SARALA BIRLA PUBLIC SCHOOL

Birla Knowledge City, Mahilong, Ranchi

CLASS XII, (2020-21)

Sub: Mathematics Assignment-4

Concepts of class XI

Sets:- Collection of well defined objects is called set.

- Elements of sets are arranged under the curly bracket separated by commas.
- It is represented by capital letter.

Examples

i) A is the set of first six natural numbers

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

Cartesian product of two set

1. If $A = \{1, 2, 3\}$, $B = \{3, 4\}$ then $A \times B = \{(1, 3), (1, 4), (2, 3), (2, 4), (3, 3), (3, 4)\}$ and $B \times A = \{(3, 1), (3, 2), (3, 3), (4, 1), (4, 2), (4, 3)\}$
2. If $A = \{a, b\}$ then $A \times A = \{(a, a), (a, b), (b, a), (b, b)\}$

Note:-

- $A \times B \neq B \times A$
- $n(A \times B) = n(A) \cdot n(B)$
- If $(a_1, b_1) = (a_2, b_2)$ then $a_1 = a_2$ and $b_1 = b_2$
- If $(a, b) \in A \times B$ then $a \in A$ and $b \in B$
- If $n\{P(A \times B)\} = 2^{n(A) \cdot n(B)}$

Question based on Basic concept of Relation

1. Let $A = \{1, 2, 3\}$, $B = \{1, 3, 4\}$. Let R be a relation from A to B, given by $R = \{(a, b) : a^2 = b, \quad a \in A, b \in B\}$. Find
   a) R as arrow diagram and order pair.
   b) Domain, Range, and Co-domain of R
   c) State True or False:

i) Image of 1 and 4	ii) pre- Image of 4 is 2	iii) $1R1$
iv) $2 \not R 4$	v) $(2, 3) \in R$	vi) $(1, 4) \notin R$
vii) $R \subseteq A \times B$	viii) $Range\ (R) \subseteq Co-dom$	

2. Let $A = \{1, 2, 3\}$ let R be a relation in A defined by $R = \{(a, b) : a+1 = b, \quad a, b \in A\}$. Find
a) R as arrow diagram and order pair.
b) Domain, Range, and Co-domain of R
c) State True or False:

i) Image of 1 and 2	*ii)* pre- Image of 3 is 2	*iii)* $1R1$
iv) $2 \not R 3$	*v)* $(2, 3) \in R$	*vi)* $(1, 3) \notin R$
vii) $R \subseteq A \times B$	*viii)* $Range\ (R) \subseteq Co-dom$	

3. Let $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$. Let R be the relation on A defined by $R = \{(x, y) : \quad x \in A, y \in B \quad and \quad x \text{ divides } \quad y\}$. Find Domain and Range.
4. If $R = \{(x, y) : x + 2y = 8\}$ is a relation on *N*, write the Range of *R.*

Reflexive Symmetric and Transitive

Let R be the relation defined on set A is called reflexive, symmetric and transitive if

Reflexive :-	*Symmetric :-*	*Transitive :-*
Let $\forall\ x \in A$ if $(x, x) \in R$, then R is called reflexive.	Let $\forall\ x, y \in A$ such that $(x, y) \in R$, then if $(y, x) \in R$, called reflexive.	Let $\forall\ x, y, z \in A$ such that $(x, y) \in R$ and $(y, z) \in R$, then if $(x, z) \in R$, called transitive.

Equivalence relations:- A relation which is reflexive symmetric and transitive called equivalence relation.

- ❖ Equivalence class of element $x \in A$ in relation R
Set of element which is related to x in the relation or set of all pre-image of x is called equivalence class of x, represented by the symbol $[x]$
Example $A = \{\ x \in Z : 0 \le x \le 12\}$ $\quad R = \{(1, 1), (1, 5), (5, 1), (1, 9), (9, 1)\}$ then the equivalence class of 2 i.e. $[2] = \{2, 6, 10\}$

Questions

1. Show that the relation *R* in the set $A = \{1, 2, 3\}$ given by $R = \{(1, 1), (2, 2)\ (3, 3), (1, 2)\ (2, 3)\}$ is reflexive but neither symmetric nor transitive.
2. Show that the relation *R* in the set $A = \{1, 2, 3\}$ given by $R = \{((1, 2)\ (2, 1)\}$ is symmetric.
3. Show that the relation *R* in the set $A = \{1, 2, 3\}$ given by $R = \{((1, 2)\ (2, 1)\}$ not Reflexive.
4. Show that the relation *R* in the set $A = \{1, 2, 3\}$ given by $R = \{((1, 2)\ (2, 1)\}$ is symmetric but

neither reflexive nor transitive.

5. Let L be the set of all lines in XY plane and let R be the relation in L defined as $R = \{(L_1, L_2) : L_1 \text{ is parallel to } L_2\}$. Show that R is an equivalence relation. Find the set of all lines related to the line $y = 2x + 4$.
6. Show that the relation R defined in the set A of all polygons as $R = \{(P_1, P_2) : P_1 \text{ and } P_2 \text{ have same number of sides}\}$, is an equivalence relation. What is the set of all elements in all A related to the right-angled triangle T with sides 3, 4 and 5?
7. Show that the relation R defined in the set A of all triangles as $R = \{(T_1, T_2) : T_1 \text{ is similar to } T_2\}$, is equivalence relation. Consider three right angled triangles T_1 with sides 3, 4, 5, T_2 with sides 5, 12, 13 and T_3 with sides 6, 8, 10. Which triangle among T_1, T_2 and T_3 are related?
8. Show that the relation R in the set A of all the books in a library of a college, given by $R = \{(x, y) : x \text{ and } y \text{ have same number of pages}\}$ is an equivalence relation.
9. Let T be the set of all triangles in a plane with R a relation in T given by $R = \{(T_1, T_2) : T_1 \text{ is congruent to } T_2\}$. Show that R is equivalence relation.
10. Check whether the relation R in **R** defined by $R = \{(a, b) : a \le b^3\}$ is reflexive, symmetric or transitive.
11. Show that the relation R in the set **R** of real numbers, defined as $R = \{(a, b) : a \le b^2\}$ is neither reflexive nor symmetric nor transitive.
12. Show that the relation R in the set Z of integers given by $R = \{(a, b) : 2 \text{ divides } a - b\}$ is an equivalence relation.