1. Let $A = \{1,2,3,7\}$ and $B = \{3,0,-1,7\}$. which of the following are relation from A to B?

(i) $R_1 = \{(2,1),(7,1)\}$

(ii) $R_2 = \{(-1,1)\}$

(iii) $R_3 = \{(2,-1),(7,7),(1,3)\}$

(iv) $R_4 = \{(7,-1),(0,3),(3,3),(0,7)\}$

Soln :-

Given $A = \{1,2,3,7\}$

$B = \{3,0,-1,7\}$

$A \times B = \{1,2,3,7\} \times \{3,0,-1,7\}$

$= \{ (1,3),(1,0),(1,-1),(1,7)$
$(2,3),(2,0),(2,-1),(2,7)$
$(3,3),(3,0),(3,-1),(7,7)$
$(7,3),(7,0),(7,-1),(7,7) \}$

(i) Since $(2,1),(7,1) \in R_1$

But $(2,1),(7,1) \notin A \times B$

Hence R_1 is not a relation from A to B.

(ii) Since $(-1,1) \in R_2$

But $(-1,1) \notin A \times B$

Hence R_2 is not a relation from A to B.

(iii) Since $(2,-1),(7,7),(1,3) \in R_3$

Also $(2,-1),(7,7),(1,3) \in A \times B$

Now, R_3 is a subset of $A \times B$

$\therefore R_3$ is a relation from A to B

(iv) Since $(7,-1), (0,3), (3,3), (0,7) \in R_4$

Here $(7,-1), (3,3) \in A \times B$

But $(0,3), (0,7) \notin A \times B$

Hence R_4 is not a relation from A to B.

2. Let $A = \{1,2,3,\ldots 45\}$ and R be the relation defined as "is square of" on A. Write R as a subset of $A \times A$. Also, find the domain and range of R.

Soln :

Given $A = \{1,2,3,\ldots 45\}$

Now,

$A \times A = \{1,2,3,\ldots 45\} \times \{1,2,3,\ldots 45\}$

$= \{(1,1), (1,2), (1,3),\ldots (1,45),$
$(2,1), (2,2), (2,3)\ldots (2,45)$
$(3,1), (3,2), (3,3),\ldots (3,45)$
$\ldots$
$(45,1), (45,2), (45,3),\ldots (45,45)\}$

Since R is the relation defined as "is square of" on A.

Here $R = \{(1,1), (2,4), (3,9), (4,16), (5,25), (6,36)\}$

Now, R is a subset of $A \times A$

$\therefore$ Domain of $R = \{1,2,3,4,5,6\}$

Range of $R = \{1,4,9,16,25,36\}$

3. A Relation R is given by the set $\{(x,y)/y=x+3, x \in \{0,1,2,3,4,5\}\}$. Determine its domain and range.

Soln:

Given $R = \left\{ (x,y)/y=x+3, x \in \{0,1,2,3,4,5\} \right\}$

$\qquad = \left\{ (0,3), (1,4), (2,5), (3,6), (4,7), (5,8) \right\}$

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

Range of $R = \{3,4,5,6,7,8\}$

4. Represent each of the given relation by
   a) An Arrow Diagram
   b) A Graph
   c) A Set in Roster form, wherever possible
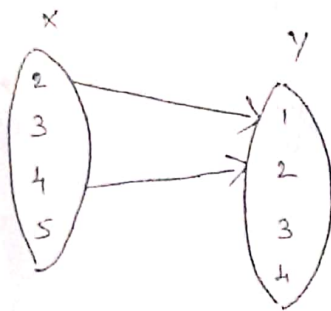
(i) $\left\{ (x,y)/x=2y, x \in \{2,3,4,5\}, y \in \{1,2,3,4\} \right\}$

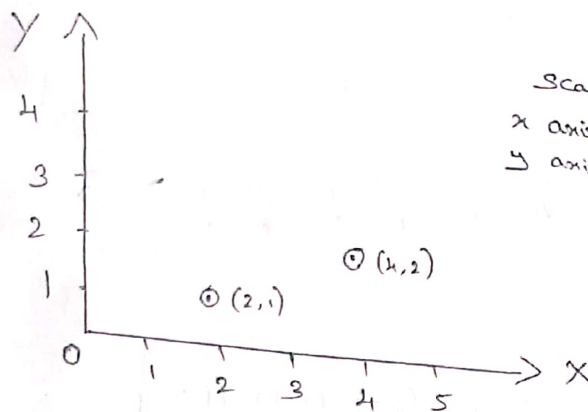(ii) $\left\{ (x,y)/y=x+3, x \text{ and } y \text{ are natural numbers} < 10 \right\}$

Soln:

(i) Given $R = \left\{ (x,y)/x=2y, x \in \{2,3,4,5\}, y \in \{1,2,3,4\} \right\}$

$\qquad = \left\{ (2,1), (2,4) \right\}$

a) An Arrow Diagram

b) A Graph

Scale
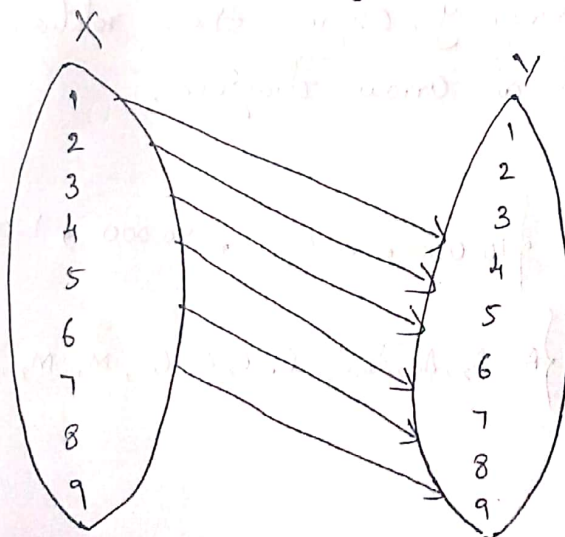x axis 1 cm = 1 unit
y axis 1 cm = 1 unit.

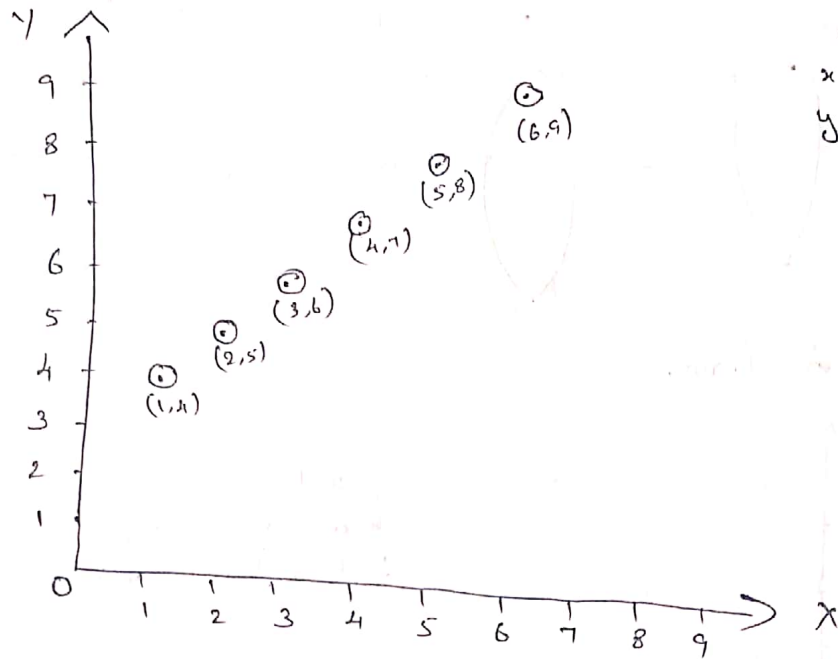⊙ (4,2)

⊙ (2,1)

c) A Set in Roster form.

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

(ii) Given $R = \{(x,y) / y = x+3, \ x \text{ and } y \text{ are natural number} < 10\}$

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

a) An Arrow Diagram

b) A Graph

c) Raster form

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

5. A Company has four Categories of employees given by Assistants (A), Clerks (C), Managers (M) and an Executive Officer (E). The Company Provide Rs 10,000, Rs 25,000, Rs 50,000, Rs 1,00,000 as salaries to the people who work in the Categories A, C, M and E respectively. If A_1, A_2, A_3, A_4 and A_5 were Assistants; C_1, C_2, C_3 and C_4 were Clerks; M_1, M_2, M_3 were managers and E_1, E_2 were Executive Officers and if the relation R is defined by xRy, where x is the Salary given to person y, express the relation R through an ordered pair and an arrow diagram.
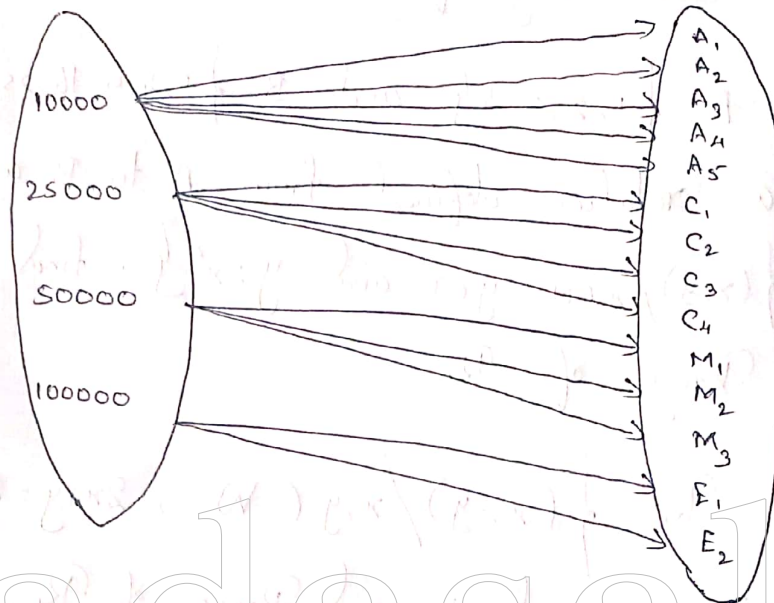
Soln :

Salaries $(S) = \{10,000, 25000, 50,000, 1,00,000\}$

Employees $(E) = \{A_1, A_2, A_3, A_4, A_5, C_1, C_2, C_3, C_4, M_1, M_2, M_3, E_1, E_2\}$

a) Ordered Pairs.

$$R = \{ (10000, A_1), (10000, A_2), (10000, A_3), (10000, A_4), (10000, A_5)$$
$$(25000, C_1), (25000, C_2), (25000, C_3), (25000, C_4)$$
$$(50000, M_1), (50000, M_2), (50000, M_3)$$
$$(100000, E_1), (100000, E_2) \}$$

b) An Arrow Diagram :

Creative Questions :

1. Express $A = \{ (a,b) / 2a+b = 5 ,\ a,b \in W \}$ as the set of Ordered pairs.

2. Let $A = \{1, 2, 3\}$ and $B = \{4, 5\}$. Find the total number of relations from A to B.

3. Given $A = \{1, 2, 3, 4, 5\}$, $S = \{ (x,y) / x, y \in A \}$
Find the Ordered pairs which satisfy the Condition given below. (i) $x+y = 5$ (ii) $x+y < 5$ (iii) $x+y > 8$

4. If $A = \{2, 4, 6, 9\}$ and $B = \{4, 6, 18, 27, 54\}$, find the set of ordered pairs such "a" is a factor of "b" where $a \in A$ and $b \in B$ and $a < b$.

5. If $R = \{(x, y) / x, y \in W \text{ and } 2x + y = 8\}$. Write the domain and range of R.

6. Let $A = \{1, 2, 3, 4\}$ and $B = \{1, 4, 9, 16, 25\}$ and R be a relation defined from A to B as,
$R = \{(x, y) / x \in A, y \in B \text{ and } y = x^2\}$. find the domain and Range of R

7. Let $R = \{(x, -y) / x, y \in W, 2x + y = 8\}$ then
(i) find the domain and Range of R.
(ii) Write R as a set of Ordered Pairs.

8. Let a relation $R = \{(0, 0), (2, 4), (-1, 2), (3, 6), (1, 2)\}$
Then (i) Write domain of R
(ii) Write Range of R.
(iii) Write R the Set builder form
(iv) Represent R by an Arrow Diagram.

9. Let $A = \{0, 1, 2, 3, 4\}$ and $B = \{4, 5, 6, 7, 8\}$ be two sets. Let $f : A \rightarrow B$ be a function given by $f(x) = x + 4$, Represent this function as
(i) A set of Ordered pairs.
(ii) An Arrow Diagram
(iii) A Graph.

10. $\{(-1, 2), (-3, 1), (-5, 6), (-4, 3)\}$ represent a function from A to B. Write its domain and range. Represent it using (i) An Arrow Diagram.
(ii) A Graph.

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