ \text{d) } f(x) &= \frac{|x|}{1+|x|} \end{aligned}$$

5. If  $f(x) = x^2 + \frac{1}{x^2}$  then show that  $f(a) = f(1/a)$  and also evaluate  $f(3/2) - f(2/3)$

6. Let  $R = \{(x,y) / x, y \in \mathbb{N}, x+2y = 13\}$  then write R as an ordered pair and also find the domain and range.

7. Let  $A = \{x / x \text{ is a natural number } < 12\}$  and R be a relation in A defined by  $(x,y) \in R$  if  $x+y = 12$ , then write R.

8. A function f is defined on the set of natural numbers as

$$f(x) = \begin{cases} x^2 & \text{if } 1 \leq x < 5 \\ x + 3 & \text{if } 5 < x \leq 8 \\ \frac{x-3}{2} & \text{if } 8 < x \leq 11 \end{cases}$$

Write the function in roster form and also find the domain and range of the function.

9. Let  $A = \{1,2,3,4\}$ ,  $B = \{-1, 0, 1\}$  and  $C = \{3, 4\}$  then verify the following:

$$\begin{aligned} \text{a) } A \times (B \cup C) &= (A \times B) \cup (A \times C) \\ \text{b) } A \times (B - C) &= (A \times B) - (A \times C) \\ \text{c) } A \times (B \cap C) &= (A \times B) \cap (A \times C) \end{aligned}$$

10. If  $A = \{-3, -2, 0, 2, 3\}$  write the subset B of  $A \times A$  such that first element of B is either -3 or +3.