# Lecture 8 — 19 | Jan | 2023

**Agenda:** 1. Sets
2. Number Systems

## Sets:

### Types of Sets:

1. Finite set : consists of finite elements. $\{1, 5, 9\}$
2. Infinite —"—: —"— infinite —"— $\{11, -1, 6, \dots\}$

3. Empty Set : No elements $\{\}$
4. Singleton : has only one element $\{19\}$

5. Equal Set: Two sets are equal if they hv same elements
$A = \{A, E, I, O, U\}$ $B = \{E, A, O, U, I\}$ $\therefore A = B$
6. Equivalent Set: —"— —— equivalent if they hv same no. of elements.
$A = \{A, E, I, O, U\}$ — 5 elements
$B = \{21, 35, E, X, 17\}$ — 5 elements
A is equivalent to B.

7. Power Set: A set of every possible subset.

8. Universal Set: Any set that contains all the sets under consideration.

9. Subset: When all the elements of set A belong to set B, then A is subset of B

$A = \{2, -13\}$ $B = \{2, 12, 18, 34, -13, 6\}$

$A \subseteq B$

eg1: **POWER SET**

THE POWER SET OF A SET X IS THE SET OF ALL SUBSETS OF X INCLUDING X ITSELF AND THE EMPTY SET.

IF X HAS n ELEMENTS, ITS POWER SET HAS $2^n$ ELEMENTS.

$X = \{a, b, c, d\}$ 4 ELEMENTS

$P(x) = \{\{a,b,c,d\}, \emptyset, \{a,b,c\}, \{a,b,d\}, \{a,c,d\}, \{b,c,d\}, \{a,b\}, \{a,c\}, \{a,d\}, \{b,c\}, \{b,d\}, \{c,d\}, \{a\}, \{b\}, \{c\}, \{d\}\}$ 16 ELEMENTS

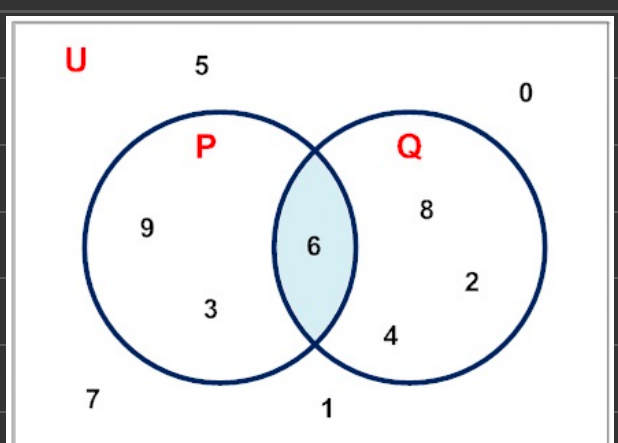
eg2: $X = \{1\}$ $N = 1$

Power set $P(X) = \{\phi, 1\}$ $2^N = 2$

eg: $X = \{a, b\}$ $N = 2$

$2^N = 4$

Power set $P(X) = \{\phi, \{a,b\}, \{a\}, \{b\}\}$




$P = \{9, 3, 6\}$

$Q = \{6, 8, 4, 2\}$

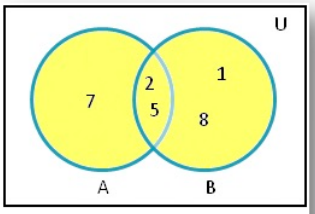
$W = \{0, 5, 1, 7\}$

$U = \{0, 5, 1, 7, 9, 3, 6, 8, 4, 2\}$

| Symbol | Symbol Name |
|---|---|
| { } | set |
| A ∪ B | A union B |
| A ∩ B | A intersection B |
| A ⊆ B | A is subset of B |
| A ⊄ B | A is not subset B |
| A ⊂ B | proper subset / strict subset |
| A ⊃ B | proper superset / strict superset |
| A ⊇ B | superset |
| A ⊅ B | not superset |
| Ø | empty set |
| P (C) | power set |
| A = B | Equal set |
| A | Complement of A |
| a∈B | a element of B |
| x∉A | x not element of A |

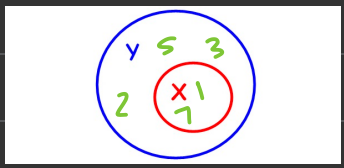
$A^c$

$A = \{2, 5, 7\}$ $B = \{2, 5, 1, 8\}$




A U B = {1, 2, 5, 7, 8}

$A \cap B = \{2, 5\}$



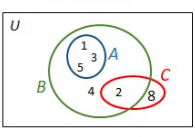

$X = \{1, 7\}$ $X \subset Y$

$Y = \{1, 7, 2, 3, 5\}$ $Y \supset X$

$3 \in \{2, 3, 9, -5\}$

$21 \notin \{2, 3, 9, -5\}$

**Subset**

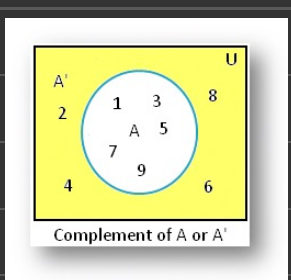



$A = \{1, 3, 5\}$ $B = \{1, 2, 3, 4, 5\}$

$C = \{2, 8\}$

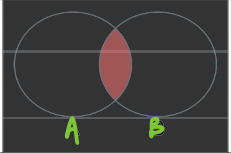
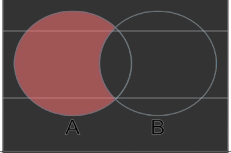
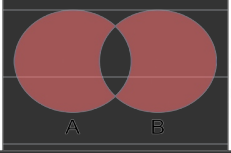
$A$ is a proper subset of $B$: $A \subset B$

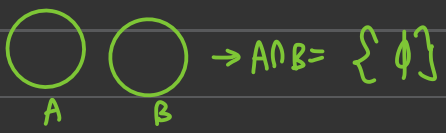
$C$ is not a subset of $B$: $C \not\subset B$

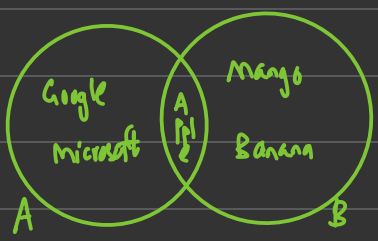



Complement of A or A'

- Visualising set operations through Venn Diagrams

| Set Operation | Venn Diagram | Interpretation |
|---|---|---|
| Union |   | $A \cup B$, is the set of all values that are a member of $A$, or $B$, or both. |
| Intersection |   | $A \cap B$, is the set of all values that are members of both $A$ and $B$. |
| Difference |   | $A \setminus B$, is the set of all values of $A$ that are not members of $B$ |
| Symmetric Difference |   | $A \triangle B$, is the set of all values which are in one of the sets, but not both. |

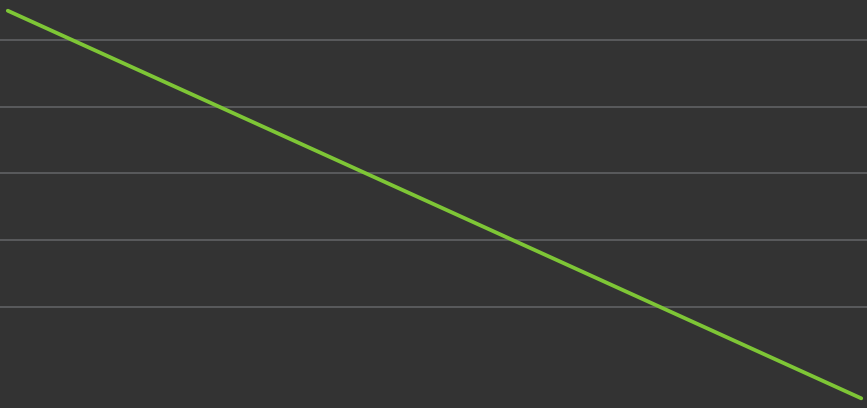



A − B = {Google, Microsoft}

B − A = {Mango, Banana}

A △ B = {Google, Microsoft, Mango, Banana}

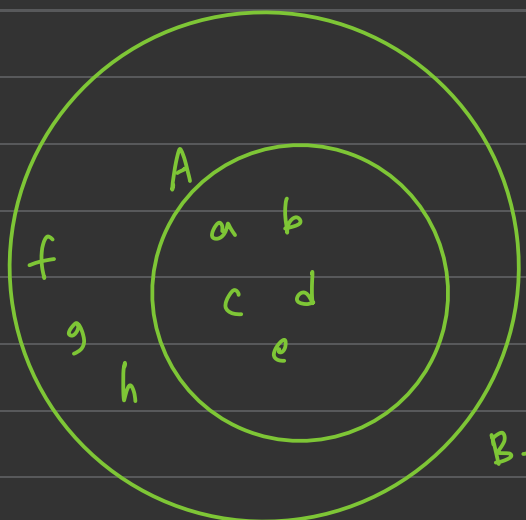


eg: $A = \{a, b, c, d, e\}$

$B = \{a, b, c, d, e, f, g, h\}$

Find $A \cup B$, $A \cap B$, $A - B$, $B - A$.

Soln:




$A \subset B$

$B \supset A$

$A \cup B = \{a, b, c, d, e, f, g, h\}$

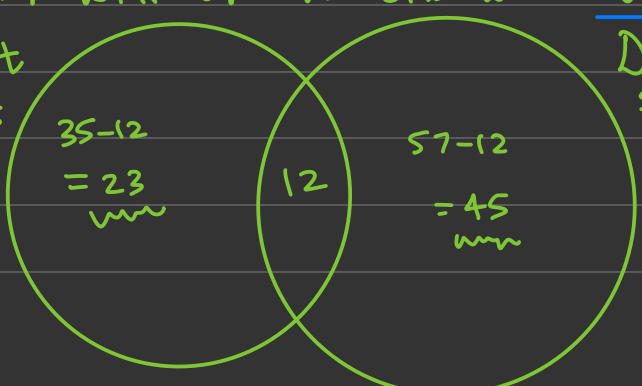
$A \cap B = \{a, b, c, d, e\}$

$A - B = \{\phi\}$

$B - A = \{f, g, h\}$

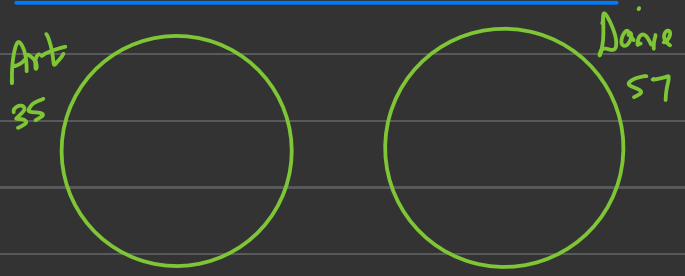
eg: There are 35 students in art class & 57 in Dance class. Find the no. of students who are in either Dance or art class. when two classes meet at ⓐ different hrs & 12 students r enrolled in both activities

Soln:



Total Students $= 23 + 12 + 45$

(b) When two classes meet at same hour?

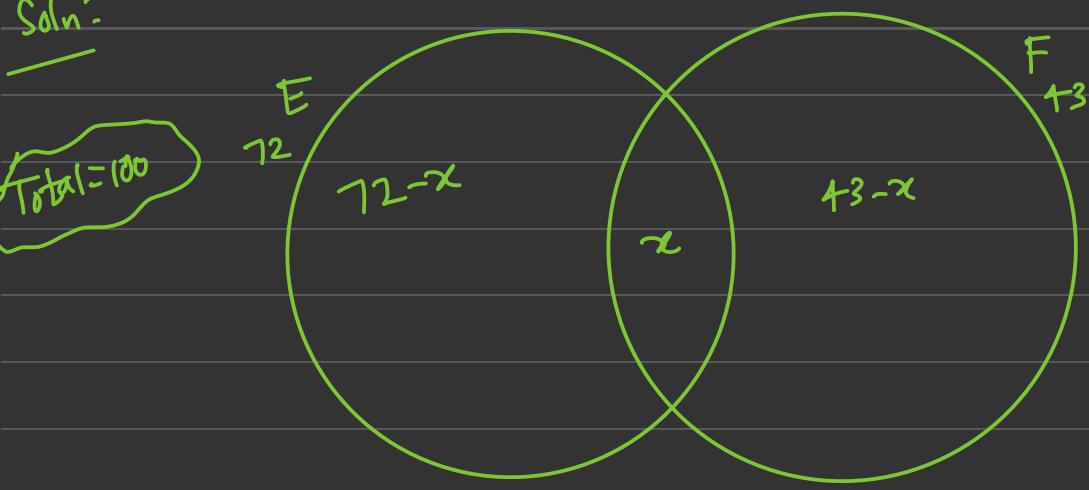



$Art \cap Dance = 0$

Total Students $= 35 + 57$

eg: Out of 100 people in a group, 72 speak English, 43 speak French. Each one out of 100 people speak atleast one language. Then how many speak only English? How many speak only French? How many speak both?

Soln:



$(72-x)+(x)+(43-x)=100$

$72+43-100=x$

$x=115$

$-100$

$\therefore \boxed{x=15}$

$E=72-x=72-15=57$

$F=43-x=43-15=28$

Lets confirm if total is 100.

$E+F+(E \cap F)=57+28+15=100$ ☺

# Number Series :

Let us see the various types of questions that may come one by one from below.

**1. Addition Series:** In this type of number series reasoning, specific numbers based on some pattern are added to get the next number. 10, 13, 16, 19, 22, ... (+3)

**2. Subtraction Series:** In this type of number series reasoning, specific numbers based on some pattern are subtracted to get the next number. 22, 19, 16, 13, 10, ... (−3)

**3. Multiplication Series:** In this type of number series reasoning, a particular type of number pattern is multiplied to get the next number. 1 2 2 4 8 32 ..

**4. Division Series:** In this type of number series reasoning, a particular type of number pattern is divided to get the next number. 100 50 25 12.5 (÷2)

**5. Square Series:** In this type of number series reasoning, each number is a perfect square of a particular number pattern. 1, 9, 25, 49, 81 (Squares of ODD Nos).

**6. Cube Series:** In this type of number series reasoning, each number is a perfect cube of a particular number pattern. 1, 8, 64, .. (cube of even nos.)

**7. Fibonacci Series:** In this type of number series reasoning, the next number is the addition of two previous numbers. Java : 0 1 1 2 3 5 8 13 21 ..

**8. Alternating Series:** In this type of number series reasoning, multiple number patterns are used alternatively to form a series. 1, 4, 3, 16, 5, 36, 7, 64, 9, 100 11

**9. Mixed Operator Series:** In this type of number series reasoning, multiple operators are applied to get the next number in the series.