Introduction

Number sets and interval notation

1- **Number sets :-** *A set is a collection of objects or things.*

For ***example****:*

$V = \{a, b, c, d\}$, $E = \{\text{even numbers}\} = \{2, 4, 6, 8, 10 \ldots\}$ *are both sets.*

1- V is ***a finite*** *set as it has a finite number of elements.*

2- E is ***an infinite*** *set as it has infinitely many elements.*

And **:**

(Empty Set) *A set containing no element is called an empty set or a null set.* ***Notations { } or Ø*** *denotes empty set.*

Examples *: 1- p= { n| n is a natural number less then 8}*

2- S={ x | x n is a natural number whose square is less then 25 }

3- R={ x| x is a real number between 0 and 2 }

* We use the symbol ∈ to mean "is a member of " or "is in". So, a ∈ V and 28 ∈ E, but h ∉V or 119 ∉ E.

Equal Sets *:- Two sets are said to be equal if they contain the same elements*

Subset *:- A set A is said to be a subset of a set B if every element of set A is also an element of set B*

Examples:

1) Let A={1,2,3} and B={a,1,2,3 }. Since every element of set A is also in B A is a subset of B

Notation: ***A⊆B means A is a subset of B***

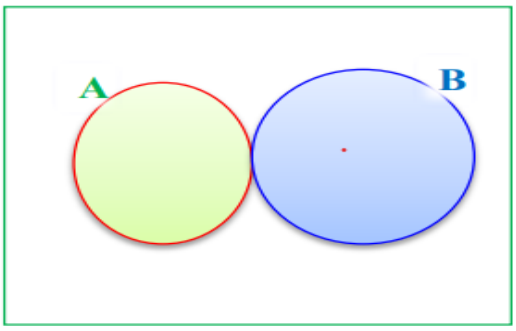
2) Let D={ 0,2,3,4,5,6,a,b,c,d,e,g } . Answer the following as True or False.

a) {0,g} ⊆D b) {0, 1, 3 , a} ⊆D c) { 0, 1,6 , a , f } ⊆D

3) let N={1,2,3 ,…} , B={n| n is an odd natural number }, and C={x | x is prime number }. Answer True or False. a) B ⊆C b) N ⊆B c) B ⊆N d) C ⊆N

Pictorial Representation of a Set: Venn Diagrams

Pictorially, a non-empty set is represented by a circle-like closed figure inside a bigger rectangle. This is called a Venn diagram. See fig below



Operation on Sets There are three types of set operations; Intersection denoted by $\cap$, union denoted by U , and complementation.

***Definitions**: Let A and B be sets*

*1- The **union** of A and B is denoted by $A \cup B$ and is defined as the set of all elements that are in A or B . That is $A \cup B = \{x; x \in A \text{ or } x \in B\}$.*

*2- The **Intersection** of A and B is denoted by $A \cap B$ and is defined as the set of all elements that are in A or B . That is $A \cap B = \{x; x \in A \text{ and } x \in B\}$.*

*3- **The Complement** of B in A is denoted by $A - B$ or $A \backslash B$ and is defined as the set of all elements that are in A but not in B. That : $A \backslash B = \{x; x \in A \text{ and } x \notin B\}$.*

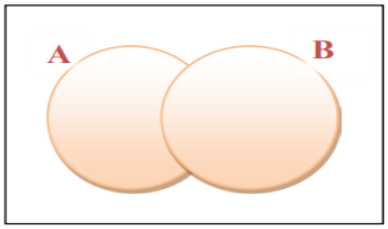
*4- **The absolute complement** of set A denoted by A' and is defined by:*

$A' = \{x; x \in U \text{ and } x \notin A\}$, *here U is the universal set .*

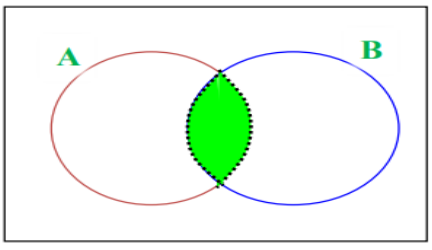
Examples: Venn Diagrams

***The Universal Set** is represented by a **rectangle**. The shaded regions represent, respectively, the **union, intersection** and **complement** of the sets A and B.*

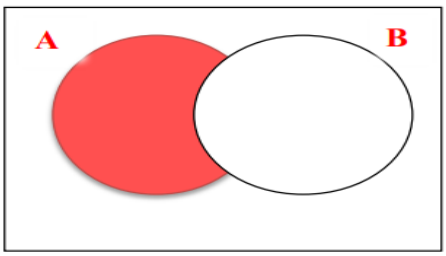
a) $A \cup B$



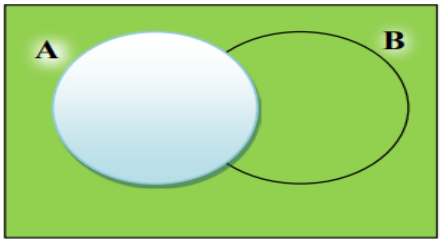
b) $A \cap B$



c) $A - B$



d) A'



Examples 1: Let A, B, and C be sets given as follows

$A = \{-3, -1, 1, 3, 5, 7\}$

$B = \{x : x \text{ is an even natural number less then } 6\}$

$c = A \text{ set consisting of squares of the first two nstural numbers}$

$Compute : a)\ A \cup B \qquad b)\ A \cap B \qquad c)\ A - B \qquad d)\ B - C$

$e)\ (A \cup B) \cup C \qquad f)\ A - (B \cup C) \qquad g)\ (A \cap B) - (A \cup C)'$

Sol;

a)

b)

c)

d)

e)

f)

g)

EXERCISE (1) :-

Let the universal set be E = {whole numbers less than 20 },

and let A = { squares less than 20 }

B = { even numbers less than 20 }

C = { odd squares less than 20 }

1- Draw A and C on a Venn diagram

2- Draw B and C on a Venn diagram

3- Shade $A \cup B$ on a Venn diagram

4- Shade $A \cap B$ on a Venn diagram.

EXERCISE (2) :-

$Compute : a)\ A \cup B$

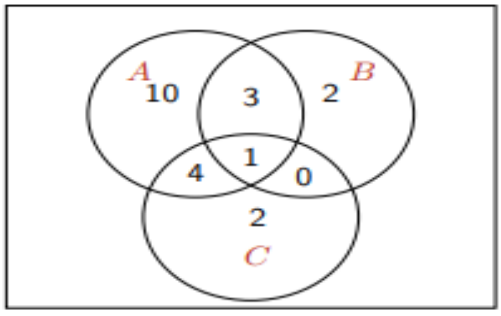
$b)\ A \cap B$

$c)\ A - B$

$d)\ B - C$

$e)\ (A \cup B) \cup C$

$g)\ (A \cap B) - (A \cup C)'$



The Real Number System

The Set of Real Numbers R is made up two disjoint set of Numbers:

- The Set of Rational Numbers and
- The Set of Irrational Numbers