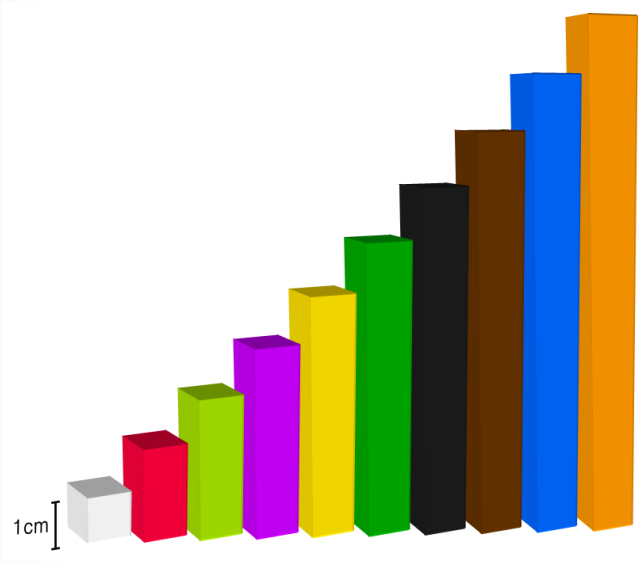
Arithmetic Progression - 1

Sequences & Series

1



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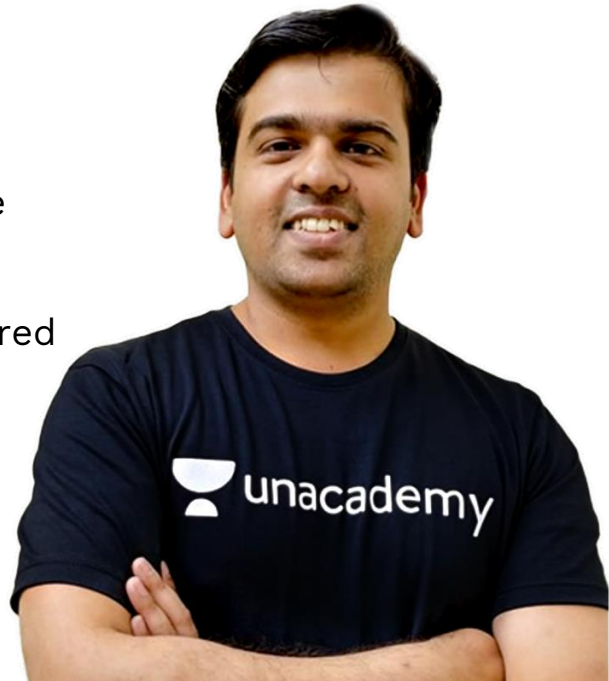
Sameer Chincholikar

B.Tech, M.Tech - IIT-Roorkee

- **10+** years Teaching experience
- Taught **1 Million+** Students
- **100+** Aspiring Teachers Mentored



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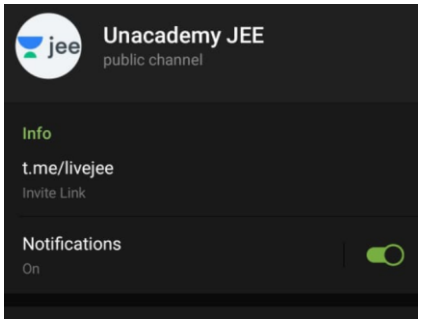

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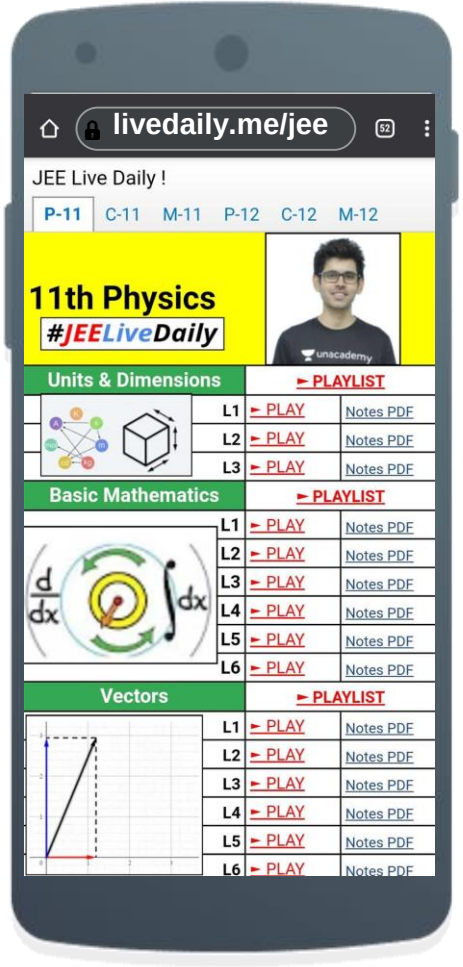

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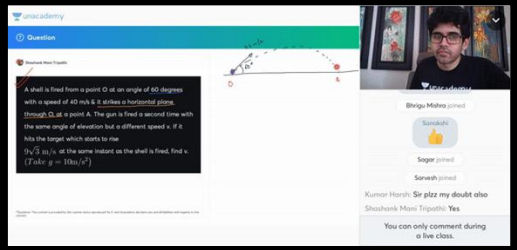

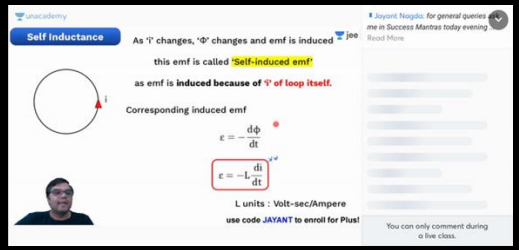

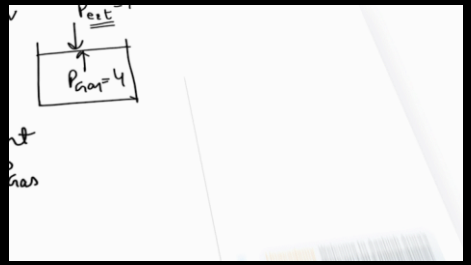

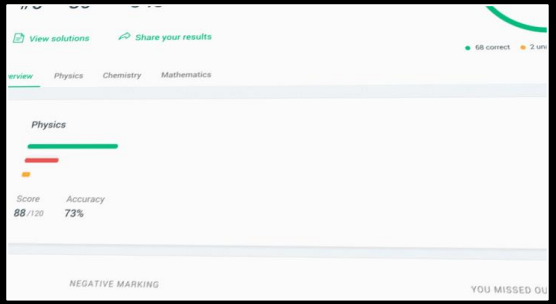

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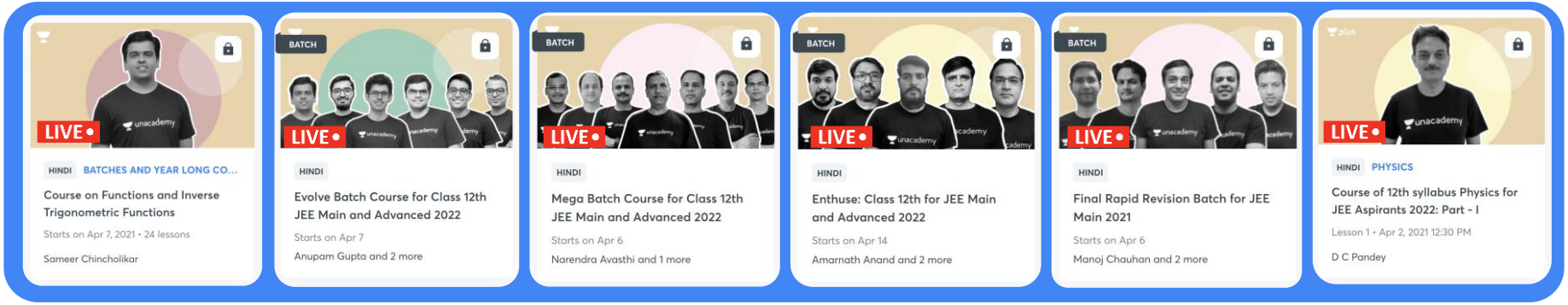

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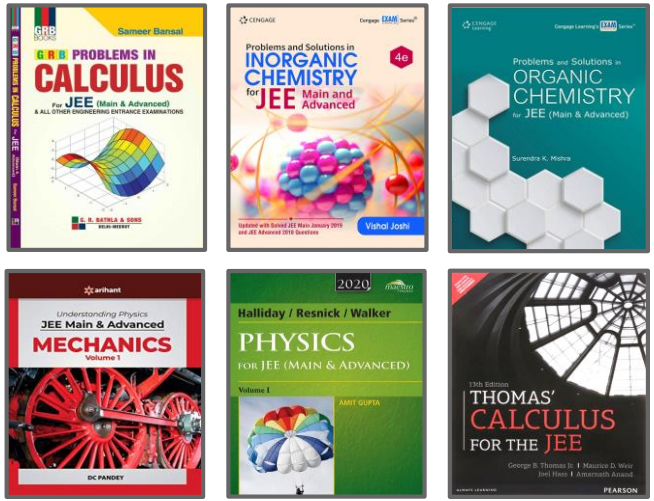

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100 %ile

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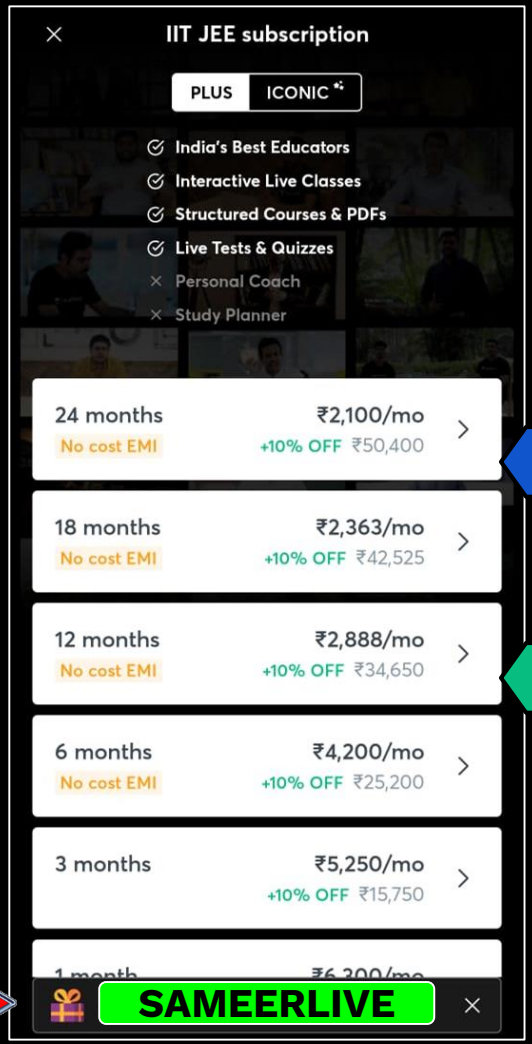

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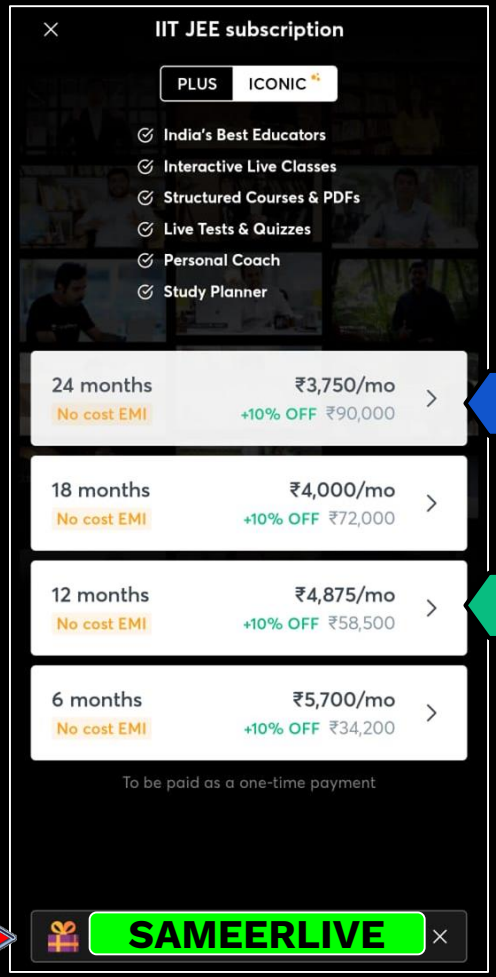

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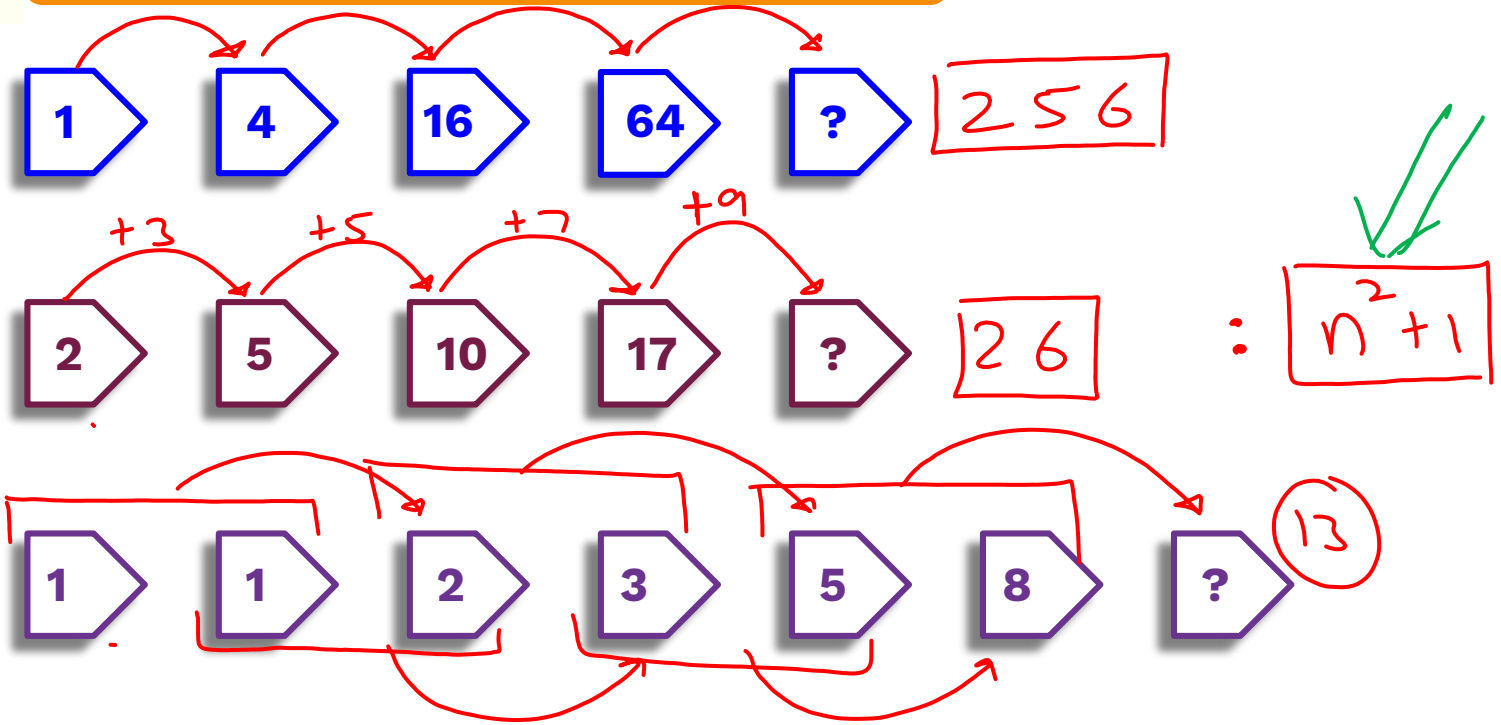
LET'S BEGIN!!

Sequences & Series

Can you find the next number?



Arithmetic Progression

Arithmetic Progression (A.P.)

AP is a sequence whose terms increase or decrease by a fixed number. This fixed number is called the common difference.

Eg: 1, 4, 7, 10, 13.....

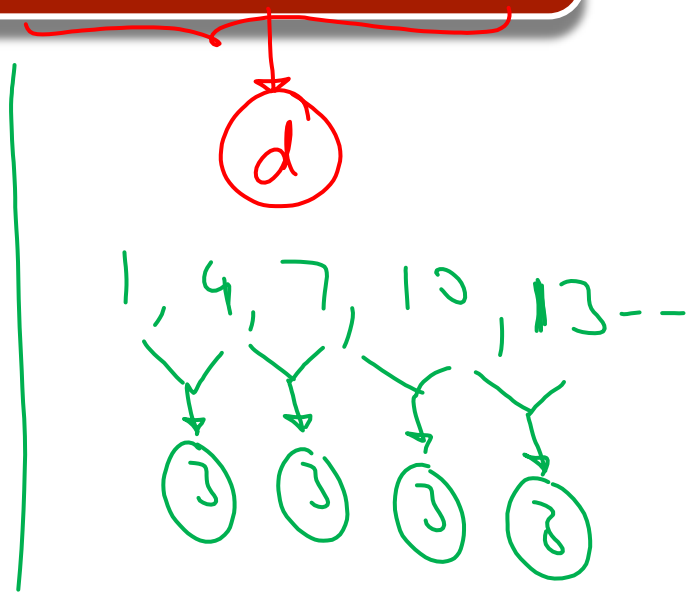
$d = 3$

Eg: 4, 2, 0, -2, -4, ...

$d = -2$

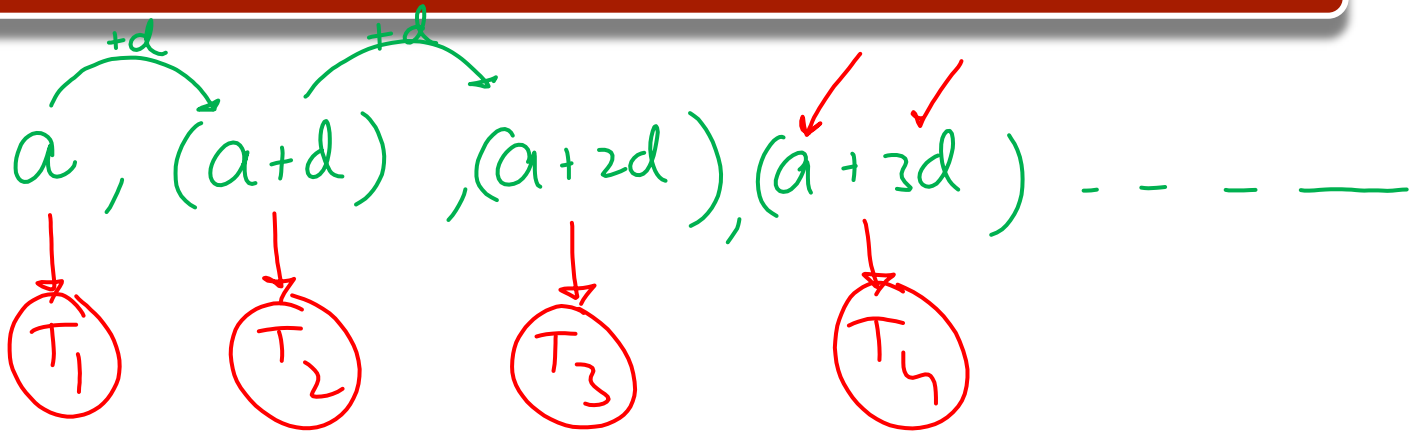
Eg: 3, 3, 3, 3, 3.....

$d = 0$



General term of A.P.

If **a** is the first term and **d** the common difference, of AP



$$T_n = a + (n-1)d$$

If 9 times the 9^{th} term of an AP is equal to 13 times the 13^{th} term, then the 22^{nd} term of the AP is

A. 0 B. 22 C. 198 D. 220

$$9(T_9) = 13(T_{13})$$

$$\Rightarrow 9(a+8d) = 13(a+12d)$$

$$\Rightarrow 9a+72d = 13a+156d$$

$$\Rightarrow \boxed{4a+84d=0}$$

$$a + 21d = 0 \quad \text{— (1)}$$

Now.

$$T_{22} = a + (22-1)d$$

$$= a + 21d$$

$$= 0$$

Find the number of terms in the sequence 4, 12, 20, ... 108

A. 12 B. 13 C. 14 D. 15

4, 12, 20, ----, 108

$a = 4$; $d = 8$

$T_n = a + (n-1)d$

$108 = 4 + (n-1)8$

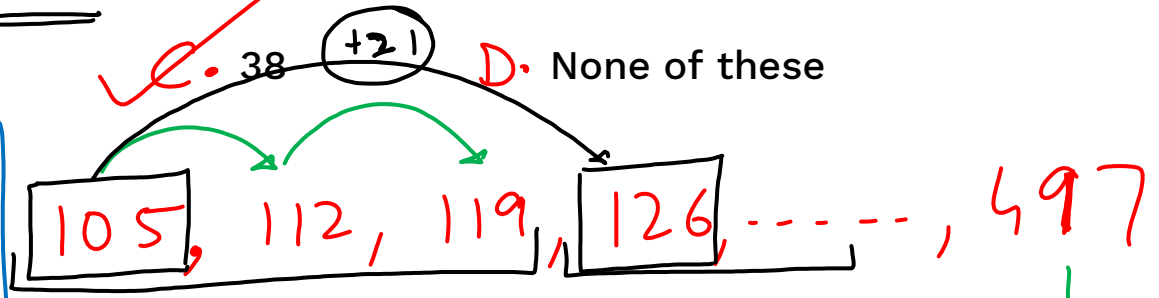
$\frac{104}{8} = (n-1)$

$13 + 1 = n$

$n = 14$

The number of numbers lying between 100 and 500 that are divisible by 7 but not by 21 is

A. 57 B. 19 C. 38 D. None of these



$$7 \overline{)100} \quad 14, \quad 7, \quad 30, \quad 28, \quad 2 \ (+5)$$

$$7 \overline{)500} \quad 71, \quad 49, \quad 10, \quad 7, \quad 3$$

$21 = 7 \times 3$

$T_n = a + (n-1)d$

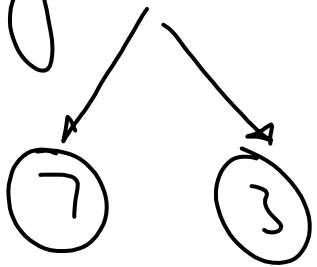
$497 = 105 + (n-1)7$

$\frac{392}{7} + 1 = n$

$\Rightarrow n = 56 + 1$

$\boxed{n = 57}$

Now. nos divisible by 21 also:



$= \frac{1}{3}(57) = 19$

. (Required Count)

$= 57 - 19$

$= 38$

If $a_1, a_2, a_3, \ldots, a_n$ are in A.P., where $a_i > 0$ for all i, then

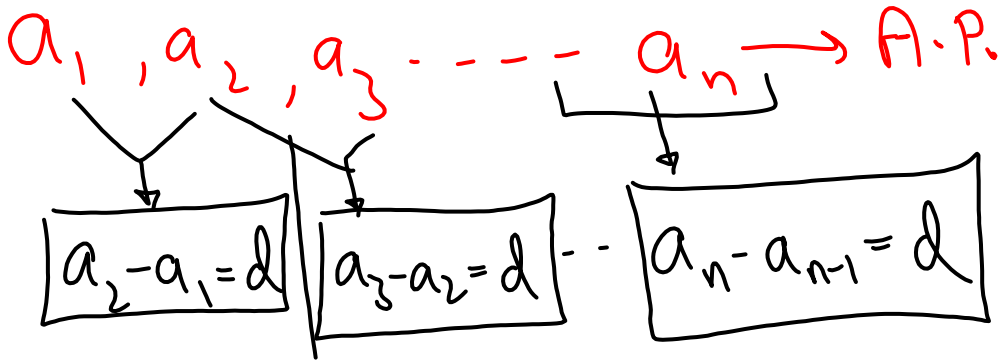
$$\frac{1}{\sqrt{a_1}+\sqrt{a_2}}+\frac{1}{\sqrt{a_2}+\sqrt{a_3}}+\ldots+\frac{1}{\sqrt{a_{n-1}}+\sqrt{a_n}}=$$

A. $\frac{n-1}{\sqrt{a_1}+\sqrt{a_n}}$

B. $\frac{n-3}{\sqrt{a_1}+\sqrt{a_n}}$

C. $\frac{n}{\sqrt{a_1}+\sqrt{a_n}}$

D. None of these



$$= \frac{(\sqrt{a_1} - \sqrt{a_2})}{(\sqrt{a_1} + \sqrt{a_2})(\sqrt{a_1} - \sqrt{a_2})} + \frac{(\sqrt{a_2} - \sqrt{a_3})}{(a_2 - a_3)}$$

$$= \left(\frac{\sqrt{a_1} - \sqrt{a_2}}{a_1 - a_2}\right) + \left(\frac{\sqrt{a_2} - \sqrt{a_3}}{-d}\right) + \cdots$$

$$= \frac{\sqrt{a_1} - \sqrt{a_2}}{(-d)}$$

$a_n = a_1 + (n-1)d$

$\frac{a_n - a_1}{d} = (n-1)$; $\frac{a_1 - a_n}{(-d)} = (n-1)$

Now.

$$= \frac{\sqrt{a_1}-\sqrt{a_2}}{-d} + \frac{\sqrt{a_2}-\sqrt{a_3}}{-d} + \cdots + \frac{\sqrt{a_{n-1}}-\sqrt{a_n}}{-d}$$

$$= \left(\frac{1}{-d}\right)\left[\sqrt{a_1}-\sqrt{a_2}+\sqrt{a_2}-\sqrt{a_3}+\cdots+\sqrt{a_{n-1}}-\sqrt{a_n}\right]$$

$$= \left(\frac{1}{-d}\right)\left[\sqrt{a_1}-\sqrt{a_n}\right] \rightarrow \left(\frac{1}{-d}\right)\left(\frac{a_1-a_n}{\sqrt{a_1}+\sqrt{a_n}}\right) \rightarrow \left(\frac{(n-1)}{\sqrt{a_1}+\sqrt{a_n}}\right)$$

The number of terms common to two A.P.s 3, 7, 11, ..., 407 and 2, 9, 16, ..., 709 is

A. 12 B. 13 C. 14 D. 15

$d_1 = 4$: 3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43, 47, 51, 55, ----

$d_2 = 7$: 2, 9, 16, 23, 30, 37, 44, 51, 58, ------

Common term ka A.P : $d = L.(M.(d_1, d_2))$

Now.

$23, 51, \dots\dots T_n$

$T_n < 407$

$23 + (n-1)28 < 407$

$(n-1) < \frac{384}{28}$

$(n-1) < \frac{96}{7}$

$n-1 < 13.\dots\dots$

$n < 14.\dots\dots$

$\therefore n = 14$

Sum of n terms of A.P.

$$S_n = (a) + (a+d) + (a+2d) + \cdots + (a+(n-1)d)$$

$$S_n = (a+(n-1)d) + (a+(n-2)d) + \cdots + a$$

$$2S_n = [2a+(n-1)d] + [2a+(n-1)d] + \cdots + [2a+(n-1)d]$$

$$2S_n = n[2a+(n-1)d]$$

$$S_n = \frac{n}{2}\left(2a + (n-1)d\right)$$

$$S_n = \frac{n}{2}\left(a + a + (n-1)d\right)$$

$$S_n = \frac{n}{2}\left(a + l\right)$$

The sum of all two digit numbers which when divided by 4, yield unity as remainder, is

A. 1100 B. 1200 C. 1210 D. None of these

one

13, 17, 21, ----- , 97

$a = 13$, $d = 4$; $T_n = 97$

$T_n = 13 + (n-1)4 = 97$

$(n-1) = \frac{84}{4}$

$\rightarrow n = 22$

$S_{22} = \frac{22}{2}(13 + 97)$

$= 11(110) = 1210$

The S_n denote the sum of the first n terms of an AP, if $S_{2n} = 3S_n$, then $S_{3n} : S_n$ is equal to

A. 4 B. 6 C. 8 D. 10

$$S_{2n} = 3S_n$$

$$\left(\frac{2n}{2}\right)(2a+(2n-1)d) = 3\left(\frac{n}{2}\right)(2a+(n-1)d)$$

$$4a + 4nd - 2d = 6a + 3nd - 3d$$

$$\Rightarrow 2a - nd - d = 0 \Rightarrow \boxed{(2a-d) = nd} \quad -(1)$$

Now.

$$\frac{S_{3n}}{S_n} = \frac{\left(\frac{3n}{2}\right)\left(2a+(3n-1)d\right)}{\left(\frac{n}{2}\right)\left(2a+(n-1)d\right)}$$

$$= \frac{3\left((2a-d)+3nd\right)}{\left((2a-d)+nd\right)}$$

using Eq^{n}.

$$\frac{3(nd+3nd)}{(nd+nd)}$$

$$= 6$$

If the sum of first n terms of two A.P.'s are in the ratio **3n + 8 : 7n + 15**, then the ratio of their **12th term** is

A. 8 : 7 B. 7 : 16 C. 74 : 169 D. 13 : 47

$$\begin{cases} 1^{st}\ AP: & a_1, d_1, (S_n)_1 \\ 2^{nd}\ AP: & a_2, d_2, (S_n)_2 \end{cases}$$

$$\frac{(S_n)_1}{(S_n)_2} = \frac{\left(\frac{n}{2}\right)(2a_1 + (n-1)d_1)}{\left(\frac{n}{2}\right)(2a_2 + (n-1)d_2)} = \left(\frac{3n+8}{7n+15}\right) \quad \text{---(1)}$$

Now:

$$\frac{(T_{12})_1}{(T_{12})_2} = \left(\frac{a_1 + 11d_1}{a_2 + 11d_2}\right)$$

Using eq^n (1):

$$\frac{a_1 + \left(\frac{n-1}{2}\right)d_1}{a_2 + \left(\frac{n-1}{2}\right)d_2} = \left(\frac{3n+8}{7n+15}\right)$$

$$n = 23$$

$$\Rightarrow \frac{a_1 + 11d_1}{a_2 + 11d_2} = \frac{3 \times 23 + 8}{7 \times 23 + 15}$$

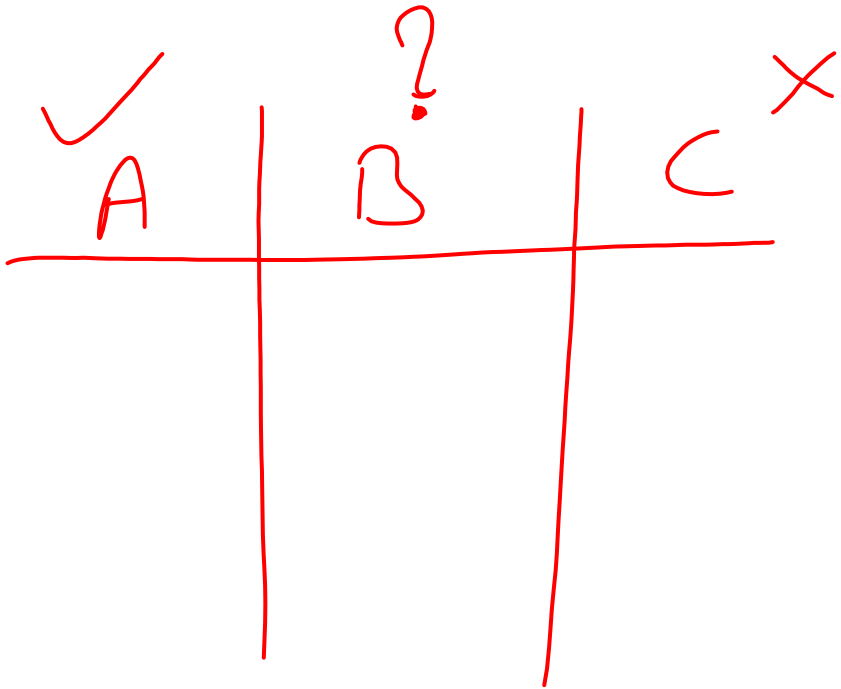
$$= \frac{69 + 8}{161 + 15}$$

$$= \frac{77}{176} = \frac{7}{16}$$

The sum of integers from 1 to 100 that are divisible by 2 or 5 is

A. 2150 B. 3050 C. 2500 D. None of these

HW-1


A
B
C

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11th

Namo Sir | Physics

6:00 - 7:30 PM

Ashwani Sir | Chemistry

7:30 - 9:00 PM

Sameer Sir | Maths

9:00 - 10:30 PM

12th

Jayant Sir | Physics

1:30 - 3:00 PM

Anupam Sir | Chemistry

3:00 - 4:30 PM

Nishant Sir | Maths

4:30 - 6:00 PM

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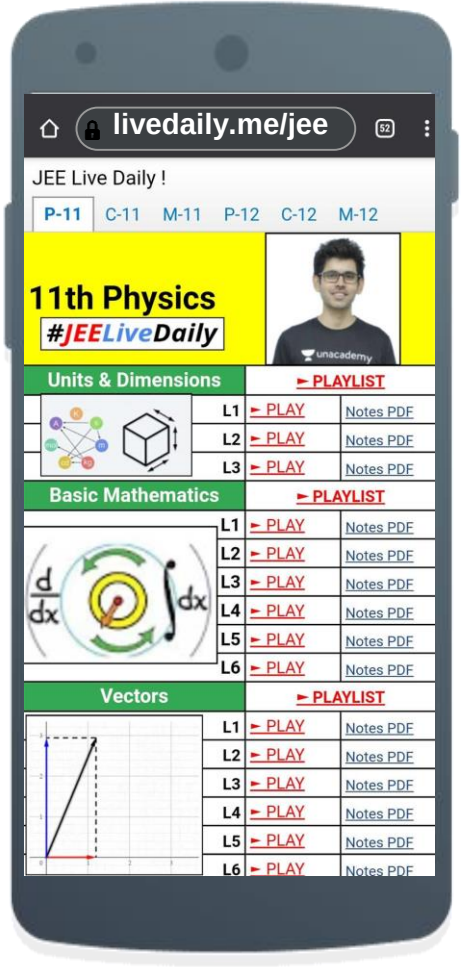

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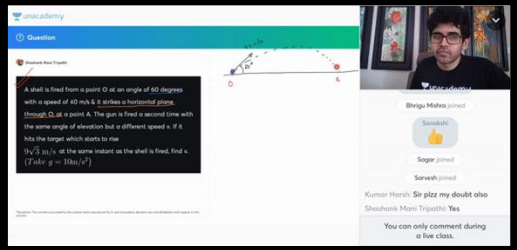

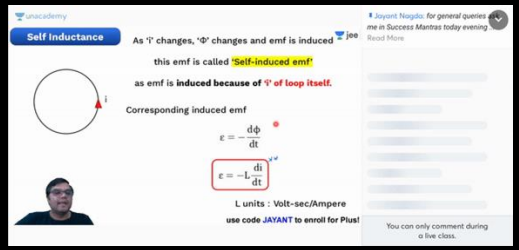

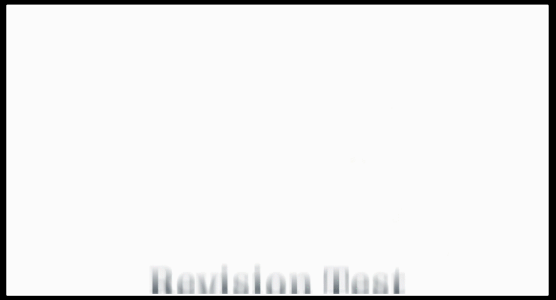

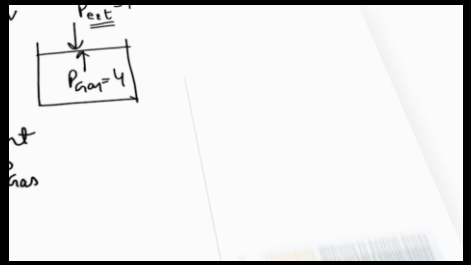

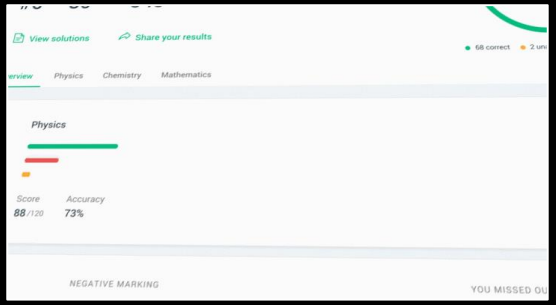

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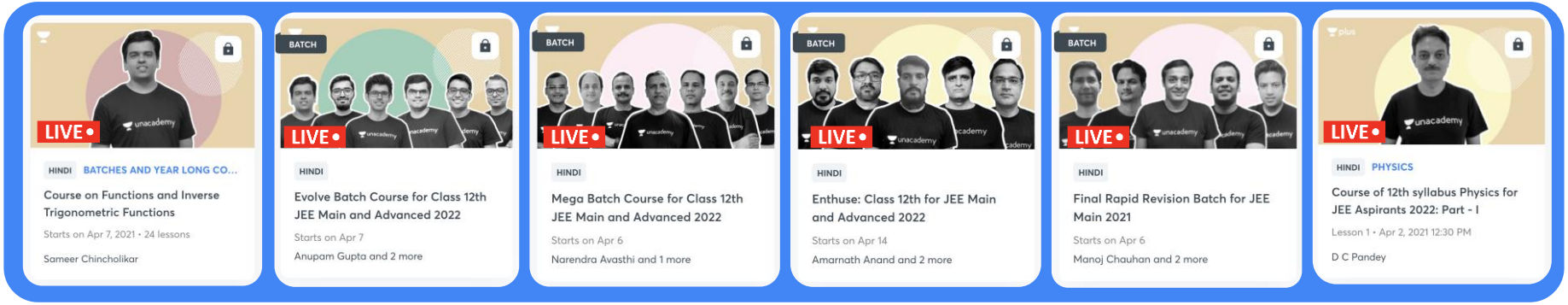

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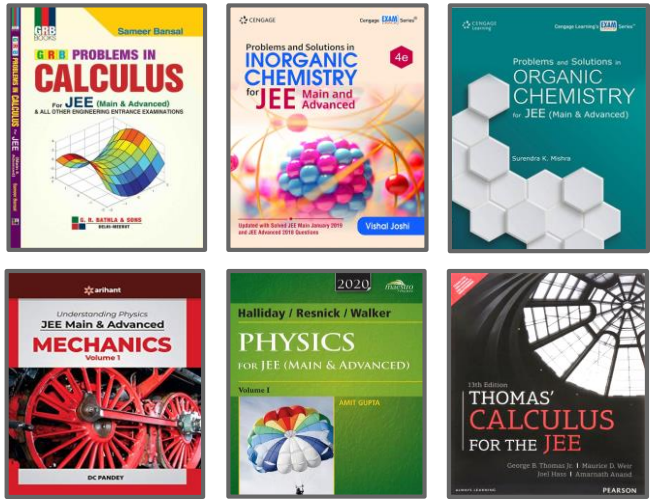

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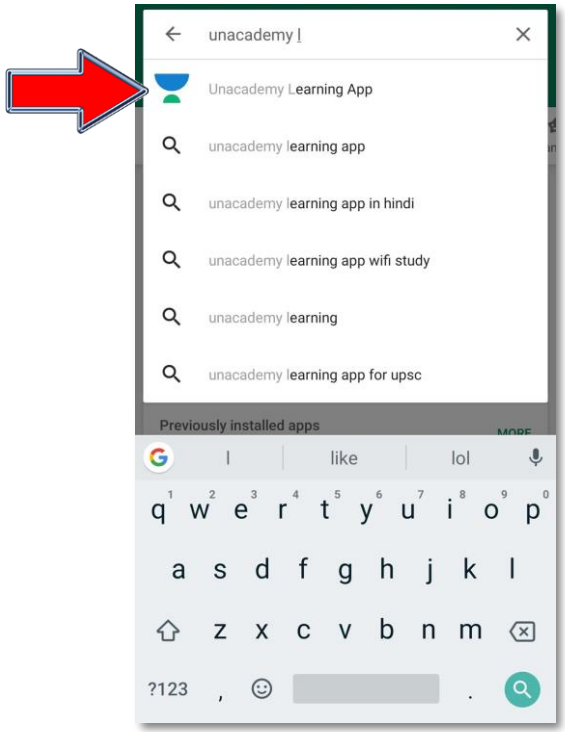
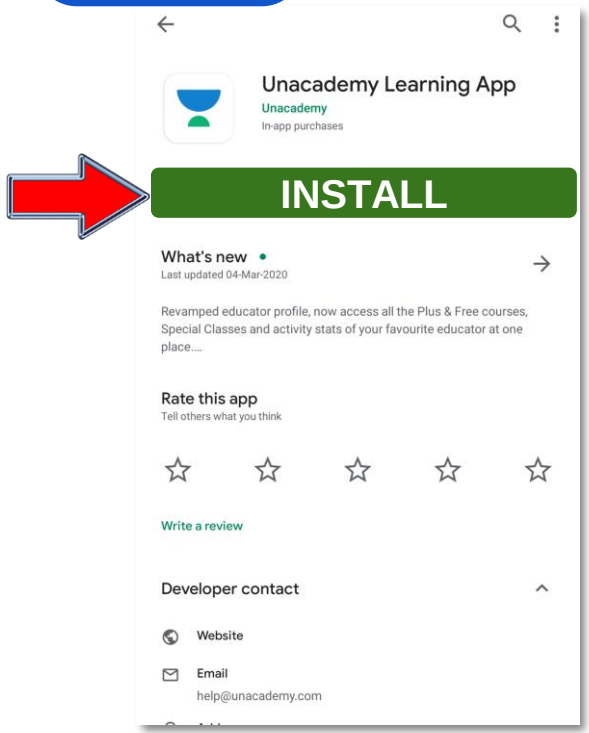
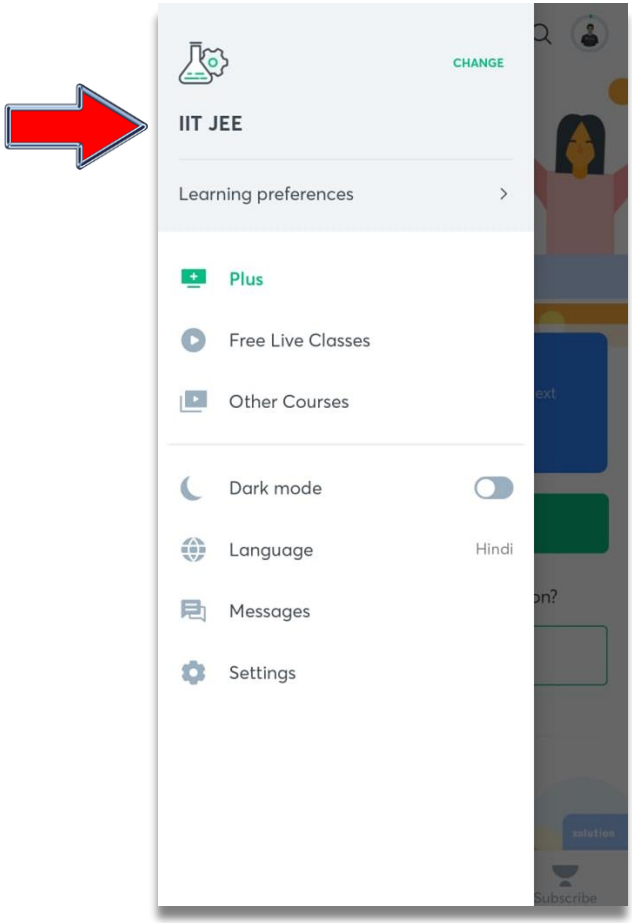
Step 1



Step 2

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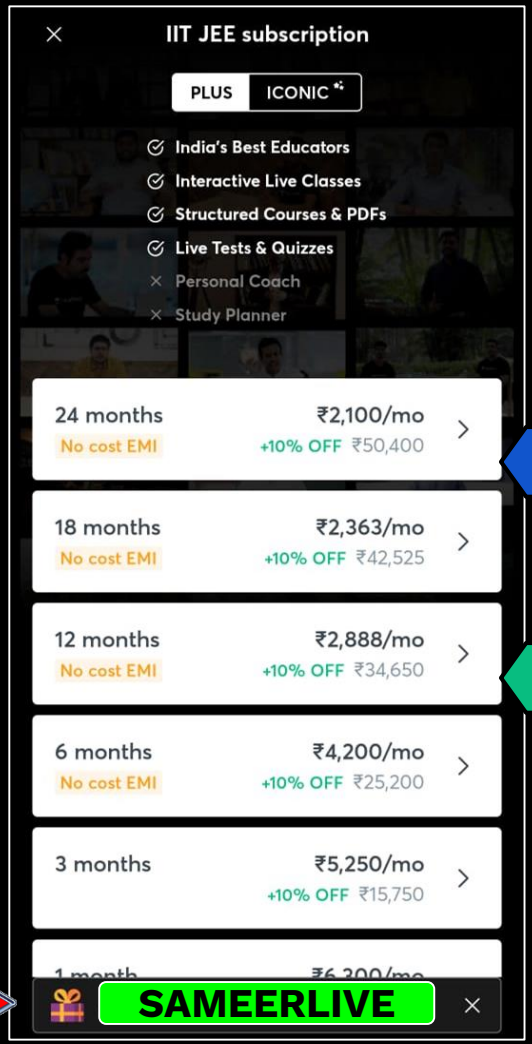

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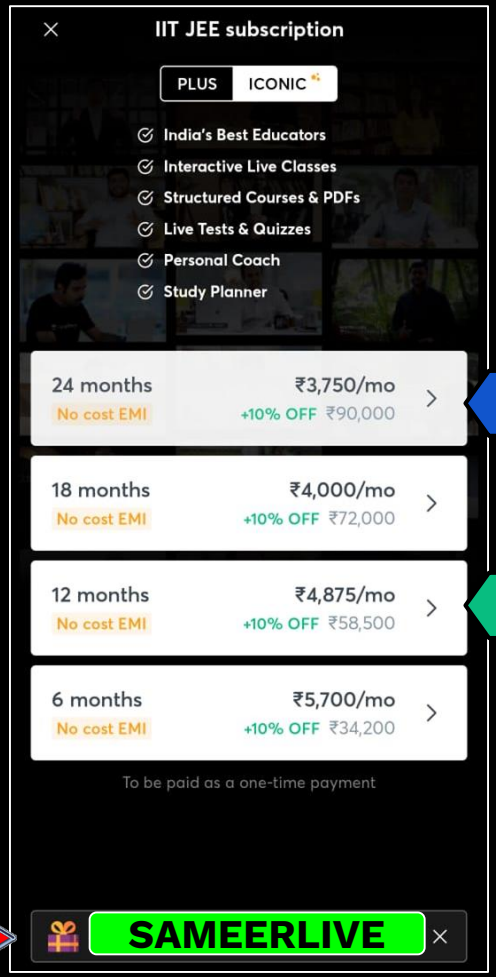

11th / 9, 10

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Test Series 2022

Test Series 2023

9th & 23rd June | 9 AM to 12 PM

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