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S1, Mathematics , Unit 1: SET

LESSON 1: Describing sets, Set Notation, Membership of a set; Number of members(elements) in a set

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Unit 1: SET
1.1 Introduction to set concept

Def: a set is A group of items with a common feature

- Examples of sets are:

a set of animals, a set of houses, set of cars and so on.

An object or item in a set is called a **member or an element** of the set.

1.2 Describing sets

- There are three methods commonly used to describe or represent a set
  (i) Statement form method
  (ii) Roster or tabular form method
  (iii) Set builder form method

All these methods are used together with a pair of curly brackets within which the description is enclosed.

- **(a) Statement form method**

Consider:
(i) the alphabets a, b, c, d and e.

These letters can be described using a statement as follows: **{the first six letters of the alphabets}**
(ii) the set of the numbers 2, 4, 6, 8, 10. This can be described as: **{the first five even numbers}** or **{the first five natural numbers divisible by 2}**

- Individually, identify another five sets and describe them in a similar method.

1.2 Describing sets

- (b) **Roster or tabular method** Using this method, we describe a set by listing all the elements in it.
- **For example,**

consider the set of all the letters in the word Mathematics.

This set can be described by listing all the elements in it.

If we let this set be N, then **N = {m, a, t, h, e, i, c, s}**
This method of describing sets is known as **Roster or Tabular** Method.
Note that each element is written only once.

For example in the word mathematics, the letters m, a and t, each appear twice but we list each of them only once

1.3. Set Notation

- A set of subjects (S) that you study in Senior one may be: S = {mathematics, physics, chemistry, biology, history, religious education…}. Capital letters are used to represent sets e.g. set S. Members of a set are separated by commas and the set is enclosed with a curly bracket**{ }.**
- **For example**,

1) a set of odd numbers(O) less than 10 can be written as O = {1, 3, 5, 7, 9}.
2) A set of the first six letters of an alphabet (A) can be written as A = {a, b, c, d, e, f}.

1.4 Membership of a set

- We use symbol ∈ to mean “is a member of” and ∉ to mean “is not a member of “.

For example, given the set A= {1, 3, 5, 7, 9, 11}, 5 ∈ A read as 5 is a member of set A. 8 ∉ A read as 8 is not a member of set A.

1.5 Number of members in a set

- Consider set T = {0, 1, 2, 3, 4, 5, 6, 7,8}. The number of elements (n) in set Tis 9.

This is written as n(T) = 9.
The number of elements in the set is called the **cardinality** or **cardinal number** of the set.

- Suppose **n(A)**means the number of elements in set A.

If D = {days of the week} then n(D) = 7.

- Suppose F = {two legged cows} L = {green men on the planet earth} then: n(F) = 0 and n(L) = 0.
- This means the two sets F and L have no members. Therefore sets F and L have no cardinal numbers

i.e. 0 is the cardinal number in each case.

EXAMPLES

- **Example 1.1**
  List down the set G of vowels in the word "algebra".
  Solution G = {a, e}
- **Example 1.2**
  Describe set B using words, given that B = { 1, 3, 5, 7 …}.
  Solution
  B is the set of all positive odd numbers.
- **Example 1.3**
  List all the elements of set A given that A = { x: –3 < x < 8, x is an integer}.
  Solution
  The elements of set A are – 2, –1, 0, 1, 2,3, 4, 5, 6 and 7.

EXAMPLES

- **Example 1.4**
  Describe set T in words, given that T = {x : x = 2n – 1, where n = 1, 2, 3, …}
  Solution
  See Table 1.1

n	*1*	*2*	*3*	*4*	*5*	*6*	*7*
x	*1*	*3*	*5*	*7*	*9*	*11*	*13*

- *Table 1.1*
  Thus, T {the set of all positive odd numbers}

EXAMPLES

- **Example 1.5**
  Sets A and B are subsets of the set of natural numbers, N. If $A = \{ x : 1 \leq x \leq 7\}$ and $B = \{ x : 2 \leq x \leq 20, x \in$ set of even numbers$\}$.
  List the members of: (i) set A (ii) set B
  Solution

- (i) $A = \{ x : 1 \leq x \leq 7)$ means that x is a positive integer between 1 and 7 inclusive.
  $\therefore \{x: 1 \leq x \leq 7\} = \{1, 2, 3, 4, 5, 6, 7\}$
  (ii) $B = \{x: 2 \leq x \leq 20, x \in$ even numbers$\}$means all even numbers between 2 and20 inclusive.
  $\therefore \{ x : 2 \leq x \leq 20\} = \{ 2, 4, 6, 8, 10,12, 14, 16, 18, 20\}$.
  $\therefore B = \{ 2, 4, 6, 8, 10, 12, 14, 16, 18,20\}$ and $A = \{ 1, 2, 3, 4, 5, 6, 7\}$.Sets A and B share some members,
  i.e. 2, 4, 6.

Unit 1: SET
1.6 Subset of a set

- A set can be obtained by taking some or all the elements of a given set to form another set (called subset).

- **For example**,

set **B = {cow, goat, pig}** is a set of some domestic animals. Similarly, we can get

set **C = {dove, weaver bird, pigeon}** which is a set of birds.

Set **D = {tilapia}**which is a set of fish and so on.

- A set that is formed by obtaining some elements or all the elements from a given set is called a subset.
- **The empty**
  set denoted by { } or ∅ is also a subset of any set. A subset is denoted by symbol ⊂.
- For example: A={1,2,3,4,5,6,7,8,9,10} B={2,4,6,8,10} means B⊂A B is subset of A

1.7 The number of subsets in a set

- If the number of subsets of a given set is represented as Ns then the number of subsets is given by; $Ns = 2^n$
  Where n equals the number of elements in the set.
- **Example 1.6**
  Set C has 5 elements. How many subsets does it have?
  Solution
  Since the number of elements is five (n = 5)then from Ns = 2n, the number of subsets is
  $N_s = 2^5 = 32$
  i.e the set has 32 subsets.
- **Example 1.7**
  A certain set has 64 subsets. How many elements are there in the set?
  Solution
  Number of subsets (N_s) = 64
  $N_S = 2^n \quad 64 = 2^n$
  $2^6 = 2^n$
  n = 6
  i.e. there are 6 elements.

1.7 The number of subsets in a set

- **Example 1.8**
  Given set B = {a, b, c}, list all the subsets of set B in your exercise book.
  Solution
  The subsets of set B are {}, {a},{b}, {c}, {a, b},{a, c}, {b, c} and {a, b, c}.
  Note: The number of subsets is obtained by the formulae 2n where n is the number of elements in a set.
  Example 1.9
  Given set A = {2, 4, 6, 8}, find the number of subsets in set A.
- **Solution**
  Number of subsets = 2^n = 24 = 16 subsets.

1.8 Subsets of numbers

- Natural numbers are counting numbers from zero to infinity. The set of natural numbers is represented as set **N = {0, 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 …}.**
- **Even numbers** are numbers divisible by 2. Set E of even numbers is represented
  as set **E = {2, 4, 6, 8 …}**. Therefore, the set of even numbers is a subset of the set of natural numbers. This
  can be represented as $E \subset N$.
- **Odd numbers** are numbers which are not divisible by 2. The set of odd
  numbers is represented by **D= {1, 3, 5,7, 9, 11, 13, 15…….}**. The set of odd numbers is a subset of the set of natural numbers which is written as $D \subset N$.

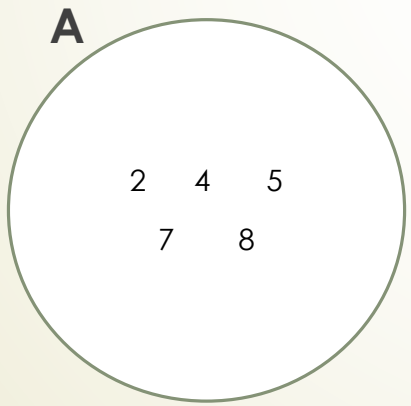
1.8 Subsets of numbers

- **A prime number** is a number which is divisible by one and itself only. In other words, prime numbers have only two factors. The set P of prime numbers is represented as set

P= {2, 3, 5, 7, 11, 13, 17…….}. The set of prime numbers is a subset of natural numbers represented as $P \subset N$.

1.9 Venn diagrams

- The circular pattern used to represent a set and its elements is called a Venn diagram.
  Example 1.10
  Given set A= {2, 4, 5, 7, 8}, represent set A on a Venn diagram.
- **Solution:**



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