RD Sharma Class 11 Solutions Chapter 2 Relations Ex 2.3 Q1

(i) We have,

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

$\{(1,6),\ (3,4),\ (5,2)\}$ is not a relation from A to B as it is not a subset of $A \times B$.

(ii) We have,

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

$\{(1,5),\ (2,6),\ (3,4),\ (3,6)\}$ is a subset of $A \times B$, so it is a relation from A to B.

(iii) We have,

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

$\{(4,2),\ (4,3),\ (5,1)\}$ is not a relation from A to B as it is not a subset of $A \times B$.

(iv) We have,

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

$A \times B$ is a relation from A to B.

Class 11 Solutions Chapter 2 Relations Ex 2.3 Q2

We have,

$A = \{2,3,4,5\}$ and $B = \{3,6,7,10\}$

It is given that $(x,y) \in R \Leftrightarrow x$ is relatively prime to y

$\therefore \quad (2,3) \in R,\ (2,7) \in R,\ (3,7) \in R,\ (3,10) \in R,\ (4,3) \in R,\ (4,7) \in R,\ (5,3) \in R,$ and $(5,7) \in R$

Thus,

$R = \{(2,3),\ (2,7),\ (3,7),\ (3,10),\ (4,3),\ (4,7),\ (5,3),\ (5,7)\}$

Clearly, Domain$(R) = \{2,3,4,5\}$ and Range $= \{3,7,10\}$.

Class 11 Solutions Chapter 2 Relations Ex 2.3 Q3

We have,

$A = \{1,2,3,4,5\}$ $\quad [\because A$ is the set of first five natural number$]$

It is given that R be a relation on A defined as $(x,y) \in R \Leftrightarrow x \le y$

For the elements of the given sets A and A, we find that

$1 = 1,\ 1 < 2,\ 1 < 3,\ 1 < 4,\ 1 < 5,\ 2 = 2,\ 2 < 3,\ 2 < 4,\ 2 < 5,\ 3 = 3,\ 3 < 4,\ 3 < 5,\ 4 = 4,\ 4 < 5,$ and $5 = 5$

$\therefore \quad (1,1) \in R,\ (1,2) \in R,\ (1,3) \in R,\ (1,4) \in R,\ (1,5) \in R,\ (2,2) \in R,\ (2,3) \in R,\ (2,4) \in R,\ (2,5) \in R,$
$(3,3) \in R,\ (3,4) \in R,\ (3,5) \in R,\ (4,4) \in R,\ (4,5) \in R,$ and $(5,5) \in R$

Thus,

$$R = \left\{\begin{matrix}(1,1),\ (1,2),\ (1,3),\ (1,4),\ (1,5),\ (2,2),\ (2,3),\ (2,4),\ (2,5),\ (3,3),\ (3,4),\ (3,5),\ (4,4), \\ (4,5),\ (5,5)\end{matrix}\right\}$$

Also,

$$R^{-1} = \left\{\begin{matrix}(1,1),\ (2,1),\ (3,1),\ (4,1),\ (5,1),\ (2,2),\ (3,2),\ (4,2),\ (5,2),\ (3,3),\ (4,3),\ (5,3),\ (4,4), \\ (5,4),\ (5,5)\end{matrix}\right\}$$

(i) Domain$(R^{-1}) = \{1,2,3,4,5\}$

(ii) Range$(R) = \{1,2,3,4,5\}$

Class 11 Solutions Chapter 2 Relations Ex 2.3 Q4

(i) We have,

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

$$\Rightarrow \quad R^{-1} = \{(2,1),\ (3,1),\ (3,2),\ (2,3),\ (6,5)\}$$

(ii) We have,

$$R = \{(x,y) : x, y \in N, x + 2y = 8\}$$

Now,

$$x + 2y = 8$$

$$\Rightarrow \quad x = 8 - 2y$$

Putting $y = 1, 2, 3$ we get $x = 6, 4, 2$ respectively.

For $y = 4$, we get $x = 0 \notin N$. Also for $y > 4$, $x \notin N$

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

Thus,

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

$$\Rightarrow \quad R^{-1} = \{(3,2),\ (2,4),\ (1,6)\}$$

(iii) We have,

R is a relation from $\{11, 12, 13,\}$ to $\{8, 10, 12,\}$ defined by $y = x - 3$

Now,

$$y = x - 3$$

Putting $x = 11, 12, 13$ we get $y = 8, 9, 10$ respectively

$$\Rightarrow \quad (11,8) \in R,\ (12,9) \notin R \text{ and } (13,10) \in R$$

Thus,

$$R = \{(11,8),\ (13,10)\}$$

$$\Rightarrow \quad R^{-1} = \{(8,11),\ (10,13)\}$$

Class 11 Solutions Chapter 2 Relations Ex 2.3 Q5

(i) We have,

$$x = 2y$$

Putting $y = 1, 2, 3$ we get $x = 2, 4, 6$ respectively.

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

(ii) We have,

It is given that relation R on the set $\{1, 2, 3, 4, 5, 6, 7\}$ defined by $(x, y) \in R \Leftrightarrow x$ is relatively prime to y.

$\therefore$ $(2,3) \in R,\ (2,5) \in R,\ (2,7) \in R,\ (3,2) \in R,\ (3,4) \in R,\ (3,5) \in R,\ (3,7) \in R,\ (4,3) \in R,\ (4,5) \in R,$
$(4,7) \in R,\ (5,2) \in R,\ (5,3) \in R,\ (5,4) \in R,\ (5,6) \in R,\ (5,7) \in R,\ (6,5) \in R,\ (6,7) \in R,\ (7,2) \in R,$
$(7,3) \in R,\ (7,4) \in R,\ (7,5) \in R$ and $(7,6) \in R.$

Thus,

$$R = \left\{\begin{matrix} (2,3),\ (2,5),\ (2,7),\ (3,2),\ (3,4),\ (3,5),\ (3,7),\ (4,3),\ (4,5),\ (4,7),\ (5,2), \\ (5,3),\ (5,4),\ (5,6),\ (5,7),\ (6,5),\ (6,7),\ (7,2),\ (7,3),\ (7,4),\ (7,5),\ (7,6). \end{matrix}\right\}$$

(iii) We have,

$$2x + 3y = 12$$

$$\Rightarrow \quad 2x = 12 - 3y$$

$$\Rightarrow \quad x = \frac{12 - 3y}{2}$$

Putting $y = 0, 2, 4$ we get $x = 6, 3, 0$ respectively.

For $y = 1, 3, 5, 6, 7, 8, 9, 10$, $x \notin$ given set

$$\therefore \quad R = \{(6,0),\ (3,2),\ (0,4)\}$$

$$= \{(0,4),\ (3,2),\ (6,0)\}$$

(iv) We have,

$A = \{5,6,7,8\}$ and $B = \{10,12,15,16,18\}$

Now,

a/b stands for 'a divides b'. For the elements of the given set A and B, we find that $5/10,\ 5/15,\ 6/12,\ 6/18$ and $8/16$

$\therefore$ $(5,10) \in R,\ (5,15) \in R,\ (6,12) \in R,\ (6,18) \in R,$ and $(8,16) \in R$

Thus,

$R = \{(5,10),\ (5,15),\ (6,12),\ (6,18),\ (8,16)\}$

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