Class XII: Math

Chapter: Relations and Functions

Concepts and Formulae

Key Concepts

1. A relation R between two non empty sets A and B is a subset of their Cartesian Product $A \times B$. If A = B then relation R on A is a subset of $A \times A$

2. If (a, b) belongs to R, then a is related to b, and written as a R b If (a, b) does not belongs to R then a $\not R$ b.

3. Let R be a relation from A to B.
   Then Domain of $R \subset A$ and Range of $R \subset B$ co domain is either set B or any of its superset or subset containing range of R

4. A relation R in a set A is called **empty** relation, if no element of A is related to any element of A, i.e., $R = \phi \subset A \times A$.

5. A relation R in a set A is called **universal** relation, if each element of A is related to every element of A, i.e., $R = A \times A$.

6. A relation R in a set A is called

   a. **Reflexive**, if $(a, a) \in R$, for every $a \in A$,

   b. **Symmetric**, if $(a_1, a_2) \in R$ implies that $(a_2, a_1) \in R$, for all $a_1, a_2 \in A$.

   c. **Transitive**, if $(a_1, a_2) \in R$ and $(a_2, a_3) \in R$ implies that $(a_1, a_3) \in R$, or all $a_1, a_2, a_3 \in A$.

7. A relation R in a set A is said to be an **equivalence relation** if R is reflexive, symmetric and transitive.

8. The empty relation R on a non-empty set *X* (i.e. a R b is never true) is not an equivalence relation, because although it is vacuously symmetric and transitive, it is not reflexive (except when *X* is also empty)

9. Given an arbitrary equivalence relation R in a set X, R divides X into mutually disjoint subsets S_i called partitions or subdivisions of X satisfying:

   - All elements of S_i are related to each other, for all i

- No element of S_i is related to S_j, if $i \neq j$
- $\bigcup_{i=1}^{n} S_j = X$ and $S_i \cap S_j = \phi$, if $i \neq j$
- The subsets S_j are called Equivalence classes.

10. A function from a non empty set A to another non empty set B is a correspondence or a rule which associates every element of A to a unique element of B written as
$f: A \rightarrow B$ s.t $f(x) = y$ for all $x \in A$, $y \in B$. All functions are relations but converse is not true.

11. If $f: A \rightarrow B$ is a function then set A is the domain, set B is co-domain and set $\{f(x) : x \in A\}$ is the range of f. Range is a subset of codomain.