11th Standard -Mathematics

Sets

Set

A set is a well-defined collection of objects.

Representation of Sets

There are two methods of representing a set

- Roster or Tabular form In the roster form, we list all the members of the set within braces { } and separate by commas.
- Set-builder form In the set-builder form, we list the property or properties satisfied by all the elements of the sets.

Types of Sets –

- **Empty Sets:** A set which does not contain any element is called an empty set or the void set or null set and it is denoted by {} or Φ.
- **Singleton Set:** A set consists of a single element, is called a singleton set.
- **Finite and infinite Set:** A set which consists of a finite number of elements, is called a finite set, otherwise the set is called an infinite set.
- **Equal Sets:** Two sets A and 6 are said to be equal, if every element of A is also an element of B or vice-versa, i.e. two equal sets will have exactly the same element.
- **Equivalent Sets:** Two finite sets A and 6 are said to be equal if the number of elements are equal, i.e. n(A) = n(B)

Subset – Class 11 Maths Notes

A set A is said to be a subset of set B if every element of set A belongs to set B. In symbols, we write

$A \subseteq B$, if $x \in A \Rightarrow x \in B$

Note:

- Every set is o subset of itself.
- The empty set is a subset of every set.
- The total number of subsets of a finite set containing n elements is 2^n.

Intervals as Subsets of R

Let a and b be two given real numbers such that $a < b$, then

- an open interval denoted by (a, b) is the set of real numbers $\{x : a < x < b\}$.
- a closed interval denoted by $[a, b]$ is the set of real numbers $\{x : a \le x \le b\}$.
- intervals closed at one end and open at the others are known as semi-open or semi-closed interval and denoted by $(a, b]$ is the set of real numbers $\{x : a < x \le b\}$ or $[a, b)$ is the set of real numbers $\{x : a \le x < b\}$.

Power Set

The collection of all subsets of a set A is called the power set of A. It is denoted by P(A). If the number of elements in A i.e. $n(A) = n$, then the number of elements in $P(A) = 2^n$.

Universal Set

A set that contains all sets in a given context is called the universal set.

Venn-Diagrams

Venn diagrams are the diagrams, which represent the relationship between sets. In Venn-diagrams the universal set U is represented by point within a rectangle and its subsets are represented by points in closed curves (usually circles) within the rectangle.

Operations of Sets

Union of sets: The union of two sets A and B, denoted by $A \cup B$ is the set of all those elements which are either in A or in B or in both A and B. Thus, $A \cup B = \{x : x \in A \text{ or } x \in B\}$.

Intersection of sets: The intersection of two sets A and B, denoted by $A \cap B$, is the set of all elements which are common to both A and B.
Thus, $A \cap B = \{x : x \in A \text{ and } x \in B\}$

Disjoint sets: Two sets Aand Bare said to be disjoint, if $A \cap B = \Phi$.

Intersecting or Overlapping sets: Two sets A and B are said to be intersecting or overlapping if $A \cap B \neq \Phi$

Difference of sets: For any sets A and B, their difference (A – B) is defined as a set of elements, which belong to A but not to B.
Thus, $A - B = \{x : x \in A \text{ and } x \notin B\}$
also, $B - A = \{x : x \in B \text{ and } x \notin A\}$

Complement of a set: Let U be the universal set and A is a subset of U. Then, the complement of A is the set of all elements of U which are not the element of A.

Thus, A’ = U – A = {x : x ∈ U and x ∉ A}

Some Properties of Complement of Sets

- A ∪ A’ = ∪
- A ∩ A’ = Φ
- ∪’ = Φ
- Φ’ = ∪
- (A’)’ = A

Symmetric difference of two sets: For any set A and B, their symmetric difference (A – B) ∪ (B – A)

(A – B) ∪ (B – A) defined as set of elements which do not belong to both A and B.

It is denoted by A Δ B.

Thus, A Δ B = (A – B) ∪ (B – A) = {x : x ∉ A ∩ B}.

Laws of Algebra of Sets – Class 11 Maths Notes

Idempotent Laws: For any set A, we have

- A ∪ A = A
- A ∩ A = A

Identity Laws: For any set A, we have

- $A \cup \Phi = A$
- $A \cap U = A$

Commutative Laws:

For any two sets A and B, we have

- $A \cup B = B \cup A$
- $A \cap B = B \cap A$

Associative Laws: For any three sets A, B and C, we have

- $A \cup (B \cup C) = (A \cup B) \cup C$
- $A \cap (B \cap C) = (A \cap B) \cap C$

Distributive Laws: If A, B and Care three sets, then

- $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
- $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

De-Morgan's Laws: If A and B are two sets, then

- $(A \cup B)' = A' \cap B'$
- $(A \cap B)' = A' \cup B'$

Formulae to Solve Practical Problems on Union and Intersection of Two Sets

Let A, B and C be any three finite sets, then

- $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
- If $(A \cap B) = \Phi$, then $n(A \cup B) = n(A) + n(B)$
- $n(A - B) = n(A) - n(A \cap B)$
- $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$