



Relations Ex 1.1 Q7.

$$R = \{(a, b) : a \leq b^3\}$$

It is observed that $\left(\frac{1}{2}, \frac{1}{2}\right) \notin R$ as $\frac{1}{2} > \left(\frac{1}{2}\right)^3 = \frac{1}{8}$.

Therefore, R is not reflexive.

Now, $(1, 2) \in R$ (as $1 < 2^3 = 8$)

But, $(2, 1) \notin R$ (as $2^3 > 1$)

Therefore, R is not symmetric.

We have

$$\left(3, \frac{3}{2}\right), \left(\frac{3}{2}, \frac{6}{5}\right) \in R \text{ as } 3 < \left(\frac{3}{2}\right)^3 \text{ and } \frac{3}{2} < \left(\frac{6}{5}\right)^3.$$

$$\text{But } \left(3, \frac{6}{5}\right) \notin R \text{ as } 3 > \left(\frac{6}{5}\right)^3.$$

Therefore, R is not transitive.

Hence, R is neither reflexive, nor symmetric, nor transitive.

Relations Ex 1.1 Q8

Let A be a set.

Then $I_A = \{(a, a) ; a \in A\}$ is the identity relation on A .

Hence, every identity relation on a set is reflexive by definition.

Converse:

Let $A = \{(a, b, c)\}$ be a set.

Let $R = \{(a, a)(b, b)(c, c)(a, b)\}$ be a relation defined on A .

Clearly R is reflexive on set A , but it is not identity relation on set A as $(a, b) \in R$

Hence, a reflexive relation need not be identity relation.

Relations Ex 1.1 Q9

We have, $A = \{1, 2, 3, 4\}$

(i) $R = \{(1, 1)(2, 2)(3, 3)(4, 4)(1, 2)\}$ is a relation on set A which is reflexive, transitive but not symmetric

(ii) $R = \{(2, 3)(3, 2)\}$ is a relation on set A which is symmetric but neither reflexive nor transitive

(iii) $R = \{(1, 1)(2, 2)(3, 3)(4, 4)(1, 2)(2, 1)\}$ is a relation on set A which is reflexive, symmetric and transitive

Relations Ex 1.1 Q10

We have, $R = \{(x, y); x, y \in N, 2x + y = 41\}$

Then Domain of R is $x \in N$, such that

$$2x + y = 41$$

$$\Rightarrow x = \frac{41 - y}{2}$$

Since $y \in N$, largest value that x can take corresponds to the smallest value that y can take.

$$\therefore x = \{1, 2, 3, \dots, 20\}$$

Range of R is $y \in N$ such that

$$2x + y = 41$$

$$\Rightarrow y = 41 - 2x$$

Since, $x = \{1, 2, 3, \dots, 20\}$

$$\therefore y = \{39, 37, 35, 33, \dots, 7, 5, 3, 1\}$$

Since, $(2, 2) \notin R$, R is not reflexive.

Also, since $(1, 39) \in R$ but $(39, 1) \notin R$, R is not symmetric.

Finally, since, $(15, 11) \in R$ and $(11, 19) \in R$ but $(15, 19) \notin R$

$\therefore R$ is not transitive.

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