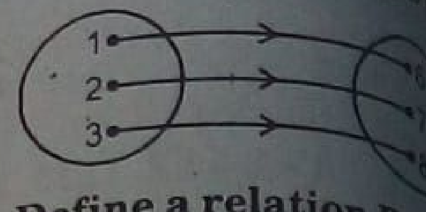
XI



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

(iii) Domain $= \{1, 2, 3\}$

Range $= \{6, 7, 8\}$

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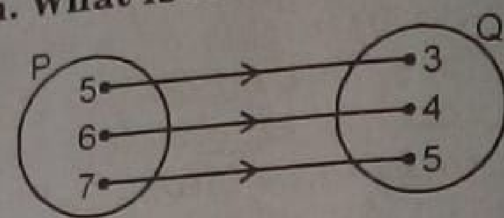
3. $\mathbf{A = \{1, 2, 3, 5\}}$ **and** $\mathbf{B = \{4, 6, 9\}}$**. Define a relation R from A to B by** $\mathbf{R = \{(x, y)}$ **: the difference between** $\mathbf{x}$ **and** $\mathbf{y}$ **is odd,** $\mathbf{x \in A, y \in B\}}$**. Write R in roster form.**

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

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

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

4. Figure given below shows a relationship between the sets P and Q. Write this relation (*i*) in set builder form (*ii*) roster form. What is its domain and range ?



Sol. (*i*) $R = \{(x, y) : x - y = 2, 4 < x < 8, x, y \in N\}$

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

Domain $= \{5, 6, 7\}$, Range $= \{3, 4, 5\}$.

5. Let $\mathbf{A = \{1, 2, 3, 4, 6\}}$**. Let R be the relation on A defined by** $\mathbf{\{(a, b) : a \in A, A \in a}$ **divides** $\mathbf{b\}}$**.**

(*i*) Write R in roster form.

(*ii*) Find the domain of R.

(*iii*) Find the range of R.

Sol. (*i*) Given $A = \{1, 2, 3, 4, 6\}$ and R is the relation on A defined by $\{(a, b) : a \in A, b \in A, a$ divides $b\}$

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

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

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

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

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

$\therefore$ Domain (R) $= \{(0, 1, 2, 3, 4, 5, 6\}$

[*On putting* $x = 0, 1, 2, 3, 4, 5$ *in* x]

and Range (R) $= \{5, 6, 7, 8, 9, 10\}$

[*On putting* $x = 0, 1, 2, 3, 4, 5$ *in* $x + 5$]

(2, 3), (2, 4)}, {(1, 3), (1, 4), (2, 3), (2, 4)}.

EXERCISE 2.2

XI

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

Sol. (*i*) R = {$(x, y) : 3x - y = 0$, where $x, y \in$ A}

= {(1, 3), (2, 6), (3, 9), (4, 12)}

(*ii*) Domain : {1, 2, 3, ..., 14}

(*iii*) Co-domain : {1, 2, 3, ..., 14}

(*iv*) Range : {3, 6, 9, 12}

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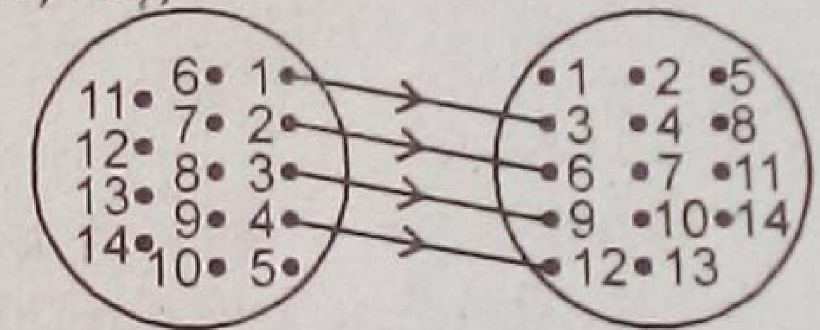

2. Define a relation R on the set N of natural numbers by R = {$(x, y) : y = x + 5$, x is a natural number less than 4; $x, y \in$ N}. Depict this relationship using (*i*) roster form (*ii*) an arrow diagram. Write down the domain and range.

Sol. (*i*) R = {$(x, y) : x = y - 5$, x is a natural number less than 4; $x, y \in$ N}

7. Write the relation $R = \{(x, x^3) : x$ is a prime number less than 10$\}$ in roster form.

Sol. Prime numbers less than 10 are 2, 3, 5, 7.

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

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

Sol. $A = \{x, y, z\}$ and $B = \{1, 2\}$.

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

Now $n(A \times B) = 6$.

Therefore, the number of subsets of $n(A \times B)$ is $2^6 = 64$.

So, the number of relations from A into B is 64.

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

Sol.

$$\begin{aligned} R &= \{(a, b) : a \in Z, b \in Z, a - b \text{ is an integer}\} \\ &= \{(a, b) : a \in Z, b \in Z, a \text{ and } b \text{ both are integers}\}. \\ \text{Domain}(R) &= Z. \\ \text{Range}(R) &= Z. \end{aligned}$$