FREE NOTES · NCERT + JEE LEVEL

Sets

Set kya hai, roster aur set-builder form, sets ke types, subsets aur power set, intervals, universal set, Venn diagrams, sets pe operations, complement, De Morgan's laws aur counting sawaal.

01 Sets & likhne ka tareeka
02 Sets ke types
03 Subsets & power set
04 Intervals (R ke subsets)
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01 Sets & likhne ka tareeka

Set alag alag objects ka well-defined collection hai. "Well-defined" matlab hum hamesha bata sakein ki koi object usme hai ya nahi. "Class ke achhe students" set nahi; "90 se upar wale students" set hai.

- Elements: a ∈ A (hai), b ∉ A (nahi hai).
- **Roster form:** elements ki list: A = {1, 2, 3, 4}. Order aur repeat se fark nahi.
- **Set-builder form:** rule likho: A = {x : x ∈ N, x < 5}.
- Standard sets: N (natural), W, Z (integers), Q (rational), R (real), T (irrational).

02 Sets ke types

Type	Matlab	Example
Empty (null, void) φ ya { }	Koi element nahi	{x : x ∈ N, 1 < x < 2}
Singleton	Sirf ek element	{0}
Finite	Gine ja sakne wale elements; n(A) = cardinal number	Vowels
Infinite	Finite nahi	N, line pe points
Equal	Bilkul same elements	{1,2,3} = {3,1,2}
Equivalent	Elements ki ginti barabar	{a,b} aur {1,2}

{0} empty nahi (isme 0 element hai). φ ≠ {φ}.

03 Subsets & power set

- $A \subseteq B$ agar A ka har element B me ho. $A \subset B$ (proper) agar saath me $A \neq B$.
- φ har set ka subset; har set khud ka subset. $N \subset Z \subset Q \subset R$.
- $n(A) = m$ ho to: subsets = $\mathbf{2^m}$; proper subsets = $2^m - 1$.
- **Power set** P(A) = A ke saare subsets ka set. $n(P(A)) = 2^m$. $P(\{1,2\}) = \{\varphi, \{1\}, \{2\}, \{1,2\}\}$.

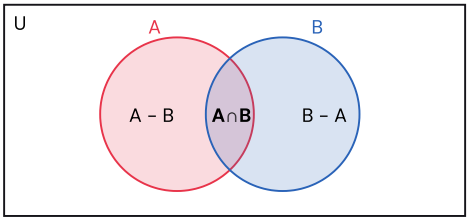
04 Intervals (R ke subsets)

Notation	Set	Matlab
(a, b)	$\{x : a < x < b\}$	Open: sire shamil nahi
[a, b]	$\{x : a \leq x \leq b\}$	Closed: sire shamil
[a, b)	$\{x : a \leq x < b\}$	Half-open
(a, b]	$\{x : a < x \leq b\}$	Half-open

Har ek ki length = b − a. ∞ ke saath hamesha gol bracket: $[2, \infty)$.

05 Venn diagrams & operations

- **Universal set U:** charcha wale saare sets isme (rectangle).
- **Union** $A \cup B = \{x : x \in A$ ya $x \in B\}$.
- **Intersection** $A \cap B = \{x : x \in A$ aur $x \in B\}$. $A \cap B = \varphi$ ho to disjoint.
- **Difference** $A - B = \{x : x \in A, x \notin B\}$.
- Symmetric difference $A \Delta B = (A - B) \cup (B - A)$.



U ke andar do sets ke hisse

LAWS

Commutative: $A \cup B = B \cup A$. Associative: $(A \cup B) \cup C = A \cup (B \cup C)$. Identity: $A \cup \varphi = A$, $A \cap U = A$. Idempotent: $A \cup A = A$. Distributive: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$; $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

06 Complement & De Morgan's laws

$A' = U - A = \{x \in U : x \notin A\}$

$$(A \cup B)' = A' \cap B' \quad (A \cap B)' = A' \cup B'$$

Saath me (A')' = A, A ∪ A' = U, A ∩ A' = φ, U' = φ, φ' = U. A − B = A ∩ B'.

07 Counting formulas

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

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

$n(A - B) = n(A) - n(A \cap B);\ n(A') = n(U) - n(A)$

Sirf $A = n(A) - n(A \cap B) - n(A \cap C) + n(A \cap B \cap C)$

08 JEE Extra + Tricks

JEE LEVEL

- $n(A \cup B \cup C) = \Sigma n(A) - \Sigma n(A \cap B) + n(A \cap B \cap C)$.
- n elements wale set ke subsets = 2^n; proper $2^n - 1$; non-empty proper $2^n - 2$.
- A (m) se B (n) tak relations = 2^{mn}.
- Symmetric difference $A \Delta B = (A - B) \cup (B - A)$; $A - B = A \cap B'$.
- "Sirf A" ka Venn trick: $n(A) - n(A \cap B) - n(A \cap C) + n(A \cap B \cap C)$.

09 Solved examples

Q1. {x : x, 30 ka prime factor hai} ko roster form me likho.

{2, 3, 5}.

Q2. 35 ki class me 24 ko cricket, 16 ko football pasand, har koi kam se kam ek. Dono kitno ko pasand?

$35 = 24 + 16 - x \Rightarrow x =$ **5**.

Q3. A me 3 elements ho to n(P(P(A)))?

$n(P(A)) = 8 \Rightarrow n(P(P(A))) = 2^8 =$ **256**.

Q4. $U = \{1,\ldots,9\}$, $A = \{1,2,3,4\}$, $B = \{2,4,6,8\}$. $(A \cup B)' = A' \cap B'$ verify karo.

$A \cup B = \{1,2,3,4,6,8\} \Rightarrow (A \cup B)' = \{5,7,9\}$. $A' = \{5,6,7,8,9\}$, $B' = \{1,3,5,7,9\} \Rightarrow A' \cap B' = \{5,7,9\}$. ✓

10 Common mistakes

- {φ} ko empty set likhna (isme ek element hai).
- Roster form me element repeat karna ya sochna ki order matter karta.
- Union ki counting me n(A ∩ B) ghatana bhool jaana.
- ∞ ke saath [lagana.
- ∈ (element) aur ⊂ (subset) me confusion: 1 ∈ {1,2} par {1} ⊂ {1,2}.

11 Practice questions

1. Kya {x : x^2 = 4, x odd hai} empty hai?
2. {a, b, c, d} ke proper subsets kitne?
3. (−3, 5] ko set-builder form me likho.
4. n(U) = 50, n(A) = 20, to n(A′)?
5. A ∩ (A ∪ B) simplify karo.

ANSWERS

1) Haan · 2) 15 · 3) {x : x ∈ R, −3 < x ≤ 5} · 4) 30 · 5) A

12 Quick revision: exam se 5 minute pehle

BASICS

- Well-defined collection.
- Roster vs set-builder.
- φ har set ka subset.

COUNTING

- Subsets 2^n, proper 2^n − 1.
- n(A∪B) = n(A)+n(B)−n(A∩B).

OPERATIONS

- A − B = A ∩ B′.
- Distributive laws.

DE MORGAN

- (A∪B)′ = A′∩B′.
- (A∩B)′ = A′∪B′.

Koi doubt? padhaiadda.netlify.app pe AI Doubt Solver se poocho, ya is chapter ka mock test do.