CDS 1 2025

LIVE

MATHS

SET THEORY

NAVJYOTI SIR

Crack
EXAMS

19 Dec 2024 Live Classes Schedule

9:00AM	19 DEC 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:30AM	COMPLETE SCREENING TESTS	ANURADHA MA'AM

NDA 1 2025 LIVE CLASSES

1:00PM	PHYSICS - ROTATIONAL MOTION	NAVJYOTI SIR
4:30PM	ENGLISH - SENTENCE IMPROVEMENT - CLASS 1	ANURADHA MA'AM
5:30PM	MATHS - INTEGRATION - CLASS 3	NAVJYOTI SIR

CDS 1 2025 LIVE CLASSES

1:00PM	PHYSICS - ROTATIONAL MOTION	NAVJYOTI SIR
4:30PM	ENGLISH - SENTENCE IMPROVEMENT - CLASS 1	ANURADHA MA'AM
7:00PM	MATHS - SET THEORY	NAVJYOTI SIR

SETS

well-defined collection

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

curly braces

set is represented by capital alphabet

→ Each object inside a set is called "element".

$1 \in A$

belongs to

$7 \notin A$

(does not belongs to)

SETS

N ⟶ set of natural numbers

W ⟶ set of whole numbers

Z ⟶ " " integers

Q ⟶ " " rational numbers

R ⟶ " " real numbers

C ⟶ " " complex numbers

Z^+ = set of positive integers

REPRESENTATION OF SETS

Listing method / Roster form

Set - builder

$A = \{1, 2, 3, 4, 5\} \longrightarrow A = \{x : x \in N ; 1 \leq x \leq 5\}$

TYPES OF SETS

1. EMPTY SET / NULL SET

$A = \{\ \} = \emptyset$

2. SINGLETON SET

→ one element only.

$\{1\}$, $\{0\}$, $\{\emptyset\}$ one element

TYPES OF SETS

3. FINITE AND INFINITE SETS

$A = \{1, 2, 3, 7, 11, 19\}$ ⟶ no. of elements is countable.

↓ FINITE SET

$B = \{2, 8, 14, 20 \ldots\}$ ⟶ no. of elements is not countable

INFINITE SET

TYPES OF SETS

4. EQUIVALENT AND EQUAL SETS

Number of elements are equal.

$\{a, b, c\}$ $\{p, q, r\}$

(3) (3)

(Equivalent)

no. of elements are equal + elements are same

$\{3, 2, 1\} = A$

$\{1, 2, 3\} = B$

$A = B$

order does not matter

(Equal sets)

TYPES OF SETS

5. SUBSET AND SUPERSET

#

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

$B = \{4, 3\} \longrightarrow$ subset of A

$(B \subset A) \rightarrow$ B is a subset of A.

TYPES OF SETS

6. POWER SET

$A = \{1, 2, 3\}$

Subsets of A

$\{\}$ (ϕ), $\{1\}$, $\{1,2\}$, $\{1,2,3\}$ (A), $\{2\}$, $\{2,3\}$, $\{3\}$, $\{3,1\}$

→ Set containing all subsets of A (POWER SET)

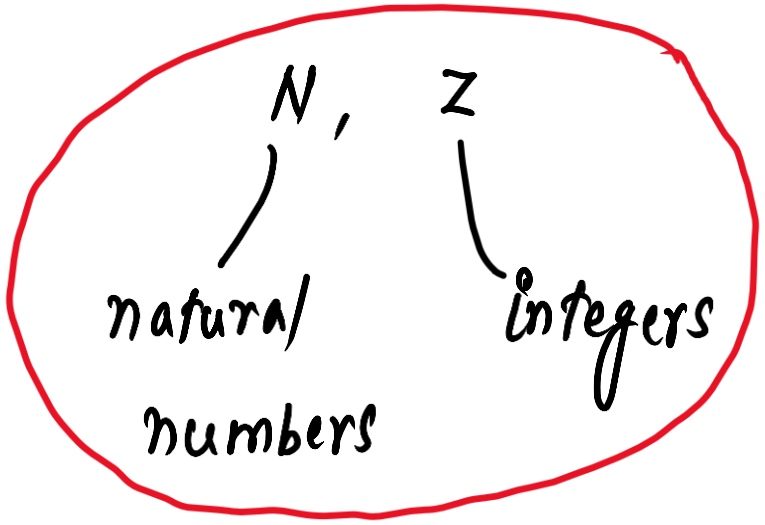
If no. of elements $\Rightarrow n(A) = n$

no. of elements in power set of A, $n(P(A)) = 2^n$

TYPES OF SETS

7. UNIVERSAL SET

→ superset for a given number of sets.

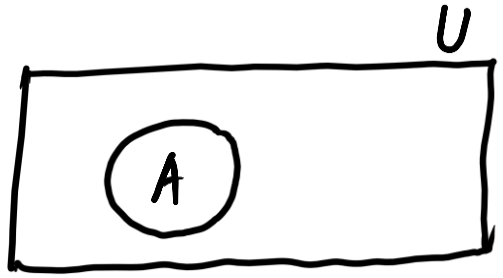


Q – rational numbers } Q acts as Universal set

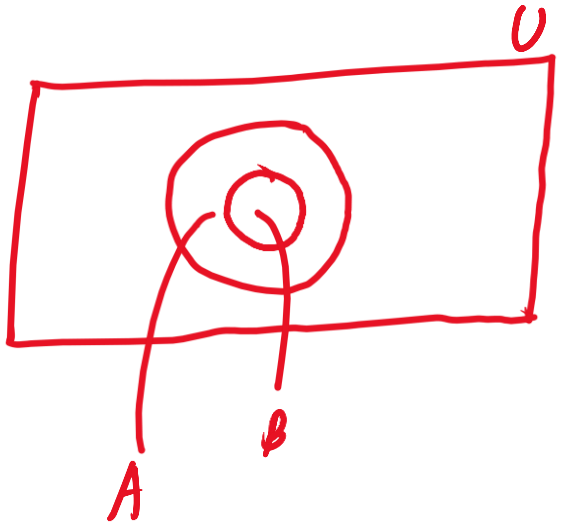
VENN DIAGRAM

Universal set ⟶ rectangle

Sets ⟶ circles

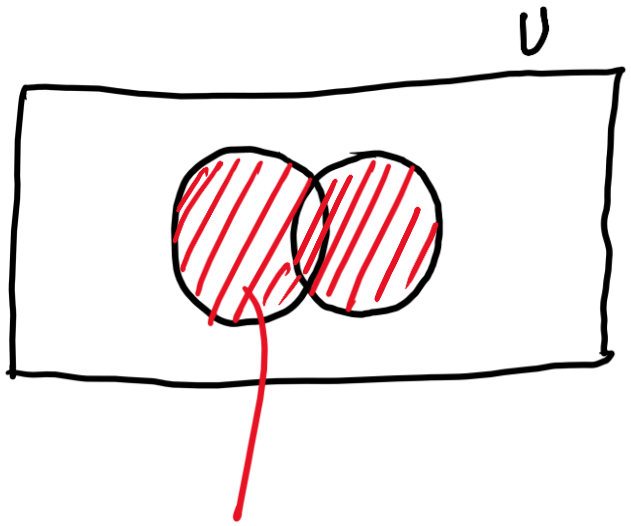


B ⊂ A,



OPERATIONS ON SETS

UNION :



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

$B = \{3, 5, 2\}$

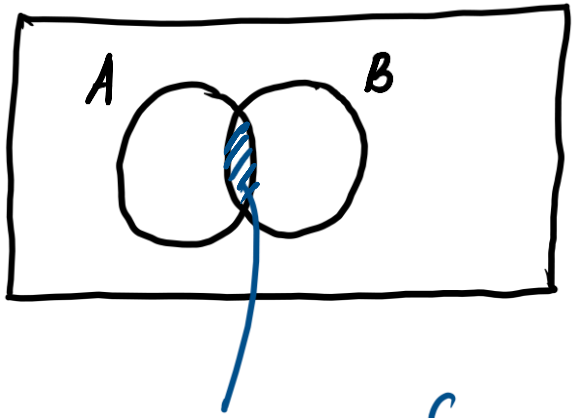
$A \cup B = \{1, 2, 3, 4, 5\}$

$A \cup B = \{x : x \in A \text{ or } x \in B \text{ or } x \in \text{both } A \text{ and } B\}$

$\cup$ — union

OPERATIONS ON SETS

INTERSECTION :



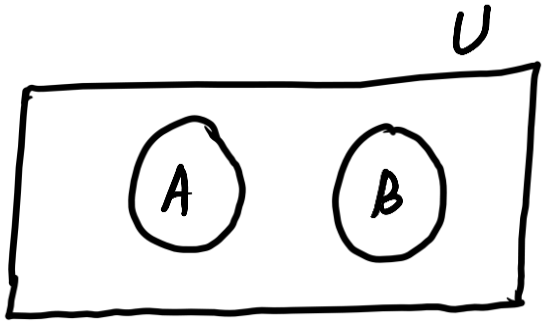
$A = \{1, 2, 3, 4\}$

$B = \{2, 7, 9\}$

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

$A \cap B = \{x : x \in A \text{ and } x \in B\}$

Disjoint sets :



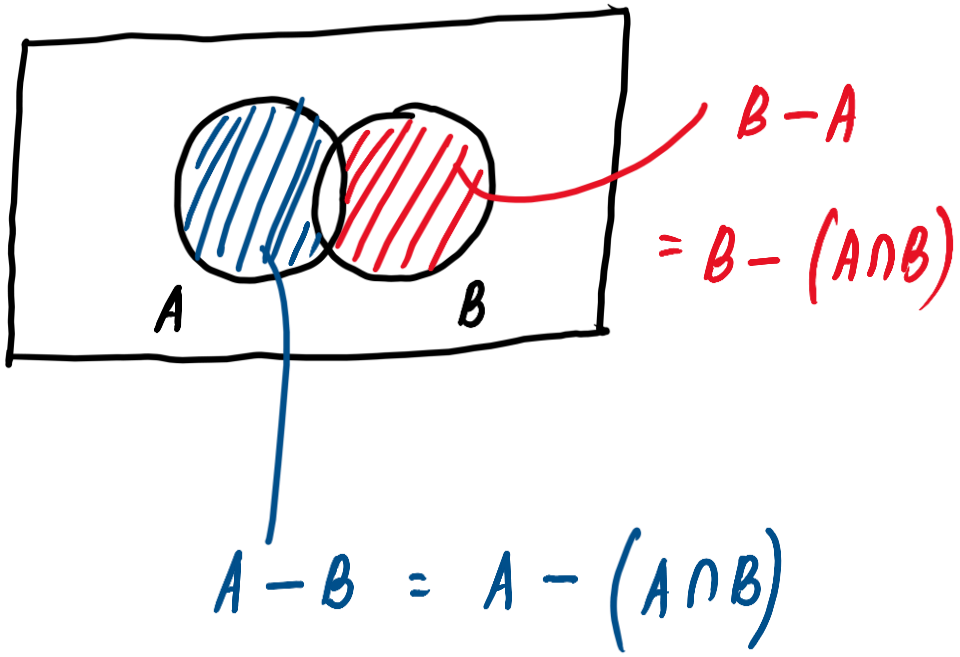
$A \cap B = \{\} = \phi$

OPERATIONS ON SETS

INTERSECTION :

OPERATIONS ON SETS

DIFFERENCE :



$A - B = \{x : x \in A \text{ but } x \notin B\}$

$B - A = \{x : x \notin A \text{ and } x \in B\}$

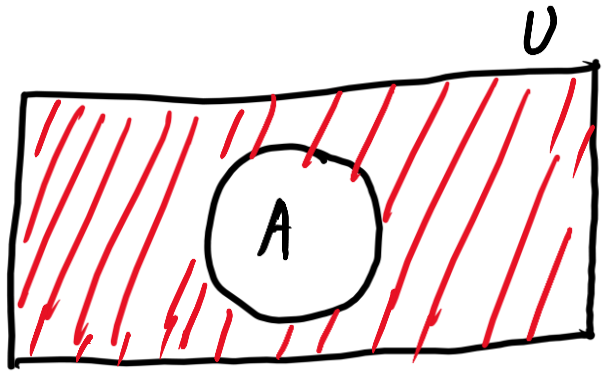
$A = \{2, 4, 6, 8, 10, 12\}$

$B = \{1, 2, 3, 6, 8, 12\}$

$A - B = \{2, 4, 10\}$ $\quad$ $B - A = \{1, 2, 3\}$

OPERATIONS ON SETS

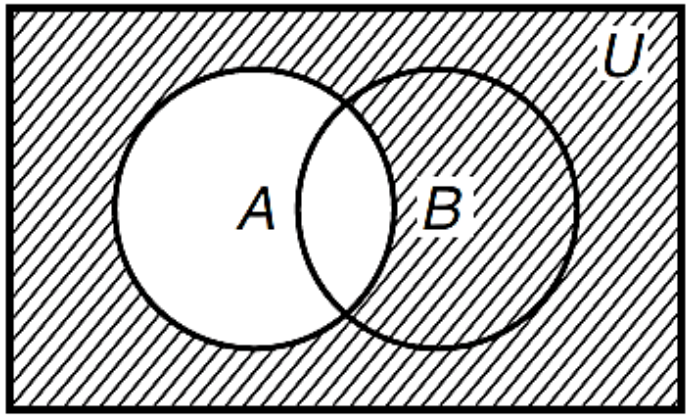
COMPLEMENT :



complement of A = A' or A^c = $U - A$

COMPLEMENT OF SETS

If U is a universal set and $A \subset U$, then complement set of A is denoted by A' or $U - A$.



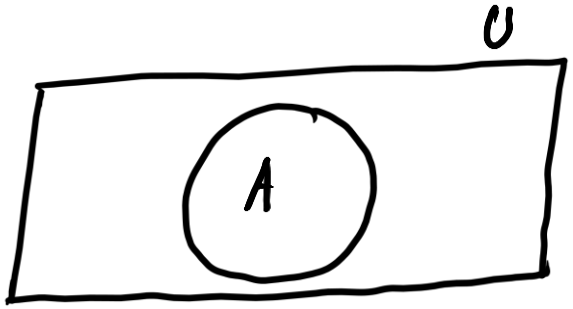
Thus, $A' = U - A = \{x : x \in U, \text{but } x \notin A\}$

It is clear that $x \in A' \Leftrightarrow x \notin A$

- $\phi = U'$
- $\phi' = U$
- $(A')' = A$
- $A \cup A' = U$
- $A \cap A' = \phi$

LAW OF ALGEBRA OF SETS

1. Idempotent laws
   (a) $A \cup A = A$ ✓ (b) $A \cap A = A$ ✓
2. Identity laws
   (a) $A \cup \phi = A$ ✓ (b) $A \cap U = A$ ✓
3. Commutative laws
   (a) $A \cup B = B \cup A$ ✓
   (b) $A \cap B = B \cap A$ ✓
4. Associative laws
   (a) $(A \cup B) \cup C = (A \cup (B) \cup C)$
   (b) $A \cap (B \cap C) = (A \cap B) \cap C$
5. Distributive laws
   (a) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
   (b) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
6. De-Morgan's laws
   (a) $(A \cup B)' = A' \cap B'$ (b) $(A \cap B)' = A' \cup B'$



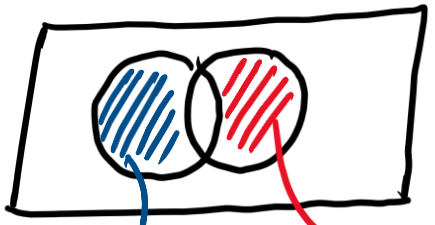
$a \times (b + c) = a \times b + a \times c$

IMPORTANT RESULTS

If A, B and C are any three finite sets, then

1. $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

2. $n(A \cup B) = n(A) + n(B)$, if and only if $A \cap B = \phi$ — disjoint sets



$(A-B) \cup (B-A) = A \Delta B$ (symmetric difference)

3. $n(A - B) = n(A) - n(A \cap B)$

4. $n(A \Delta B) = n(A - B) + n(B - A) = n(A) + n(B) - 2n(A \cap B)$

5. $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$

6. $n(A' \cup B') = n(U) - n(A \cap B)$

7. $n(A' \cap B') = n(U) - n(A \cup B)$

} De-morgan's laws,

PYQ – 24 - II

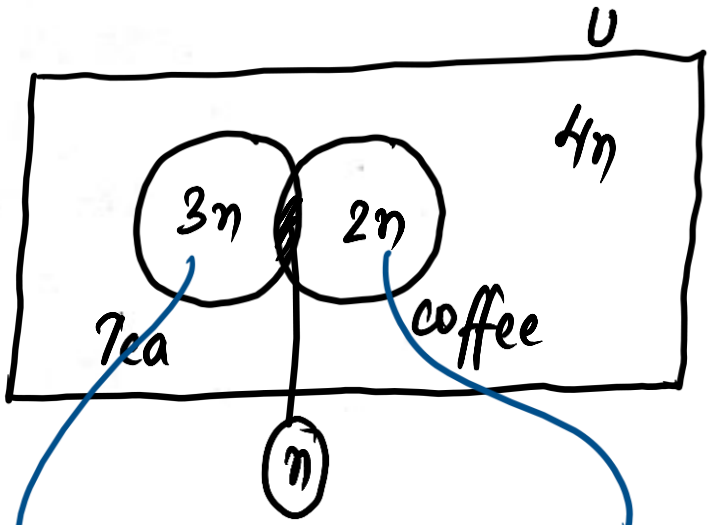
In a class containing 200 students, n students prefer both tea and coffee; $2n$ students prefer coffee, $3n$ students prefer tea; $4n$ students prefer neither tea nor coffee. What is the value of n ?

(a) 20

(b) 25

(c) 30

(d) 35



only tea = $3n - n = 2n$

only coffee = $2n - n = n$

$$200 = 4n + 2n + n + n$$

$$200 = 8n$$

$$n = \frac{200}{8} = 25$$

PYQ – 24 - II

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(a) 20

(b) 25

(c) 30

(d) 35

Ans: (b)

PYQ – 24 - II

In a class of 160 students, each of them opt at least one language from among English, Hindi and Sanskrit. It is found that 130 students opt English, 120 students Hindi and 110 Sanskrit. If the students opt either only one language or all three languages, then what is the number of students who study all three languages ?

(a) 40

(b) 60

(c) 80

(d) 100

PYQ – 24 - II

In a class of 160 students, each of them opt at least one language from among English, Hindi and Sanskrit. It is found that 130 students opt English, 120 students Hindi and 110 Sanskrit. If the students opt either only one language or all three languages, then what is the number of students who study all three languages ?

(a) 40

(b) 60

(c) 80

(d) 100

Ans: D

Directions Consider the information given below and answer the two items that follow

In a class, 54 students are good in Hindi only, 63 students are good in Mathematics only and 41 students are good in English only. There are 18 students who are good in both Hindi and Mathematics. 10 students are good in all three subjects.

Q) What is the number of students who are good in Hindi and Mathematics but not in English?

(a) 18 (b) 12 (c) 10 (d) 8

Q) What is the number of students who are good in Hindi and Mathematics but not in English?

(a) 18 (b) 12 (c) 10 (d) 8

Ans: (d)

Q) What is the number of students who are good in either Hindi or Mathematics but not English?

(a) 99 (b) 107 (c) 125 (d) 130

Q) What is the number of students who are good in either Hindi or Mathematics but not English?

(a) 99 (b) 107 (c) 125 (d) 130

Ans: (c)