SET THEORY..

Learning Objectives:

1. At the end of the lecture, students should be able to

1. Understand the use of set notations such as union, intersection, proper subset, element of, complement, etc.

2. Represent the relationship between sets in a Venn-diagram.

3. Solve problems regarding set.

Definition: A set is a collection or group of objects (items) called elements.

Example: (1) The names of students in this class.

(2) The set of even numbers between 1 and 10 inclusive.

(3) The solution to the equation $x^2 + 4x + 4 = 0$.

Notation:

Let $B = \{2, 4, 6, 8, 10\}$.

We say "2 is an element of set B", denoted by "$2 \in B$". or "2 belongs to B" or "2 is a member of B".

Also, "$14 \notin B$" read as "14 is not an element of set B".

In general, if "$x \in A$", we say "x is an element of set A". and if "x is not an element of set A", we say "$x \notin A$".

Example:

1. Let $A = \{0, 1, 2, \cdots, 10\}$.

$2 \in A$ but $-2 \notin A$.

We can also define a set by a set of statements.

Example:

$A = \{$the names of the states in Nigeria$\}$.

$B = \{$The set of prime numbers$\}$

$C = \{ x \mid x$ is a letter of the English alphabet$\}$ $\left.\begin{array}{l} \\ \\ \end{array}\right\}$ Builder form.

$D = \{ x \mid x$ is an English vowel$\}$.

Finite and Infinite Sets :

A **finite set**: consists of a specified number of elements

i.e We can count the number of elements in such set.
However, not every countable set is finite. e.g $\mathbb{Q}$ is a countable but infinite set.

Infinite Set : This is a set which is not finite.

e.g $\mathbb{Z}, \mathbb{N}, \mathbb{R}, \mathbb{Q},$ etc.

Universal Set: Contains all the elements of a particular set.
  Elements of this set can form another set, denoted a
  designated as "Subsets".
For example. (1) Let $\mathcal{U} = \{ x \mid x$ is a natural number$\}$
$$= \{ x \mid x \in \mathbb{N} \}.$$

Then $A = \{ 1, 4, 7, 9 \}, \Rightarrow A \subset \mathcal{U}.$

(2) Let $B = \{ 4, 5, 6 \}$ & $C = \{ 9, 7, 8 \}$, Then;

$$\mathcal{U} = \{ 4, 5, 6, 7, 8, 9 \}.$$

Null Set: This is a set that contains no elements. It is also called an empty set.

e.g $A = \{ \emptyset \}.$

Cardinality of Set: This represents the number of elements or objects in a set; denoted by $|A|$.

Example: Cardinality of the set $\{ 2, 3, \frac{1}{2} \}$ is 3.