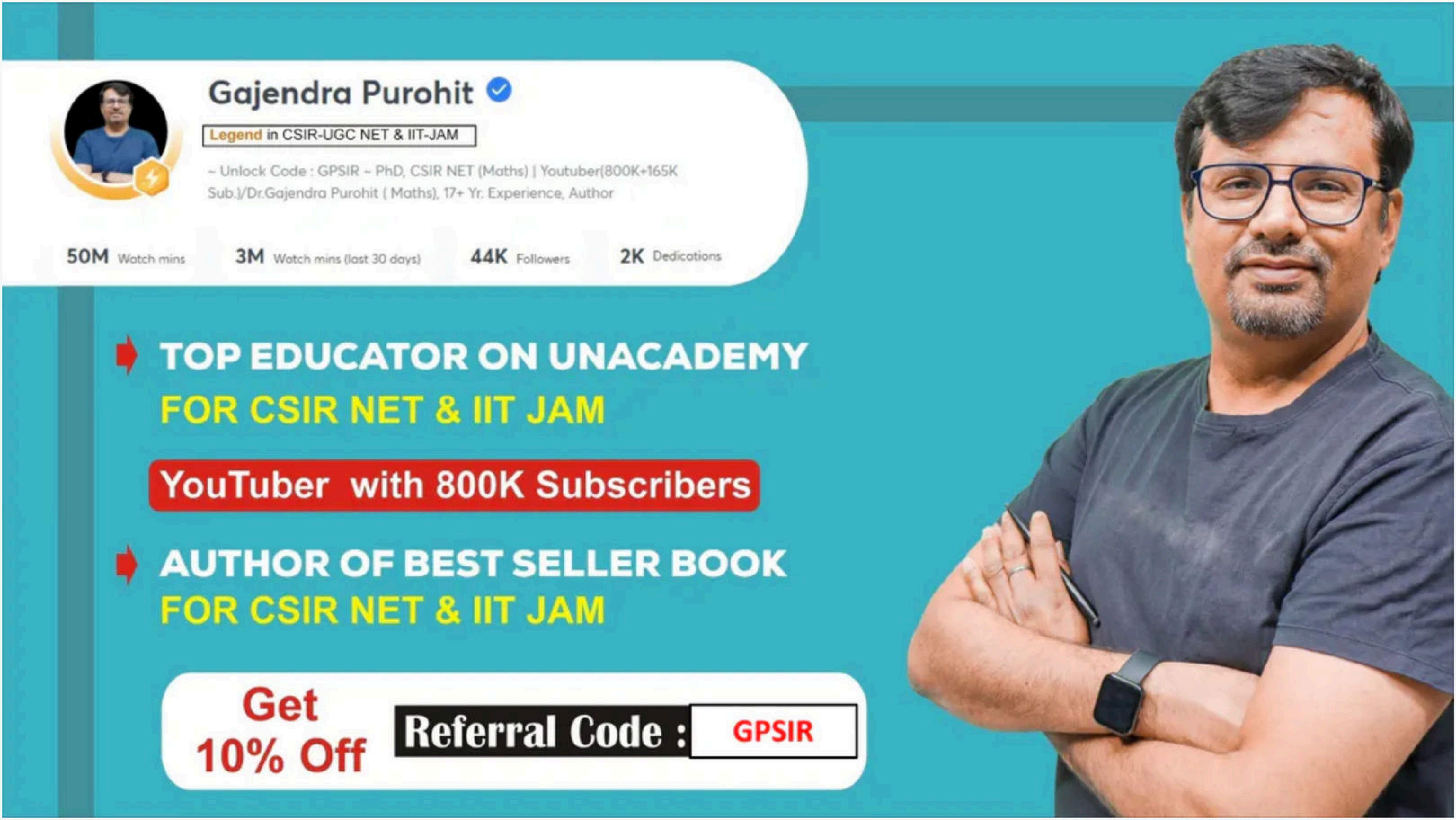

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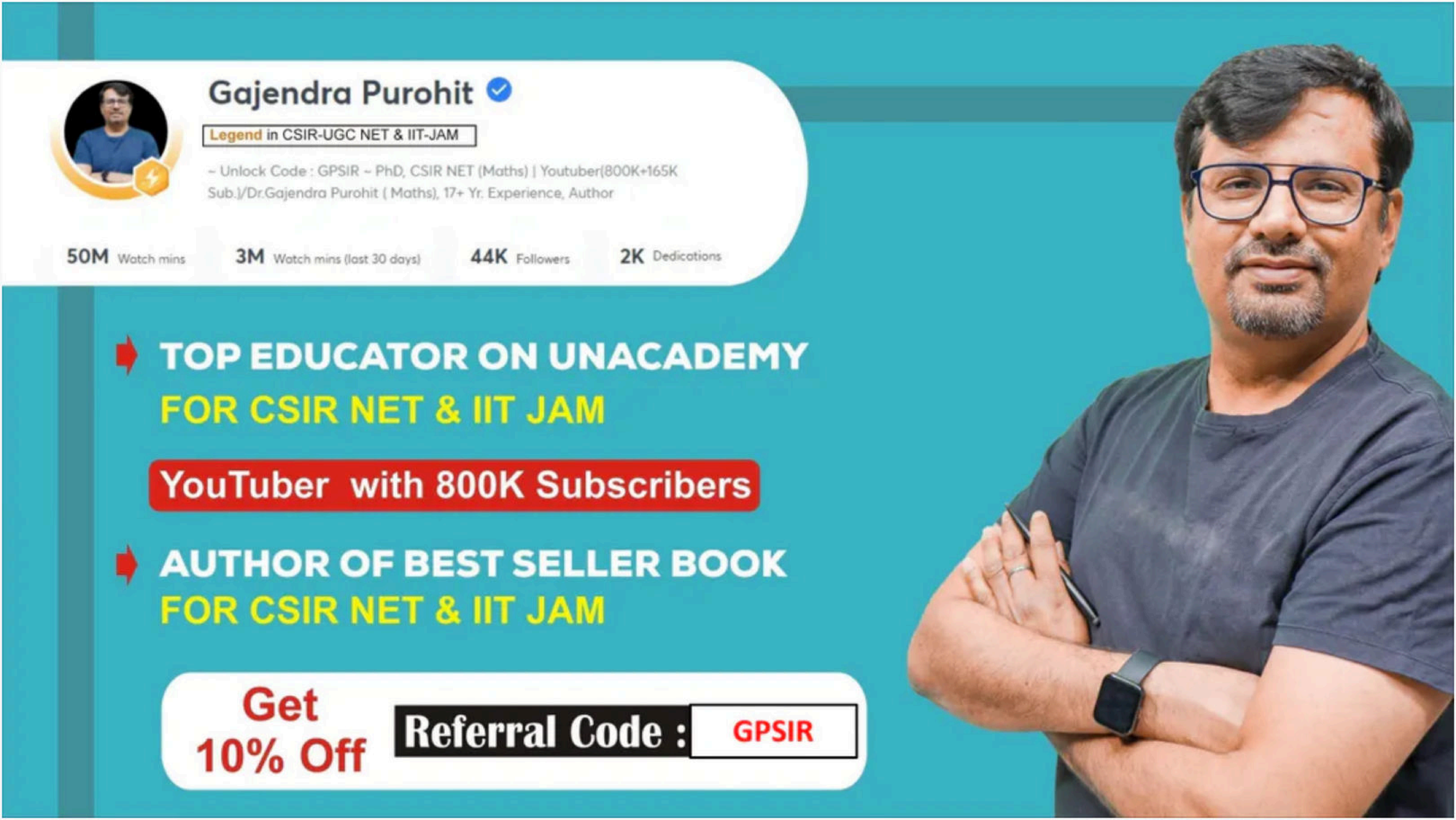

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Definition $\Rightarrow$ A non-empty set G with binary composition $\star$ is said to be group if it satisfy following property

A. Closure property $\Rightarrow a \star b \in G$, $\forall\, a, b \in G$

B. Associative prop. $\Rightarrow a \star (b \star c) = (a \star b) \star c$

$$\forall\, a, b, c \in G$$

C. Identify exist $\Rightarrow a \star e = e \star a = a$

$$\forall\, a \in G$$

D. Inverse exist $\Rightarrow \exists\, b \in G$

$$a \star b = b \star a = e \quad ; \forall\, a \in G$$

The fact that $(G, \star)$ is a group

Ex. 1 (z, +), (Q , +), (R, +), (C, +)

Ex. 2 ($R^\star$, ×), ($Q^\star$, ×)

Where $R^\star = R - \{o\}$ & $Q^\star = Q - \{o\}$

Ex. 3 (Z_m, $\oplus_m$)

Where $Z_m = \{0, 1, 2\ldots m-1\}$

Cyclic group : A group G is called cyclic if ∃ a ∈G s.t.

o (a) = o (G) and such type of a is called generator of G

Ex. Let G = (Z_4, $\oplus_4$)

O (G) = 4

and o (1) = o (3) = 4

so G is cyclic & 1, 3 are two generator

Trick $\Rightarrow$ Number of generator in cyclic group of order m is ϕ (m)

Where ϕ (m) is

If $m = a^p b^q$

Then $\phi(m) = m\left(1-\frac{1}{a}\right)\left(1-\frac{1}{b}\right)$

Ex. Let $G = (Z_4, \oplus_4)$ then Number of generator in G are ϕ (4)

ie. $\phi(4) = \phi(2^2) = 4\left(1-\frac{1}{2}\right) = 4 \times \frac{1}{2} = 2$

Q1. The number of generator at Additive group Z_{36} is equal to

(A) 6 (B) 12

(C) 18 (D) 36

Q2. The number of generator of $(Z_{100}, \oplus_{100})$ is

(A) 40 (B) 9

(C) 41 (D) 100

Trick : Let a be an element of a group G then $O(a) | O(G)$

Ex. $G = (Z_4, \oplus_4)$

$G = \{(0, 1, 2, 3), \oplus_4\}$

Here $o(0) = 1$, $o(1) = 4$, $o(2) = 2$

& $o(3) = 4$

here Number of element of order 4 are $\phi(4) = \phi(2^2) = 2$

& Number of element of order 2 are $\phi(2) = 1$

Trick$\rightarrow$ Number of elements of order 'd' in $(Z_m, \oplus_m)$ are ϕ (d) where $d|m$

Q3. WOTF is possible order of element in $(z_{100}, \oplus_{100})$

(A) 40 (B) 20

(C) 50 (D) 21

Q4. WOTF is/ are not possible order of element of group of order 10

(A) 2 (B) 6

(C) 1 (D) 7

Q5 Number of elements of order 8 in cyclic group are

(A) 6 (B) 4

(C) 2 (D) 8

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Q6. Number of elements of order 15 in cyclic group

(A) 5 (B) 3

(C) 8 (D) Not

★ Let G be a non-abelian group & o (G) = p.q (p <q)

& p & q are prime Then

(a) Number of elements of order q are q -1
(b) Number of elements of order p are (p-1)q

Q7. Let G be a non- abelian group of order 55 then number of element of order 5 & number of element of order 11 are

(A) (2, 3) (B) (44, 10)

(C) (4, 11) (D) Not

Q8. Let G be a non-abelian group of order 21 s.t. p & q are number of element of order 3 & order 7 respectively then p + q are

(A) 3 (B) 14

(C) 6 (D) 20

Q9. Let G be a non-abelian group of order 69, s.t. p & q are number of element of order 23 & 69 then $|q - p|$ is

(A) 22 (B) -22

(C) 69 (D) -69

★ Let G be a group of order p^2 where p is prime.

then G must be abelian group.

Ex. Group of order 4 is always abelian

Q10. WOTF possible order of group s.t. group is abelian

(A) 6 (B) 8

(C) 9 (D) 25


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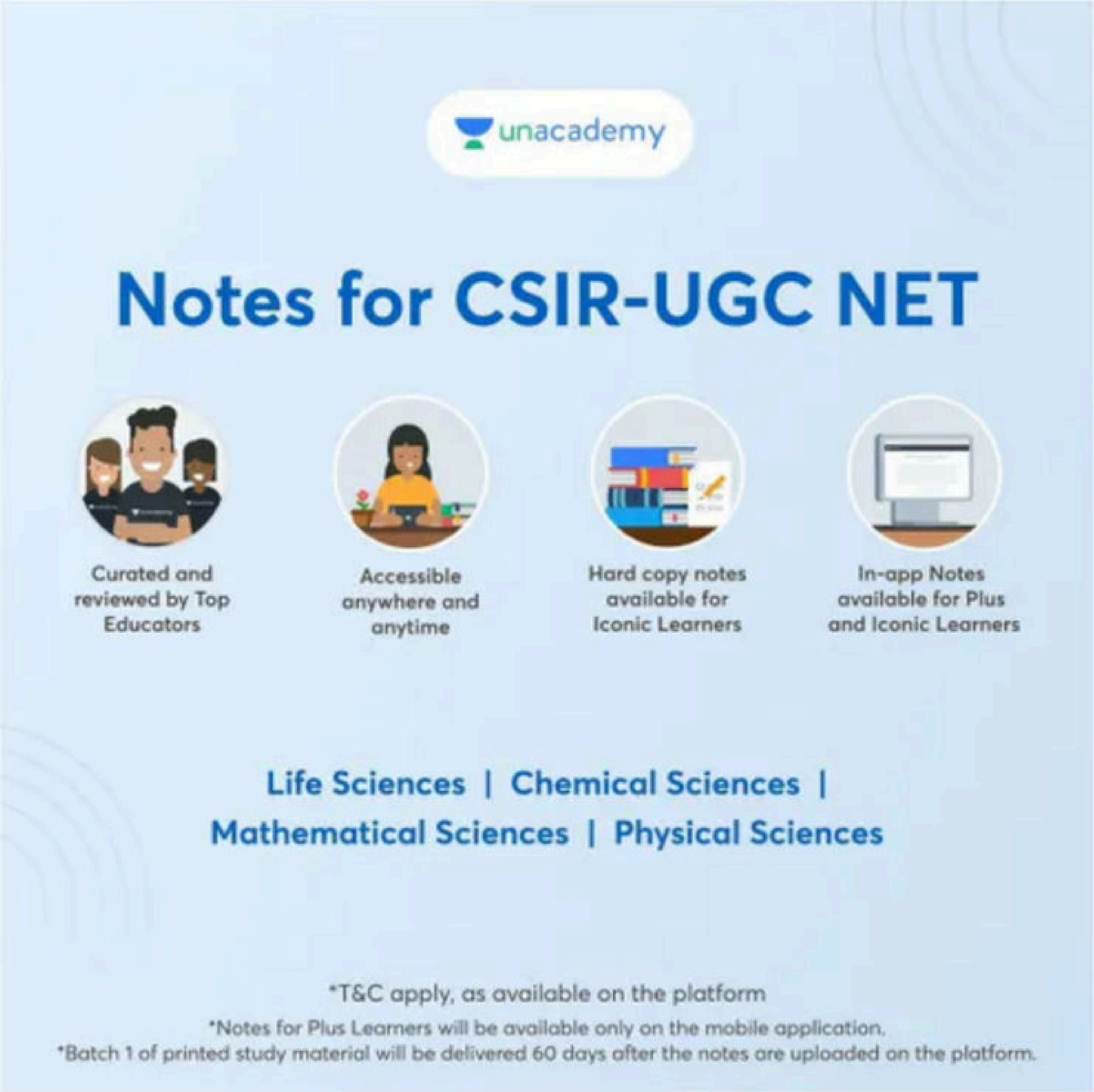
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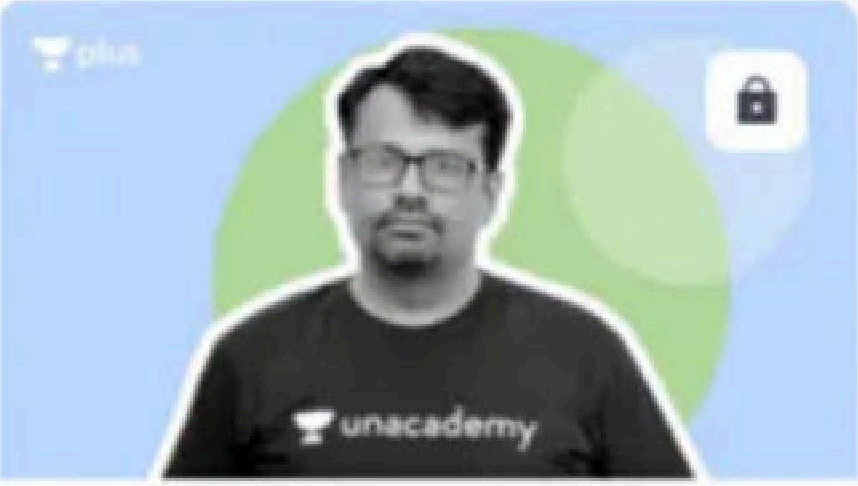

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GROUP OF ORDER 1 TO 12

Q.1. Let G be a group of order 12 then which of the following is true

(a) G is always abelian group

(b) G has always an element of order 6

(c) G has always an elements of order 3

(d) None of these

Q.2. Which of the following is true

(a) G is always abelian group if $O(G) < 6$

(b) G is always cyclic group if $O(G) < 6$

(c) $\exists$ a group of order 9 which is non - abelian

(d) None of these

Q.3. Let G be a group of order 8 then which of the following is always true

(a) G is always abelian

(b) G is always non – abelian group

(c) G has an elements of order 8

(d) None of these

Q.4. Which of the following is true

(a) G is always abelian group if $O(G) = 12$

(b) G is always cyclic group if $O(G) = 11$

(c) Every elements of order 11 in G if $O(G) = 11$

(d) None of these

Result :

(1) If $O(G) = pq$ where $p < q$

(i) If $p \nmid q - 1$ then G is cyclic

(ii) If $p \mid q - 1$ then G may not be abelain group

(2) If G is non – abelian group of order pq where $p < q$ then

(i) G has an elements of order q are $q - 1$

(ii) G has an elements of order p are $q(p - 1)$

(3) If G is abelian group of order pq then G is cyclic group

Q.5. If G is abelian group then Which of the following is true

(a) G is always cyclic group if $O(G) = 14$

(b) G is always cyclic group if $O(G) = 12$

(c) G is always cyclic group if $O(G) = 20$

(d) G is always cyclic group if $O(G) = 21$

Q.6. Which of the following is cyclic group

(a) $O(G) = 14$

(b) if $O(G) = 77$

(c) if $O(G) = 35$

(d) if $O(G) = 21$

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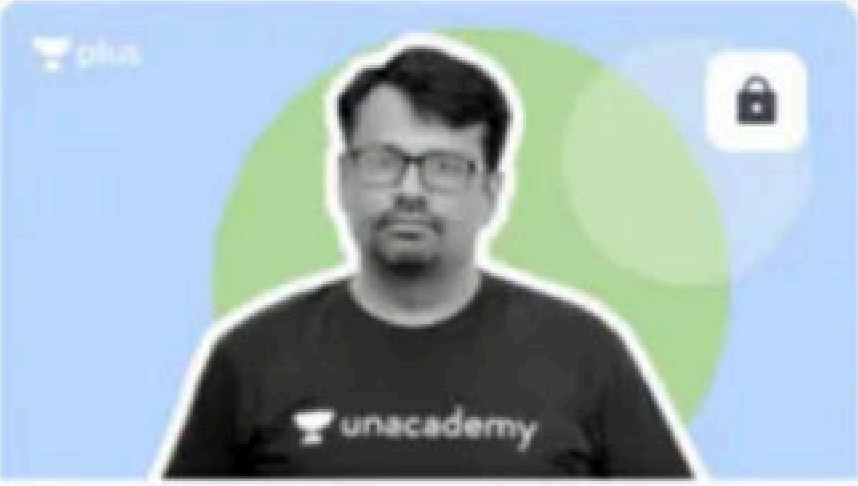

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