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

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

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

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

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 $5 = 5$

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

Thus,

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

Also,

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

(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

$\Rightarrow \quad (11,8) \in R,\ (12,9) \notin R$ 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.

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

Thus,

$R = \{(2,3),\ (2,5),\ (2,7),\ (3,2),\ (3,4),\ (3,5),\ (3,7),\ (4,3),\ (4,5),\ (4,7),\ (5,2),$
$(5,3),\ (5,4),\ (5,6),\ (5,7),\ (6,5),\ (6,7),\ (7,2),\ (7,3),\ (7,4),\ (7,5),\ (7,6).\}$

(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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