Sets

- A **set** is a well-defined collection of objects.
- Sets are usually represented by capital letters A, B, C, D, X, Y, Z, etc. The objects inside a set are called **elements** or **members** of a set. They are denoted by small letters a, b, c, d, x, y, z, etc.
- If a is an element of a set A, then we say that "a belongs to A" and mathematically we write it as "$a \in A$"; if b is not an element of A, then we write "$b \notin A$".
- There are three different ways of representing a set:
    - **Description method:** Description about the set is made and it is enclosed in curly brackets { }.

      For example, the set of composite numbers less than 30 is written as follows:

      {Composite numbers less than 30}

    - **Roster method or tabular form:** Elements are separated by commas and enclosed within the curly brackets { }.

      For example, a set of all integers greater than 5 and less than 9 will be represented in roster form as {6, 7, 8}.

    - **Set-builder form or rule method:** All the elements of the set have a single common property that is exclusive to the elements of the set i.e., no other element outside the set has that property.

      For example, a set L of all integers greater than 5 and less than 9 in set-builder form can be represented as follows:

      $L = \{x : x \text{ is an integer greater than 5 and less than 9}\}$

- **Some important points:**
    1. The order of listing the elements in a set can be changed.
    2. If one or more elements in a set are repeated then the set remains the same.

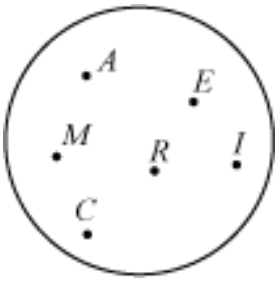
3. Each element of the set is listed once and only once.

- On the basis of number of elements, sets can be classified as:
  - **Finite set** − A set that contains limited (countable) number of different elements is called a finite set.
  - **Infinite set** − A set that contains unlimited (uncountable) number of different elements is called an infinite set.
  - **Empty set** − A set that contains no element is called an empty set. It is also called null (or void) set. An empty set is denoted by Φ or {}. Also, since an empty set has no element, it is regarded as a finite set.
- The number of distinct elements in a finite set *A* is called its **cardinal number**. It is denoted by *n* (*A*).
- As the empty set has no elements, therefore, its cardinal number is 0 i.e., *n* (Φ) = 0

- A set can also be represented using a venn diagram. **Venn diagrams** are closed figures such as square, rectangle, circle, etc. inside which some points are marked. The closed figure represents a set and the points marked inside it represent the elements of the set.

  For example, consider the set of all letters in the word AMERICA. This set consists of the letters A, M, E, R, I, and C.

  This set can be represented by a Venn diagram as follows:



- Two finite sets are called equivalent, if they have the same number of elements.

Thus, two finite sets *X* and *Y* are equivalent, if *n* (*X*) = *n* (*Y*). We write it as $X \leftrightarrow Y$ (read as "*X* is equivalent to *Y*")

For example, for sets $A = \{-9, -3, 0, 5, 12\}$, $B = \{-2, 1, 2, 4, 7\}$

n (*A*) = 5 and *n* (*B*) = 5

Therefore, sets *A* and *B* are equivalent sets

- Two sets are called equal, if they have same elements.

For example, for sets X = {all letters in the word STONE}, Y = {all letters in the word NOTES}

X = {S, T, O, N, E} and Y = {N, O, T, E, S}

Here, the sets X and Y have same elements. Therefore, in this case, we say that the sets X and Y are equal sets.