Class XI MATHEMATICS

Chapter 1 – SETS

Module – 1/2

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Learning Outcome:

In this module we are going to learn about

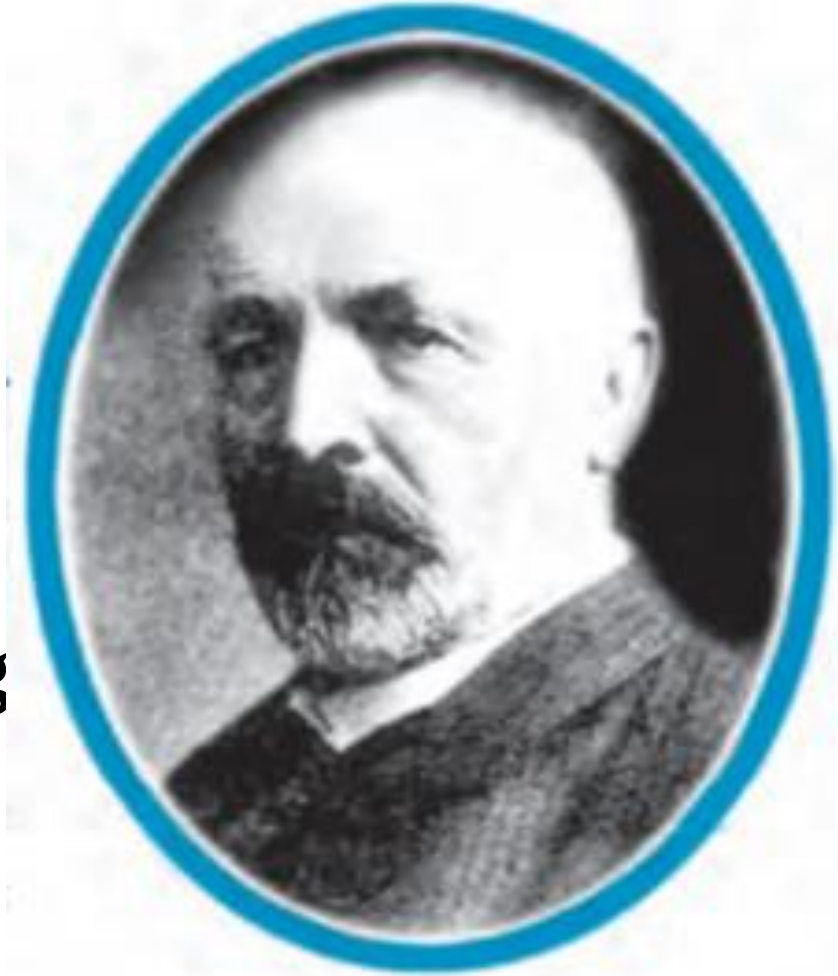
- **Definition of Set**
- **Representation of a set**
- **Empty Set, Finite and Infinite sets & Equal sets**
- **Subsets**
- **Subsets of set of real numbers**

HISTORY OF SETS:

The theory of sets was developed by German mathematician Georg Cantor (1845-1918).

He first encountered sets while working on "problems on trigonometric series".

Today this concept is being used in almost every branch of mathematics.



Georg Cantor
(1845-1918)

A set is a well-defined collection of objects

Examples:

- The rivers of India
- The vowels in the English alphabet, namely, a, e, i, o, u
- Various kinds of triangles
- The solution of the equation: $4x-3=0$
- The set of all natural numbers
- the set of all real numbers

EXAMPLES OF SETS IN MATHEMATICS

N : The set of all natural numbers

Z : The set of all integers

Q : The set of all rational numbers

R : The set of real numbers

Z+ : The set of positive integers

Q+ : The set of positive rational numbers

R+ : The set of positive real numbers.

Points to be noted :

- Sets are usually denoted by capital letters A, B, C, etc.
- Objects, elements and members of a set are synonymous terms.
- The elements of a set are represented by small letters a, b, c, etc
- If a is an element of a set A, we say that

  " a belongs to A" denoted by $a \in A$.
- If 'b' is not an element of a set A, we say that

  "b does not belong to A" denoted by "$b \notin A$".

REPRESENTATION OF A SET

There are two methods of representing a set :

- **Roster or tabular form**
- **Set-builder form.**

ROSTER FORM OR TABULAR FORM

In roster form, all the elements of a set are listed, the elements are being separated by commas and are enclosed within braces { }.

Ex. i) The set of all even positive integers less than 7 is {2, 4, 6}.

ii) The set of all vowels in the English alphabet is {a, e, i, o, u}.

Note : The order in which the elements are listed is immaterial

SET BUILDER FORM

In set-builder form, all the elements of a set possess a single common property which is not possessed by any element outside the set.

Example:

The set {1,2,3,4,5} is represented in set builder form as

V = {x : x is a natural number less than 6}

THE EMPTY SET

A set which does not contain any element is called the empty set or the null set or the void set

The empty set is denoted by the symbol ϕ or { }.

Example:

B = {x : x is a student presently studying in both classes X and XI}

FINITE AND INFINITE SETS

A set which is empty or consists of a definite number of elements is called finite otherwise, the set is called infinite

Examples :

1) **Let W be the set of the days of the week. Then W is finite.**
2) **Let G be the set of points on a line. Then G is infinite.**

EQUAL SETS

Two sets A and B are said to be equal if they have exactly the same elements and we write A = B. Otherwise, the sets are said to be unequal and we write A ≠ B.

Examples :

i) Let A = {1, 2, 3, 4} and B = {3, 1, 4, 2}. Then A = B.

ii) Let C = {x : x – 5 = 0 }, D = {x: x^2 = 25},

Thus C ={5}, and D = {–5, 5} Then C ≠ D.

SUB SETS

A set A is said to be a subset of a set B if every element of A is also an element of B. It is denoted as $A \subset B$

If A is not a subset of B, we write $A \not\subset B$.

That is, $A \subset B$ if $a \in A \Rightarrow a \in B$

- Every set is a subset of itself .
- Null set is a subset of every set.
- If A is a proper subset of B then B is called superset of A.

SUB SETS OF REAL NUMBERS

Some subsets of the set of real numbers 'R' are

- **The set of natural numbers N = {1, 2, 3, 4, 5, . . .}**
- **The set of integers Z = {. . ., –3, –2, –1, 0, 1, 2, 3, . . .}**
- **The set of rational numbers Q =$\{ x: x = \frac{p}{q}, p, q \in Z$ and $q \neq 0\}$**
- T =$\{x: x \in R$ and $x \notin Q\}$ i.e., all real numbers that are not rational.

Here, $N \subset Z \subset Q$, $Q \subset R$, $T \subset R$, $N \not\subset T$.

What we have learned?

- **A set is a well-defined collection of objects.**
- **A set which does not contain any element is called empty set.**
- **A set which consists of a definite number of elements is called finite set, otherwise, the set is called infinite set.**
- **Two sets A and B are said to be equal if they have exactly the same elements.**
- **A set A is said to be subset of a set B, if every element of A is also an element of B.**

THANK YOU.