



## EXERCISE - 2.2

### Question-1

Let  $A = \{1, 2, 3, \dots, 14\}$ . Define a relation  $R$  from  $A$  to  $A$  by  $R = \{(x, y): 3x - y = 0, \text{ where } x, y \in A\}$ . Write down its domain, codomain and range.

Ans.

The relation  $R$  from  $A$  to  $A$  is given as

$$R = \{(x, y): 3x - y = 0, \text{ where } x, y \in A\}$$

$$\text{i.e., } R = \{(x, y): 3x = y, \text{ where } x, y \in A\}$$

$$\therefore R = \{(1, 3), (2, 6), (3, 9), (4, 12)\}$$

The domain of  $R$  is the set of all first elements of the ordered pairs in the relation.

$$\therefore \text{Domain of } R = \{1, 2, 3, 4\}$$

The whole set  $A$  is the codomain of the relation  $R$ .

$$\therefore \text{Codomain of } R = A = \{1, 2, 3, \dots, 14\}$$

The range of  $R$  is the set of all second elements of the ordered pairs in the relation.

$$\therefore \text{Range of } R = \{3, 6, 9, 12\}$$

### Question-2

Define a relation  $R$  on the set  $\mathbf{N}$  of natural numbers by  $R = \{(x, y): y = x + 5, x \text{ is a natural number less than } 4; x, y \in \mathbf{N}\}$ . Depict this relationship using roster form. Write down the domain and the range.

Ans.

$$R = \{(x, y): y = x + 5, x \text{ is a natural number less than } 4, x, y \in \mathbf{N}\}$$

The natural numbers less than 4 are 1, 2, and 3.

$$\therefore R = \{(1, 6), (2, 7), (3, 8)\}$$

The domain of  $R$  is the set of all first elements of the ordered pairs in the relation.

$$\therefore \text{Domain of } R = \{1, 2, 3\}$$

The range of  $R$  is the set of all second elements of the ordered pairs in the relation.

$$\therefore \text{Range of } R = \{6, 7, 8\}$$

### Question-3

$A = \{1, 2, 3, 5\}$  and  $B = \{4, 6, 9\}$ . Define a relation  $R$  from  $A$  to  $B$  by  $R = \{(x, y): \text{the difference between } x \text{ and } y \text{ is odd}; x \in A, y \in B\}$ . Write  $R$  in roster form.

Ans.

$$A = \{1, 2, 3, 5\} \text{ and } B = \{4, 6, 9\}$$

$$R = \{(x, y): \text{the difference between } x \text{ and } y \text{ is odd}; x \in A, y \in B\}$$

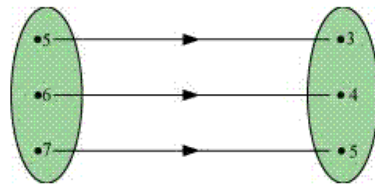
$$\therefore R = \{(1, 4), (1, 6), (2, 9), (3, 4), (3, 6), (5, 4), (5, 6)\}$$

Question-4

The given figure shows a relationship between the sets P and Q. write this relation

(i) in set-builder form (ii) in roster form.

What is its domain and range?



Ans.

According to the given figure,  $P = \{5, 6, 7\}$ ,  $Q = \{3, 4, 5\}$

$$(i) R = \{(x, y): y = x - 2; x \in P\} \text{ or } R = \{(x, y): y = x - 2 \text{ for } x = 5, 6, 7\}$$

$$(ii) R = \{(5, 3), (6, 4), (7, 5)\}$$

$$\text{Domain of } R = \{5, 6, 7\}$$

$$\text{Range of } R = \{3, 4, 5\}$$

Question-5

Let  $A = \{1, 2, 3, 4, 6\}$ . Let R be the relation on A defined by

$$\{(a, b): a, b \in A, b \text{ is exactly divisible by } a\}.$$

(i) Write R in roster form

(ii) Find the domain of R

(iii) Find the range of R.

Ans.

$$A = \{1, 2, 3, 4, 6\}, R = \{(a, b): a, b \in A, b \text{ is exactly divisible by } a\}$$

$$(i) R = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 6), (2, 2), (2, 4), (2, 6), (3, 3), (3, 6), (4, 4), (6, 6)\}$$

$$(ii) \text{Domain of } R = \{1, 2, 3, 4, 6\}$$

$$(iii) \text{Range of } R = \{1, 2, 3, 4, 6\}$$

Question-6

Determine the domain and range of the relation R defined by  $R = \{(x, x + 5): x \in \{0, 1, 2, 3, 4, 5\}\}$ .

Ans.

$$R = \{(x, x + 5): x \in \{0, 1, 2, 3, 4, 5\}\}$$

$$\therefore R = \{(0, 5), (1, 6), (2, 7), (3, 8), (4, 9), (5, 10)\}$$

$$\therefore \text{Domain of } R = \{0, 1, 2, 3, 4, 5\}$$

$$\text{Range of } R = \{5, 6, 7, 8, 9, 10\}$$

Question-7

Write the relation  $R = \{(x, x^2): x \text{ is a prime number less than } 10\}$  in roster form.

Ans.

$$R = \{(x, x^2): x \text{ is a prime number less than } 10\}$$

The prime numbers less than 10 are 2, 3, 5, and 7.

$$\therefore R = \{(2, 8), (3, 27), (5, 125), (7, 343)\}$$

Question-8

Let  $A = \{x, y, z\}$  and  $B = \{1, 2\}$ . Find the number of relations from A to B

Ans.

It is given that  $A = \{x, y, z\}$  and  $B = \{1, 2\}$ .

$$\therefore A \times B = \{(x, 1), (x, 2), (y, 1), (y, 2), (z, 1), (z, 2)\}$$

Since  $n(A \times B) = 6$ , the number of subsets of  $A \times B$  is  $2^6$ .

Therefore, the number of relations from A to B is  $2^6$ .

Question-9

Let R be the relation on  $\mathbb{Z}$  defined by  $R = \{(a, b): a, b \in \mathbb{Z}, a - b \text{ is an integer}\}$ . Find the domain and range of R.

Ans.

$$R = \{(a, b): a, b \in \mathbb{Z}, a - b \text{ is an integer}\}$$

It is known that the difference between any two integers is always an integer.

$$\therefore \text{Domain of } R = \mathbb{Z}$$

$$\text{Range of } R = \mathbb{Z}$$

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