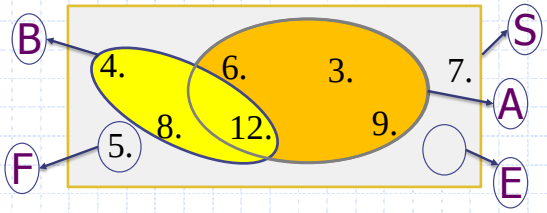
Objectives of session 1:

- Introduction and definition of a set.
- Notations.
- Writing of a set.
- Representation of sets.
- Types of sets.

S-1 "Rabih S Khater" 2

Introductive - activity:

Q. What do you see in front of you?



A. A collection (group, set) of natural numbers.

Q. Circle the set of multiples of:

a) 3. c) 5.

b) 4. d)11.

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Introduction: - What is a set? - Application.

A **'Set'** is an unordered collection of zero or more distinct well defined objects.

Do the following statements form sets?

Examples of sets:

✓ Collection of English vowels

A = {a. e. i. o. u.}

✓ Set of positive divisors of 3

C = {1. 3.}

Can't form a set:

✓ The list of difficult words in a text.

✓ The list of beautiful countries.

Note: We can form a set when it is possible to ***list all its members***, or when we are able to ***recognize*** if an object belongs to it or not.

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Introduction:

- What is an element?
- How to name a set?
- How to name an element?

The objects that make up a set are called **elements** or **members** of the set.

e.g: Let A be the set of all quadrilaterals.
Squares and rectangles are elements of set A.

➢A set is usually denoted by a capital letter.

e.g: Sets: $A, P, \Re \ldots$

➢An element of a set is usually denoted by a small letter.

e.g: Elements: $a, b, i, o, u \ldots$

Some Notations

Mathematics is the language of simplicity.

- Consider the set A = {a, e, i, o, u} then we write 'a' is a member of the set 'A' as:
  - $a \in A$ "we read a belongs to set A"
- We write 'b' is not a member of the set 'A' as:
  - $b \notin A$ "we read a does not belong to set A"

Frequently used sets:

- $\mathbb{N}$:The set of natural numbers.
- $\mathbb{N}^*$:The natural numbers except zero.
- $\mathbb{Z}$:The set of integers.
- $\mathbb{Z}^+$:The set of all positive integers.
- $\mathbb{Z}^-$:The set of non zero integers.
- $\mathbb{Q}$:The set of all rational numbers.
- $\mathbb{R}$:The set of all real numbers.
- $\mathbb{C}$:The set of all complex numbers.

Writing of a Set

A set is often represented in the following two ways:

(I) Extension: Roster method (Tabular form)

In this method, a set is described by listing elements separated by commas, within braces { }.

For example, the set of even natural numbers can be described as:

E={2, 4, 6, 8, ...}.

Writing of a Set

(II) Comprehension: or Set Builder Method

In this method, a set is described by a characterizing property P(x) of its element x.

In such a case the set is described by:

{x : P(x) holds}
or
{x | P(x) holds}

The symbol '|' or ':' is read as 'such that'.

In this representation the set of all even natural numbers can be written as :

$$E = \{x \mid x = 2n, \forall n \in N\}.$$

Representation of a set:

- Def. of Venn Diagram
- Usage of Venn Diagram

A set is represented by a closed domain in which elements are listed, such domain is called **Euler-Venn** diagram or simply **Venn** diagram.

Venn diagrams are used to teach elementary set theory, as well as illustrate simple set relationships.

Representation of a set: - Application.

Consider set $E = \{x|x$ is a letter of the English alphabets$\}$

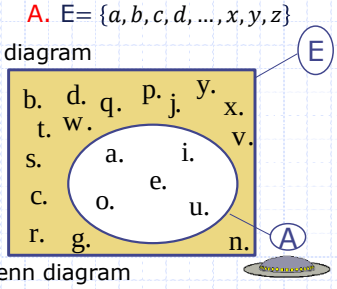
Q. Write E in extension. A. E= $\{a, b, c, d, \ldots, x, y, z\}$

Q. Represent E on a Venn diagram

Let $A = \{x|x \text{ is a vowel}\}$

Q. Write A in extension.

$$A = \{a, e, o, i, u\}$$



Q. Represent set A on a Venn diagram

Types of Sets:

Universal Set

Any set which is super set of all the sets under consideration is called the universal set and is denoted by E, S, Ω or ∪.

For example:

When we are using sets containing natural numbers then ℕ is the universal set.

When we are using letters then, the set of all alphabets is the universal set.

Types of Sets:

Empty set:

A set having no element is called an empty set. It is also known as **null** set or **void** set. It is denoted by ϕ.

For example:

$$A = \{x|x \in R \ \& \ x^2 = -10\} = \phi$$

Types of Sets

Singleton set:

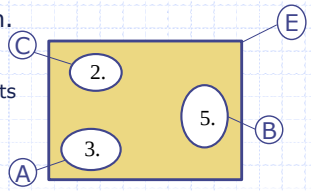
A set having a single element is called singleton set.

E.g: Consider the sample set E= {2,3,5}

Write E in comprehension.
$E = \{x|x \text{ is a prime } \& \ x < 7\}$

Q. What can you say about sets A, B & C?

A={2}, B={3}, C={5} are singleton sets.



Types of Sets

Pair set:

A set having exactly two elements is called a pair set.

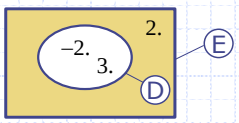
E.g: Consider the set: $E = \{x|(x-3)(x^2-4) = 0\}$

Q. Write E in extension.

A. $E = \{-2, 2, 3\}$

Q. What can you say about set D?

A. D={1,7} is a pair set.



Types of Sets

Finite set: A set is called a finite set if it is either void set or its elements can be counted.

For example: A={1, 2, 4, 6} is a finite set since it has a definite number of elements "four".

Infinite set: A set which is not a finite set, i.e. the counting up of whose elements is impossible, is called an infinite set.

For example:

(i) The set of points that belong to a straight line.
(ii) The set of all natural numbers.
(iii) The set of positive multiples of 3.