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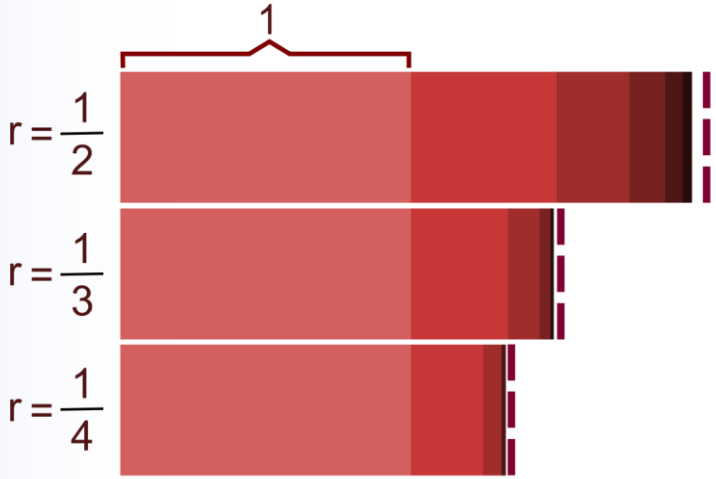
A.M, G.M and H.M.

Sequences & Series 6



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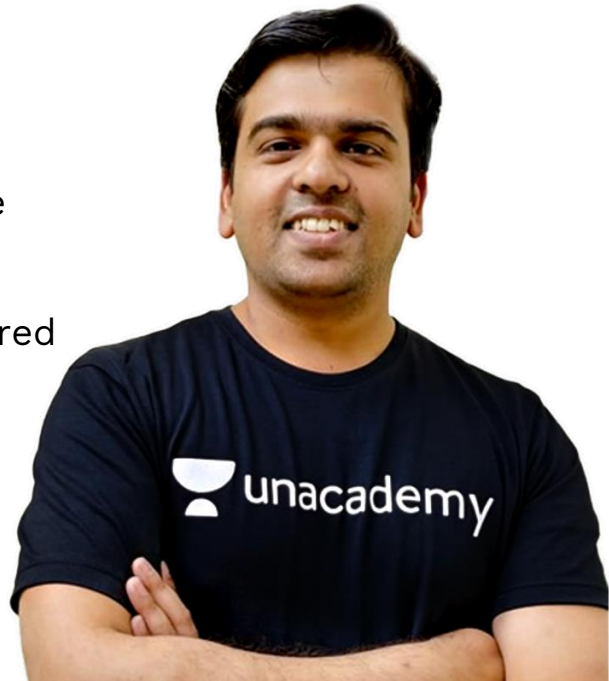
Sameer Chincholikar

B.Tech, M.Tech - IIT-Roorkee

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



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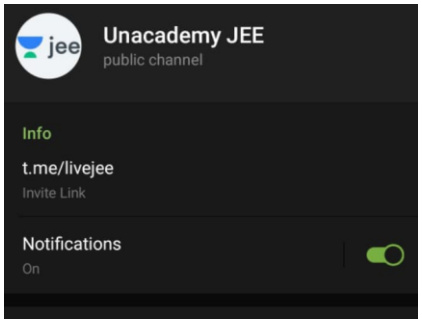
Telegram Channel



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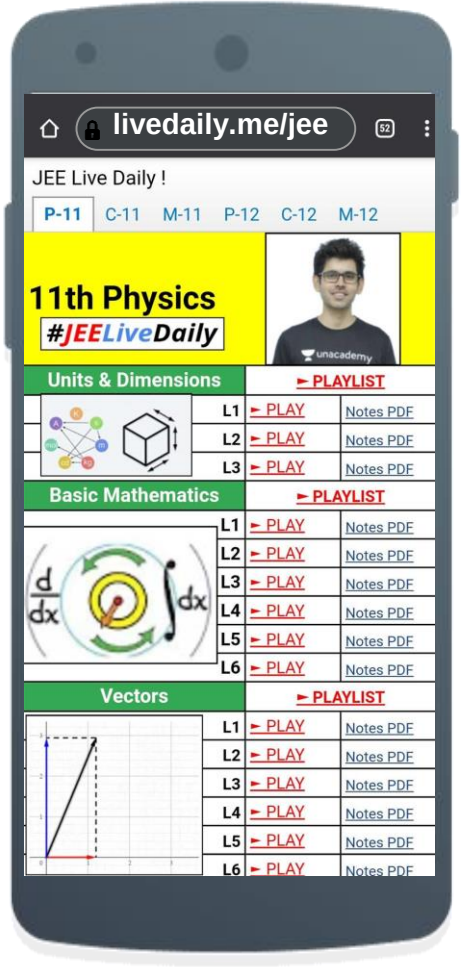

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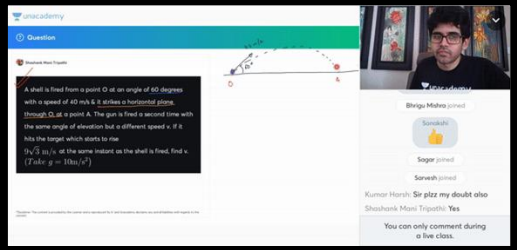

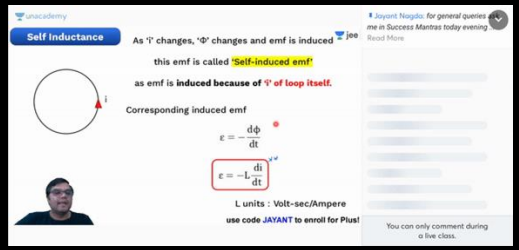

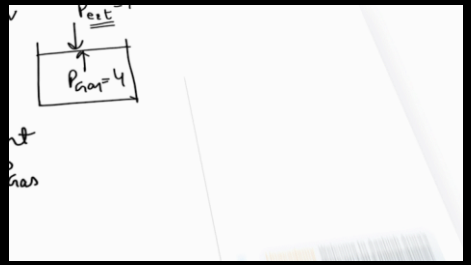

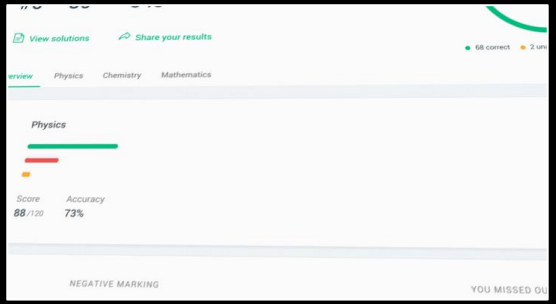

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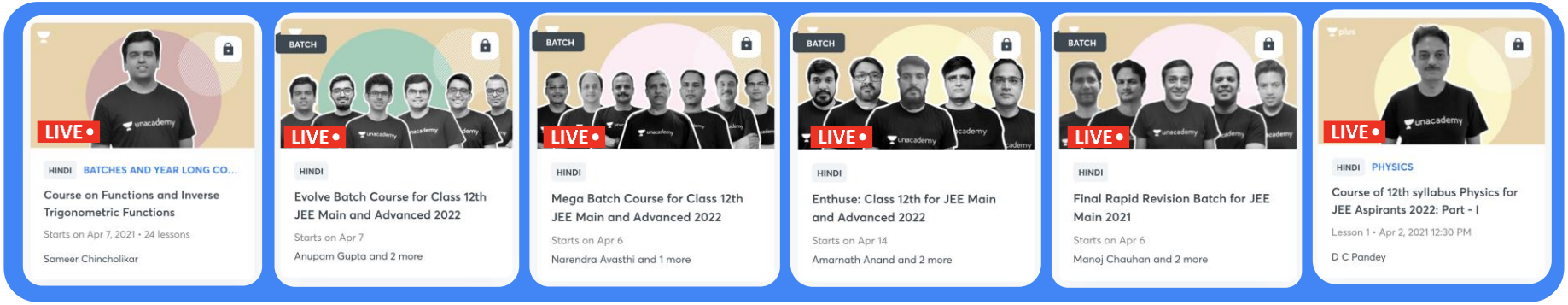
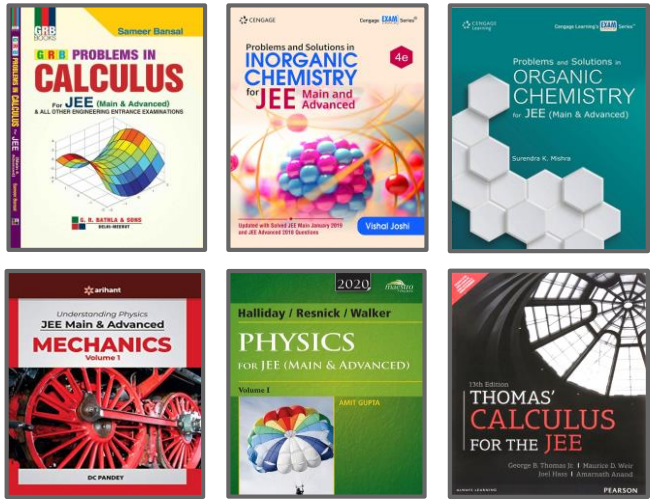


If you want to be the **BEST**
"Learn" from the **BEST**



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Top Results

Bratin Mondal

100 %ile

Amaiya Singhal
99.97

Adnan
99.95

Ashwin Prasanth
99.94

Tanmay Jain
99.86

Kunal Lalwani
99.81

Utsav Dhanuka
99.75

Aravindan K Sundaram
99.69

Manas Pandey
99.69

Mihir Agarwal
99.63

Akshat Tiwari
99.60

Sarthak Kalankar
99.59

Vaishnovi Arun
99.58

Devashish Tripathi
99.52

Maroof
99.50

Tarun Gupta
99.50

Siddharth Kaushik
99.48

Mihir Kothari
99.39

Sahil
99.38

Vaibhav Dhanuka
99.34

Pratham Kadam
99.29

Shivam Gupta
99.46

Shrish
99.28

Yash Bhaskar
99.10

Subhash Patel
99.02

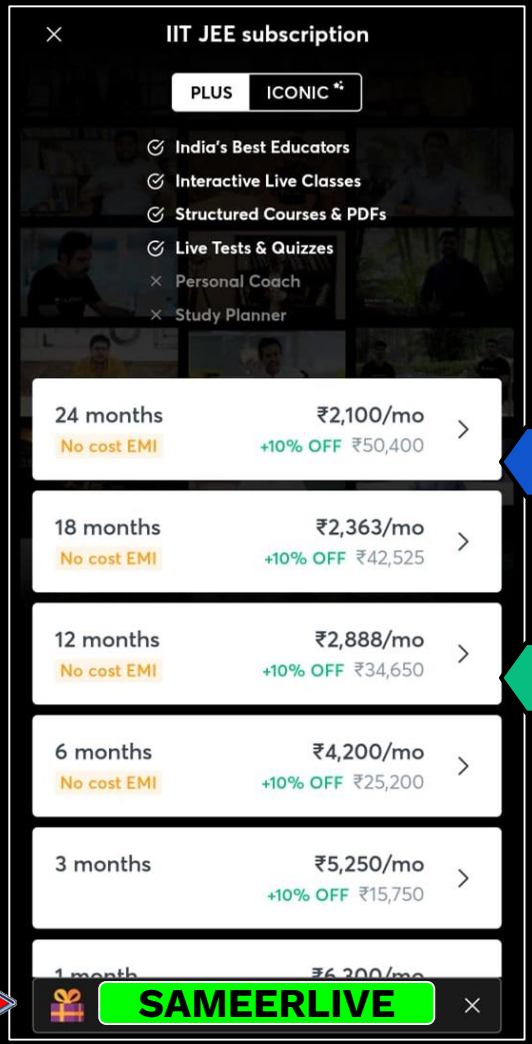
Ayush Kale
98.85

Ayush Gupta
98.67

Megh Gupta
98.59

Naman Goyal
98.48

MIHIR PRAJAPATI
98.16



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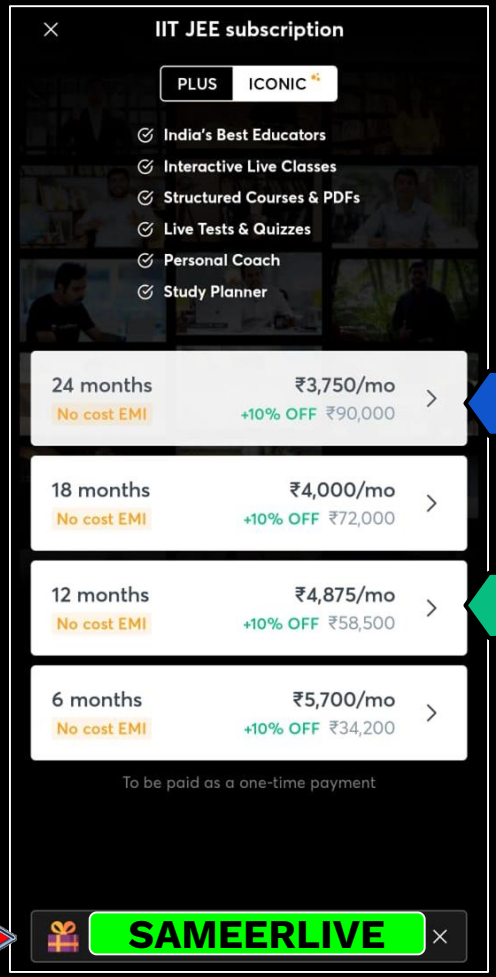
11th / 9, 10

12th / Drop



11th / 9, 10

12th / Drop

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LET'S BEGIN!!

Homework Question

If a, b and c are distinct numbers in A.P. and a^2, b^2 and c^2 are in H.P. then which of the following is/are true:

A. a, -b/2 , c are in G.P.

B. a, 2b , c are in G.P.

C. a, b , -c/2 are in G.P.

D. a, b , 2c are in G.P.

$2b = a + c$

&

$(b - a) = (c - b)$

$a^2, b^2, c^2 \longrightarrow$ H.P.

$\Rightarrow \frac{1}{a^2}, \frac{1}{b^2}, \frac{1}{c^2} \longrightarrow$ A.P.

$$\frac{1}{b^2} - \frac{1}{a^2} = \frac{1}{c^2} - \frac{1}{b^2}$$

$$\frac{a^2 - b^2}{a^2 b^2} = \frac{b^2 - c^2}{b^2 c^2}$$

$$\frac{(a-b)(a+b)}{a^2} = \frac{(b-c)(b+c)}{c^2}$$

$$ac^2 + bc^2 = a^2 b + a^2 c$$

$$\Rightarrow ac(c-a) = b(a^2 - c^2)$$

$$\Rightarrow -ac(a-c) = b(a-c)(a+c)$$

$$\Rightarrow -ac = ab + bc$$

$$\Rightarrow \boxed{ab + bc + ca = 0}$$

$b(a+c) + ac = 0$

$b(2b) + ac = 0$

$b^2 = -\frac{ac}{2}$

$b^2 = (a)\left(-\frac{c}{2}\right)$ → $a, b, -\frac{c}{2}$ → G.P

A.M., G.M. & H.M.
of two numbers

Definition and Understanding

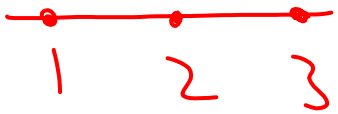
Arithmetic Mean

$a, A, b \longrightarrow$ A.P.

$$A = \frac{a+b}{2}$$

$$2A = a+b$$

$$A = \frac{a+b}{2}$$



Definition and Understanding

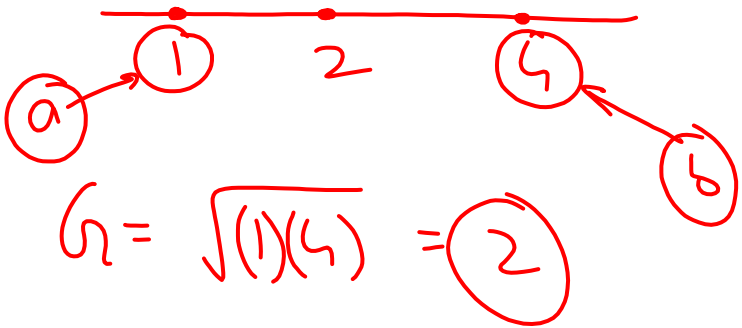
Geometric Mean for positive numbers:

$a, G, b \rightarrow$ G.P.

$$G^2 = a \cdot b$$

$$\boxed{G = \sqrt{ab}}$$

Eg:



$$G = \sqrt{(1)(4)} = 2$$

Definition and Understanding

Geometric Mean for negative numbers:

$a, G_1, b \longrightarrow$ GP

$G_1^2 = ab$

$$\boxed{G_1 = -\sqrt{ab}}$$

Eg:

$G_1^2 = (-9)(-1) = 9$

$G_1 = -3$

Definition and Understanding

Harmonic Mean

$a, H, b \rightarrow$ HP.

$\Rightarrow \frac{1}{a}, \frac{1}{H}, \frac{1}{b} \rightarrow$ AP

$$2\left(\frac{1}{H}\right) = \left(\frac{1}{a} + \frac{1}{b}\right)$$

$$\frac{2}{H} = \left(\frac{1}{a} + \frac{1}{b}\right)$$

$$H = \frac{2}{\left(\frac{1}{a} + \frac{1}{b}\right)}$$

$$H = \frac{2ab}{a+b}$$

Important Result:

For two numbers a and b if ***A, G*** *and* ***H*** are **AM, GM** and **HM** then **$G^2 = AH$.**

$$A = \frac{a+b}{2}, \quad H = \frac{2ab}{a+b}$$

$$G = \sqrt{ab} \rightarrow G^2 = ab$$

The harmonic mean of the roots of the equation

$(5+\sqrt{2})x^2-(4+\sqrt{5})x+8+2\sqrt{5}=0$ is (α,β)

A. 2 **B.** 3 **C.** 4 **D.** 5

$$\alpha+\beta=\left(\frac{4+\sqrt{5}}{5+\sqrt{2}}\right)$$

$$\alpha\beta=\left(\frac{8+2\sqrt{5}}{5+\sqrt{2}}\right)$$

$$HM=\frac{2\alpha\beta}{(\alpha+\beta)}$$

$$=\frac{2\left(\frac{8+2\sqrt{5}}{5+\sqrt{2}}\right)}{\left(\frac{4+\sqrt{5}}{5+\sqrt{2}}\right)}=4$$

Let the harmonic mean and geometric mean of two positive numbers be the ratio 4: 5. Then find the ratio of the two numbers.

A. 2 **B.** 3 **C.** 4 **D.** 5

$$\begin{cases} H = \dfrac{2ab}{a+b} \\ G = \sqrt{ab} \end{cases}$$

$$\frac{H}{G} = \frac{2\sqrt{ab}}{a+b} = \frac{4}{5}$$

$$5\sqrt{ab} = 2a + 2b$$

$$5 = 2\frac{a}{\sqrt{ab}} + 2\frac{b}{\sqrt{ab}}$$

$$5 = 2\sqrt{\frac{a}{b}} + 2\sqrt{\frac{b}{a}}$$

t $\quad$ $\frac{1}{t}$

$$s = 2t + \frac{2}{t}$$

$$st = 2t^2 + 2$$

$$2t^2 - st + 2 = 0$$

$$2t^2 - 4t - t + 2 = 0$$

$$(2t-1)(t-2) = 0$$

$$\boxed{t = \frac{1}{2}, 2}$$

$$\sqrt{\frac{a}{b}} = \frac{1}{2}$$

$$\frac{a}{b} = \frac{1}{4}$$

$$\sqrt{\frac{a}{b}} = 2$$

$$\frac{a}{b} = 4$$

For the two numbers a and b $(a > b > 0)$, the **A.M.** exceeds their **G.M. by 5,** and the **G.M.** exceeds their **H.M. by 4.** Then find the value of **| a - 2b |**.

A. 20 **B.** 30 **C.** 40 **D.** None of these

$$\begin{cases} A - G = 5 \\ G - H = 4 \end{cases}$$

$$\begin{cases} \frac{a+b}{2} - \sqrt{ab} = 5 \\ \sqrt{ab} - \frac{2ab}{a+b} = 4 \end{cases}$$

$$(a+b) = 2(5 + \sqrt{ab})$$

$$\Rightarrow \sqrt{ab} - \frac{2ab}{2(5+\sqrt{ab})} = 4$$

Let: $\sqrt{ab} = t$

$$t - \frac{t^2}{s+t} = 4$$

$$\frac{st + t^2 - t^2}{s+t} = 4$$

$$st = 20 + 4t$$

$$\boxed{t = 20}$$

$$\Rightarrow \sqrt{ab} = 20$$

$$\boxed{ab = 400}$$

Now.

$$a+b = 2(s+\sqrt{ab})$$

$$= 2(s+20)$$

$$\boxed{a+b = 50}$$

$$\boxed{\begin{matrix} a = 40 \\ b = 10 \end{matrix}}$$

If the roots of the equation $a(b-c)x^2 + b(c-a)x + c(a-b) = 0$ (where a, b, c are unequal real numbers) are real and equal and α, β be the roots of equation $ax^2 + bx + c = 0, a \neq 0$ then harmonic mean of α, β is

A. $1 - \alpha\beta$ **B.** $1 + \alpha\beta$ **C.** $\alpha\beta - 1$ **D.** $-1 - \alpha\beta$

$$a(b-c)x^2 + b(c-a)x + c(a-b) = 0$$

$x=1$: $a(b-c) + b(c-a) + c(a-b) = 0$

$\Rightarrow$ both roots are 1

$$\left(\begin{matrix}\text{Product of}\\ \text{roots}\end{matrix}\right) = \frac{c(a-b)}{a(b-c)} = 1$$

$$\Rightarrow ac - bc = ab - ac$$

$$\Rightarrow 2ac = ab + bc$$

$$\Rightarrow \boxed{\frac{2}{b} = \frac{1}{c} + \frac{1}{a}}$$

$$HM.(\alpha, \beta)$$

$$= \frac{2\alpha\beta}{\alpha+\beta}$$

$$= \frac{2(c/a)}{(-b/a)}$$

$$= (-c)\left(\frac{2}{b}\right)$$

$$= (-c)\left(\frac{1}{c} + \frac{1}{a}\right)$$

$$= \boxed{-1 - \frac{c}{a}} \Rightarrow \boxed{-1 - \alpha\beta}$$

If **a, b** and **c** are distinct positive integers less than or equal to **10.** The arithmetic mean of a and b is **9.** The geometric mean of a and c is **6√2.** If the harmonic mean of b and c is H, then find the value of ***19H***.

A. 175 **B.** 180 **C.** 195 **D.** 200

H.W

A.M., G.M. & H.M. of ‘n’ numbers

For n numbers $a_1, a_2, \ldots\ldots, a_n$

Arithmetic Mean

$n=2$; a_1, a_2 : $A = \dfrac{a_1 + a_2}{2}$

$a_1, a_2, a_3 - - -, a_n$: $\boxed{A = \dfrac{a_1 + a_2 + a_3 + - - - + a_n}{n}}$

For n numbers $a_1, a_2, \ldots\ldots, a_n$

Geometric Mean

$n = 2$: a_1, a_2 : $G = (a_1 a_2)^{1/2}$

$a_1, a_2, a_3 \ldots a_n$: $G = (a_1 a_2 \ldots a_n)^{1/n}$

For n numbers $a_1, a_2, \ldots\ldots, a_n$

Harmonic Mean

$n=2$: a_1, a_2 : $H = \dfrac{2a_1a_2}{a_1+a_2} = \dfrac{2}{\left(\frac{1}{a_1}+\frac{1}{a_2}\right)}$

$(a_1, a_2, a_3, \ldots, a_n)$: $\boxed{H = \dfrac{n}{\left(\frac{1}{a_1}+\frac{1}{a_2}+\cdots+\frac{1}{a_n}\right)}}$

Let a, b, c be positive integers such that b/a is an integer. If a, b, c are in geometric progression and the arithmetic mean of a, b, c is b + 2, then find the value of $\left(\frac{a^2+a-14}{a+1}\right)$

2014 Adv.

$\frac{a+b+c}{3} = b+2$

$a+b+c = 3b+6$

$\boxed{a-2b+c=6}$

$a, b, c \longrightarrow$ G.P.

$\{a, ar, ar^2$

$a-2(ar)+ar^2=6$

$a(1-2r+r^2)=6$

$a(r-1)^2 = 6$

$r = 2 \longrightarrow a = 6$ ✓

$r = 3 \longrightarrow a = \frac{3}{2}$ X

$r = 4 \longrightarrow a = \frac{2}{3}$ X

Now.

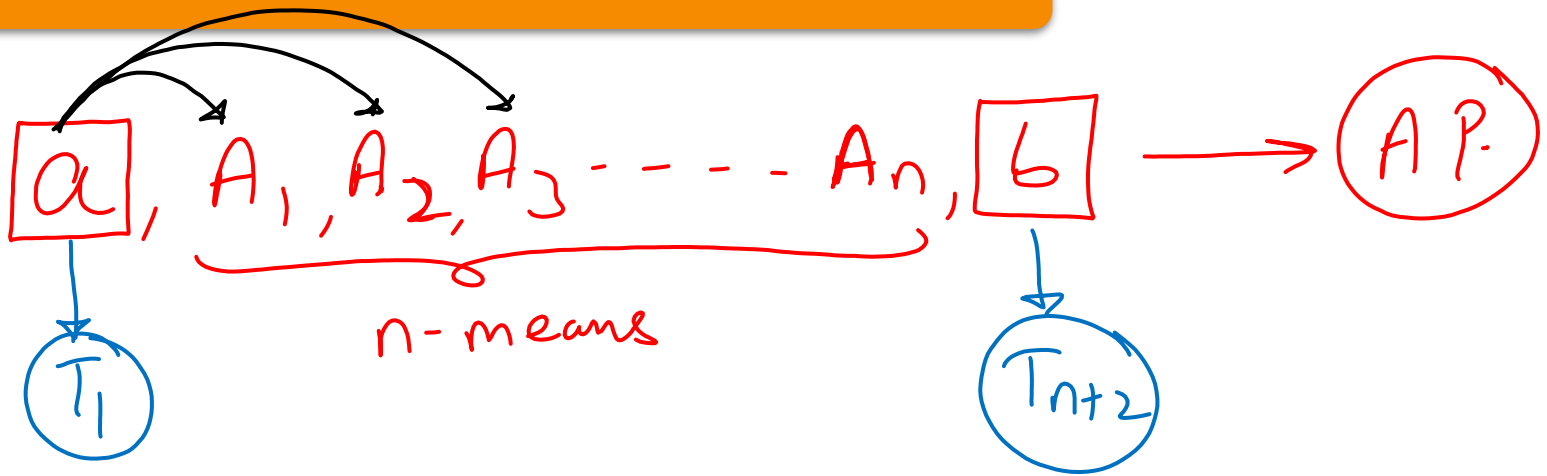
$\frac{a^2 + a - 14}{a + 1}$

$\frac{36 + 6 - 14}{6 + 1}$

$= 4$

Inserting n-means between two numbers

n-Arithmetic Mean between a & b



$$T_{n+2} = a + ((n+2)-1)d$$

$$b = a + (n+1)d$$

* $$d = \frac{b-a}{n+1}$$

$A_1 = a + d$

$A_2 = a + 2d$

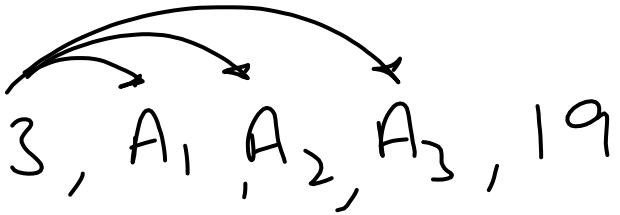
$\vdots$

$$A_n = a + nd$$

Insert **three arithmetic means** between the numbers **3** and **19.**

$n = 3$

a b



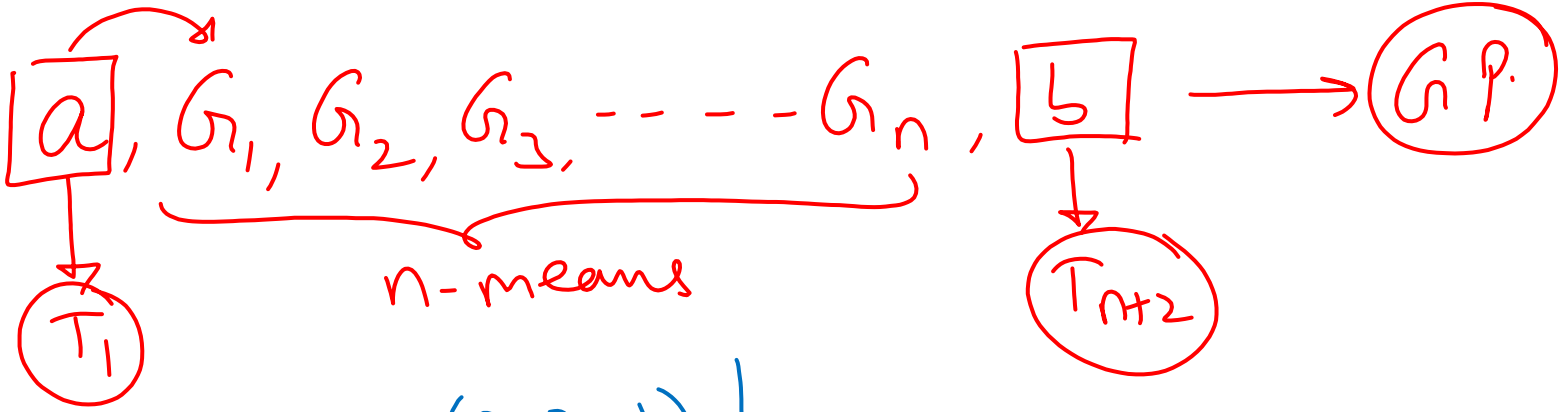
$$d = \frac{b-a}{n+1}$$

$$= \frac{19-3}{3+1}$$

$$= 4$$

$$\begin{cases} A_1 = 3+4 = 7 \\ A_2 = 11 \\ A_3 = 15 \end{cases}$$

n-Geometric Mean between a & b



$$T_{n+2} = a R^{(n+2-1)}$$

$$b = a R^{n+1}$$

$$R^{n+1} = \frac{b}{a}$$

* $\boxed{R = \left(\frac{b}{a}\right)^{\frac{1}{n+1}}}$

Now:

$G_1 = aR$

$G_2 = aR^2$

$\vdots$

$\boxed{G_n = aR^n}$

Insert **three geometric means** between the numbers **1** and **256.**

$n = 3$

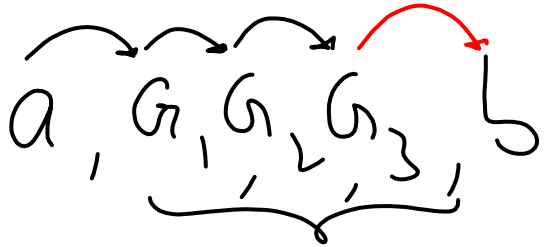
a b

$R = \left(\frac{b}{a}\right)^{\frac{1}{n+1}}$

$R = \left(\frac{256}{1}\right)^{\frac{1}{4}}$

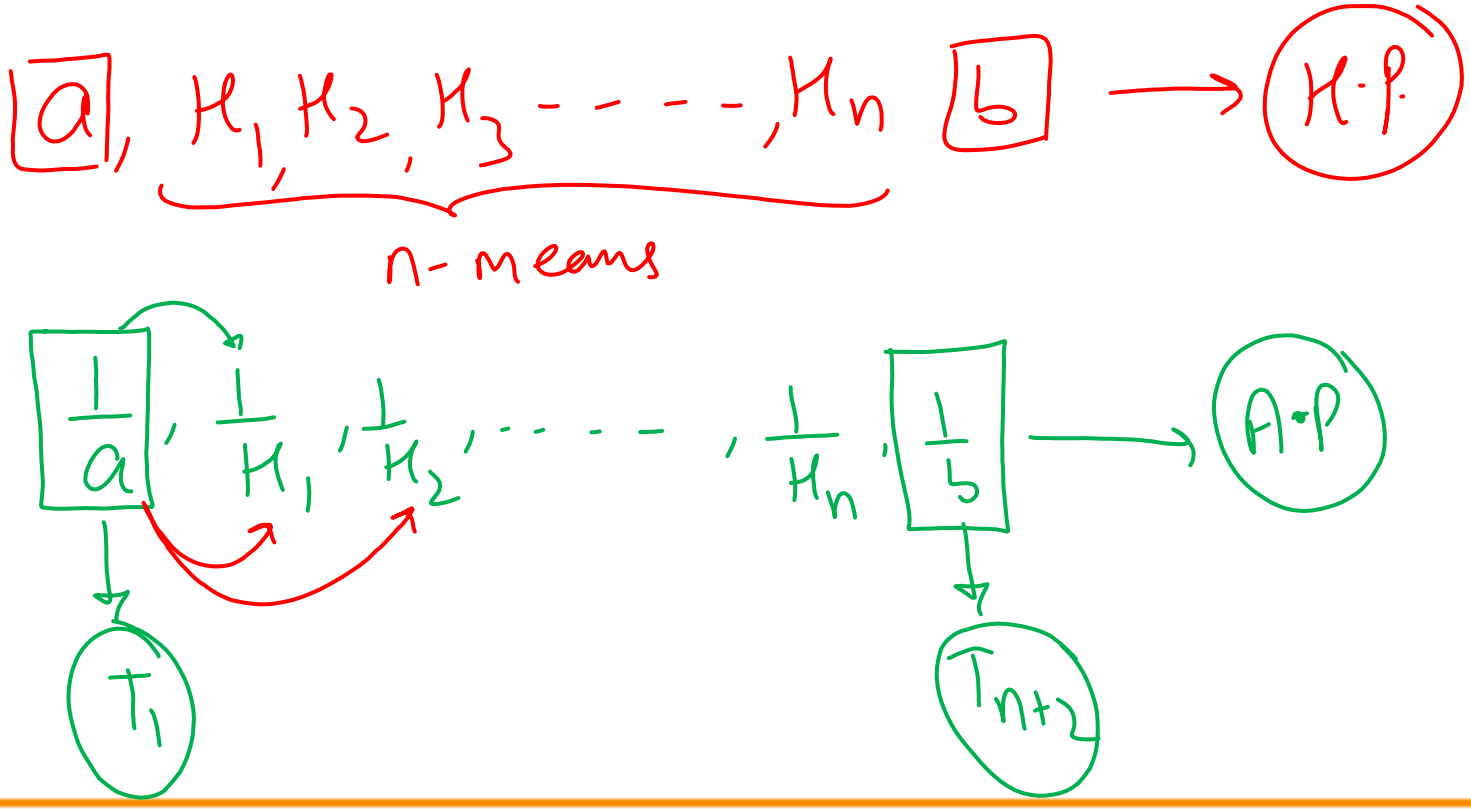
$R^4 = 256$

$R = 4$



$G_1 = 4 ; G_2 = 16 ; G_3 = 64$

n-Harmonic Mean between a & b



$$T_{n+2} = \frac{1}{a} + ((n+2)-1)d$$

$$\frac{1}{b} = \frac{1}{a} + (n+1)d$$

$$* \boxed{d = \frac{\left(\frac{1}{b} - \frac{1}{a}\right)}{(n+1)}}$$

$$\frac{1}{H_1} = \frac{1}{a} + d$$

$$\frac{1}{H_2} = \frac{1}{a} + 2d$$

$$\vdots$$

$$\boxed{\frac{1}{H_n} = \frac{1}{a} + nd}$$

Insert **four harmonic means** between the numbers **2/3** and **2/13.**

$n = 4$

$a = \frac{2}{3}$ $\quad b = \frac{2}{13}$

$$d = \frac{\frac{1}{b} - \frac{1}{a}}{n+1}$$

$$= \frac{\left(\frac{13}{2} - \frac{3}{2}\right)}{5}$$

$$= 1$$

$$\frac{1}{H_1} = \frac{3}{2} + 1 = \frac{5}{2}$$

$$\frac{1}{H_2} = \frac{3}{2} + 2 = \frac{7}{2}$$

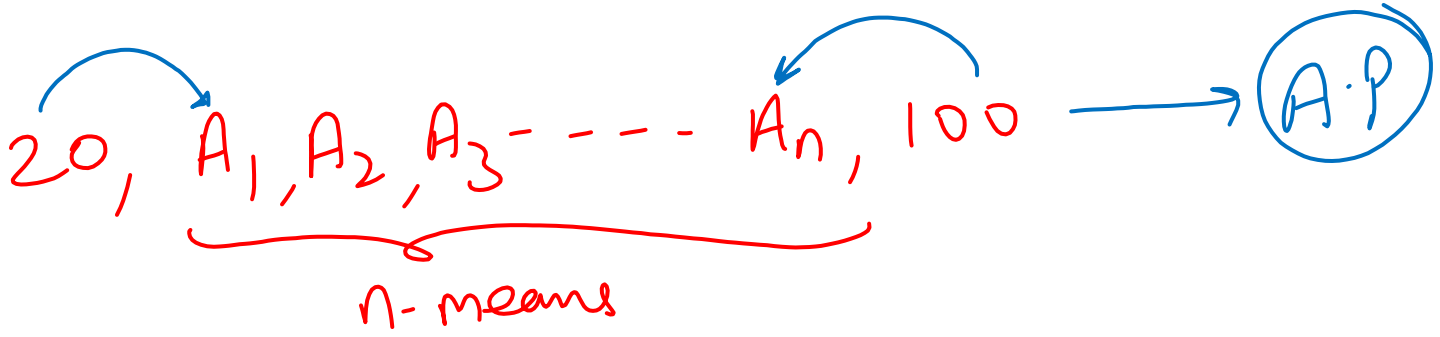
$$\frac{1}{H_3} = \frac{3}{2} + 3 = \frac{9}{2}$$

$$\frac{1}{H_4} = \frac{3}{2} + 4 = \frac{11}{2}$$

$$\begin{cases} H_1 = \frac{2}{5} \\ H_2 = \frac{2}{7} \\ H_3 = \frac{2}{9} \\ H_4 = \frac{2}{11} \end{cases}$$

If n A.M.s are inserted between 20 and 100 such that

first means : last mean = 1 : 2, find **n.**



$$\frac{A_1}{A_n} = \frac{1}{2} \Rightarrow \frac{20+d}{100-d} = \frac{1}{2} \Rightarrow 40+2d = 100-d$$

$$3d = 60$$

$$\boxed{d = 20}$$

$$\boxed{d = \frac{100-20}{n+1}}$$

$$\Rightarrow 20 = \frac{80}{n+1}$$

$$\Rightarrow n+1 = 4$$

$$\therefore \boxed{n = 3}$$

#JEELiveDaily Schedule

jee

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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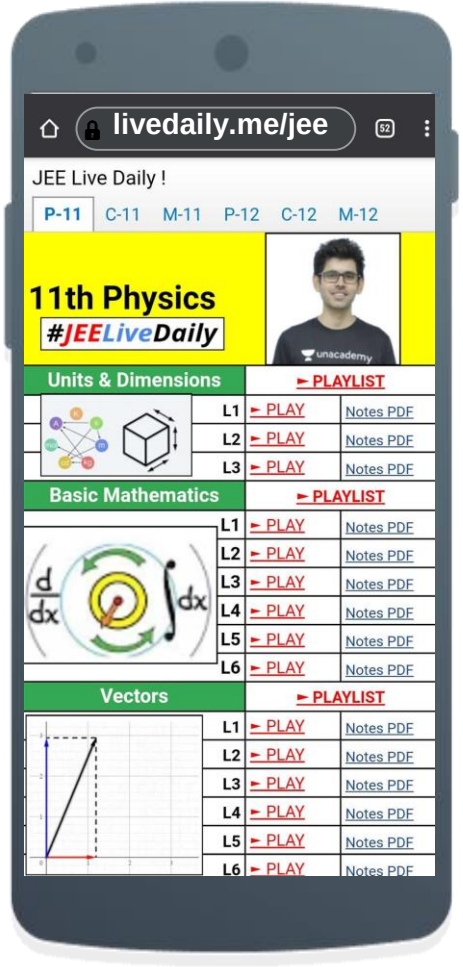

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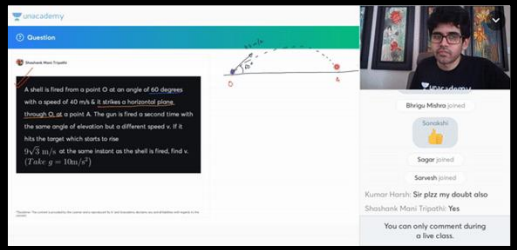

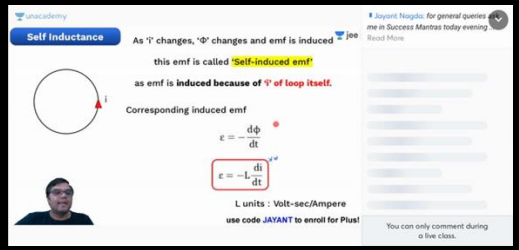

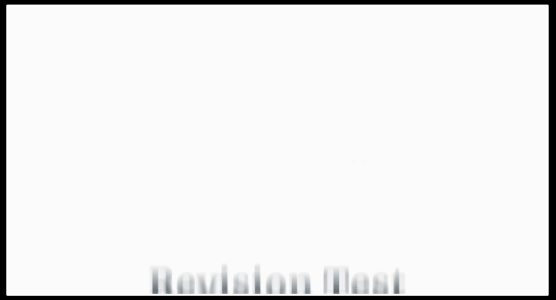

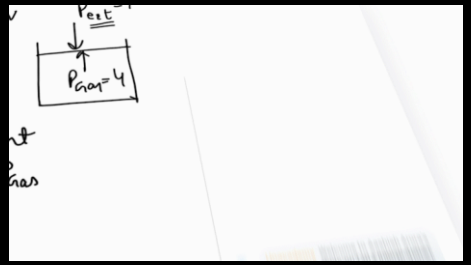

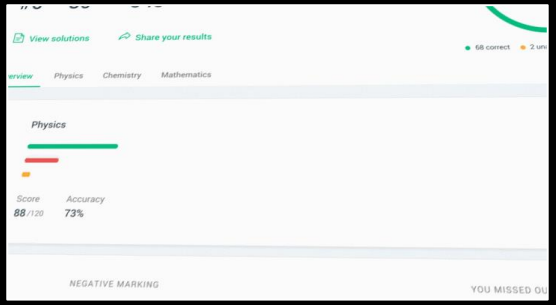

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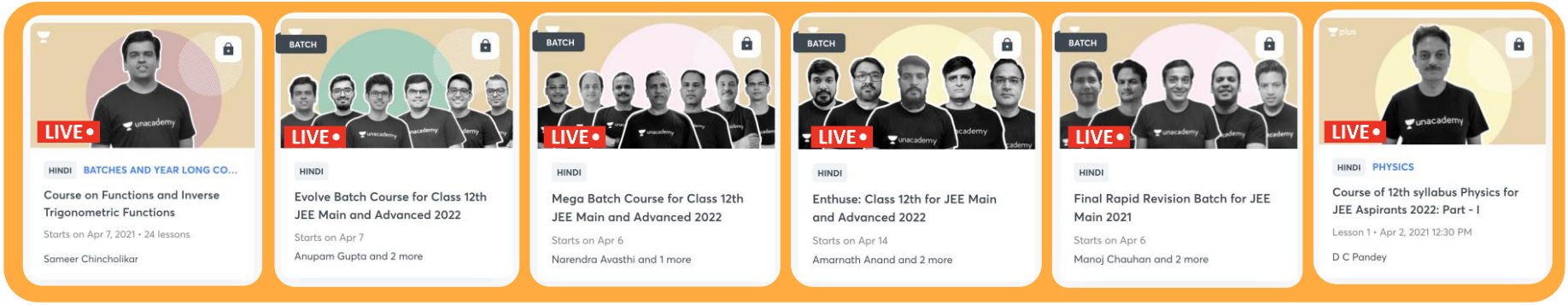

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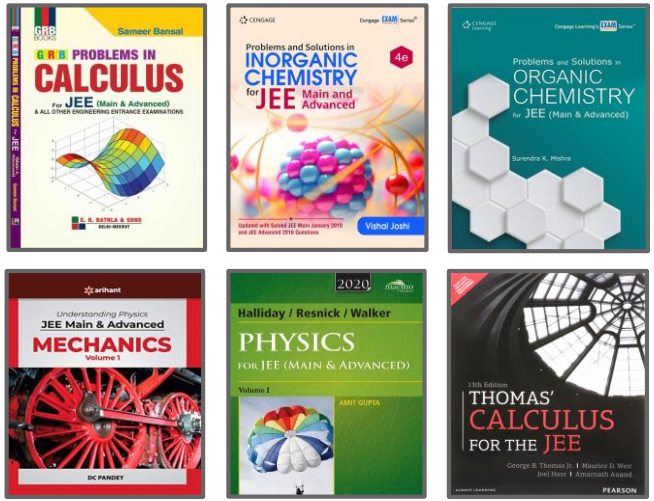

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Top Results

Bratin Mondal

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Amaiya Singhal
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Adnan
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Tanmay Jain
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Kunal Lalwani
99.81

Utsav Dhanuka
99.75

Aravindan K Sundaram
99.69

Manas Pandey
99.69

Mihir Agarwal
99.63

Akshat Tiwari
99.60

Sarthak Kalankar
99.59

Vaishnovi Arun
99.58

Devashish Tripathi
99.52

Maroof
99.50

Tarun Gupta
99.50

Siddharth Kaushik
99.48

Mihir Kothari
99.39

Sahil
99.38

Vaibhav Dhanuka
99.34

Pratham Kadam
99.29

Shivam Gupta
99.46

Shrish
99.28

Yash Bhaskar
99.10

Subhash Patel
99.02

Ayush Kale
98.85

Ayush Gupta
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Megh Gupta
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MIHIR PRAJAPATI
98.16

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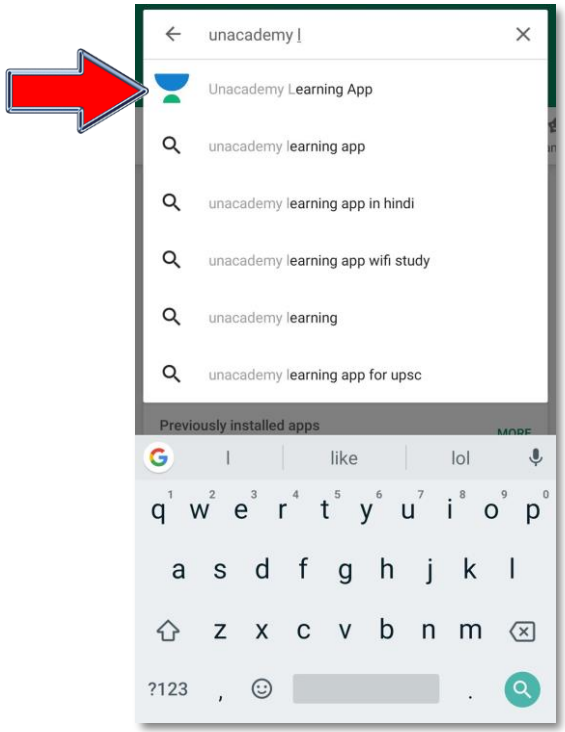
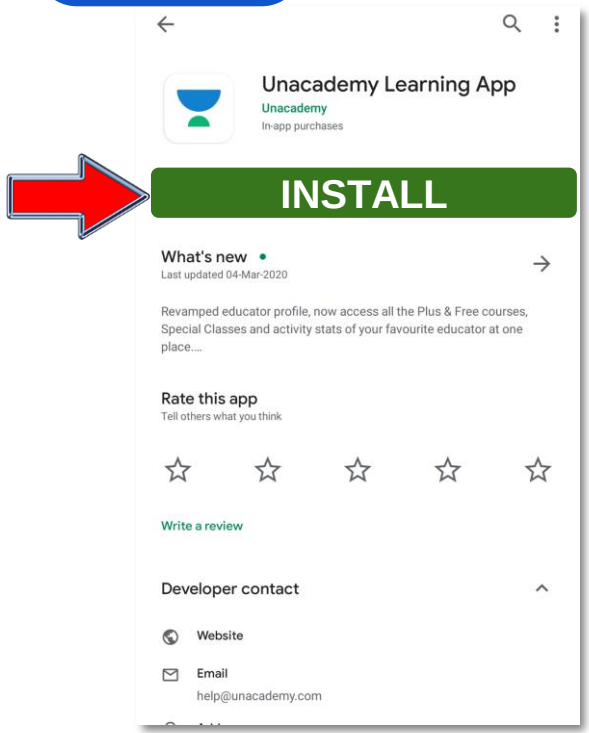
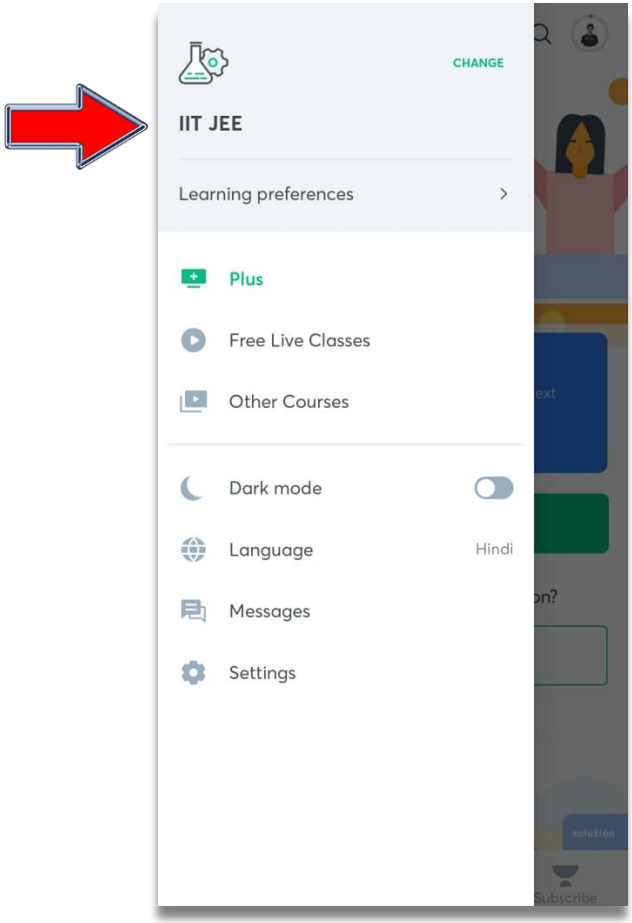
Step 1



Step 2

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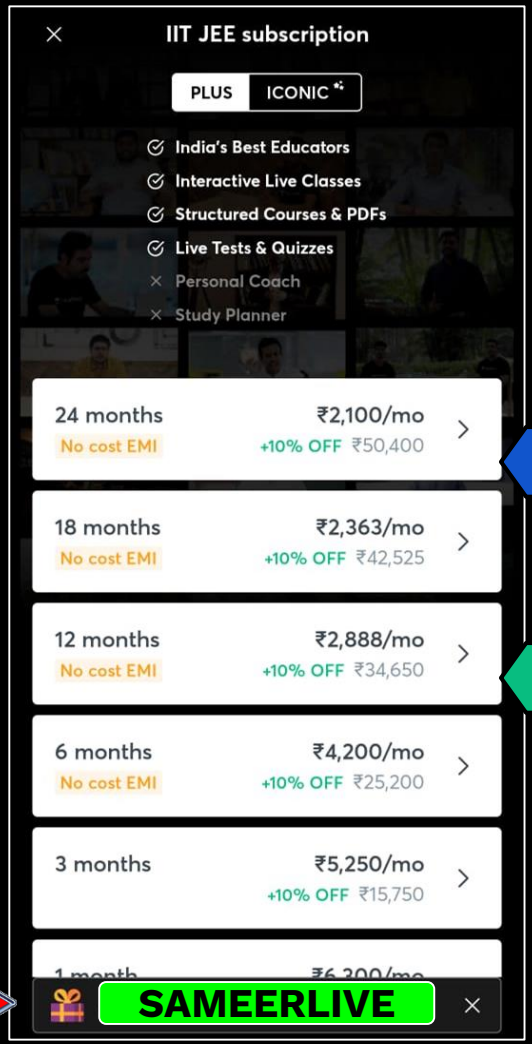

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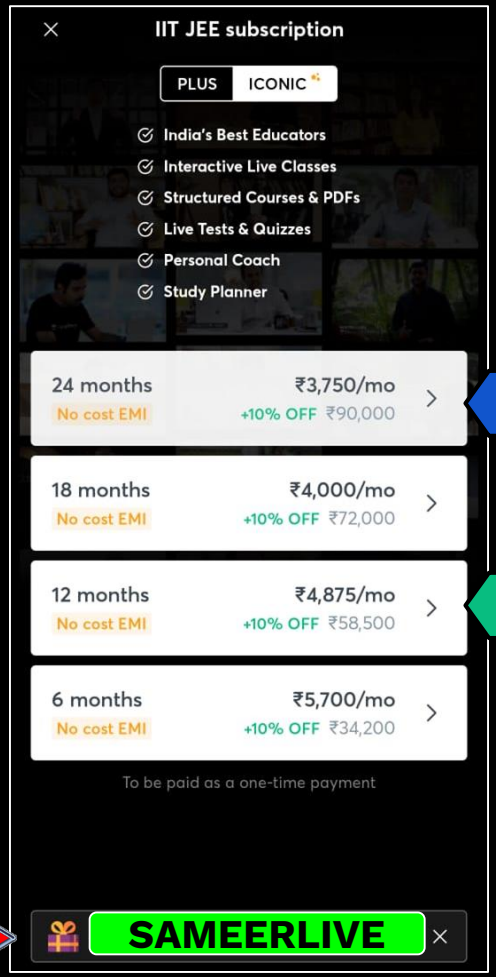
11th / 9, 10

12th / Drop



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