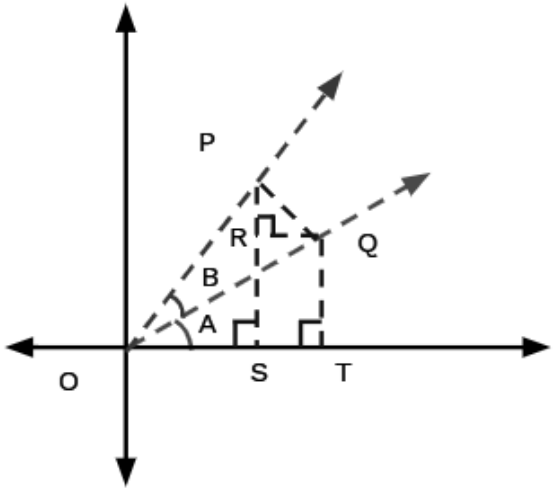
jee LIVE daily 3.0

Multiple & Submultiple Angle Formulas - 2

Trigonometry 8



jee LIVE daily 3.0

Sameer Chincholikar

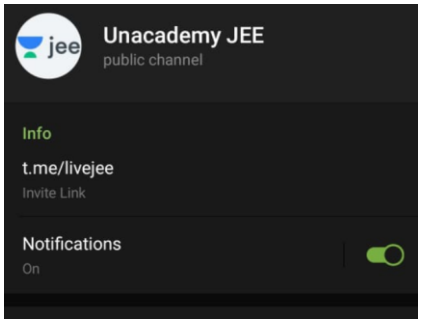
B.Tech, M.Tech - IIT-Roorkee

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

sameer_iitr

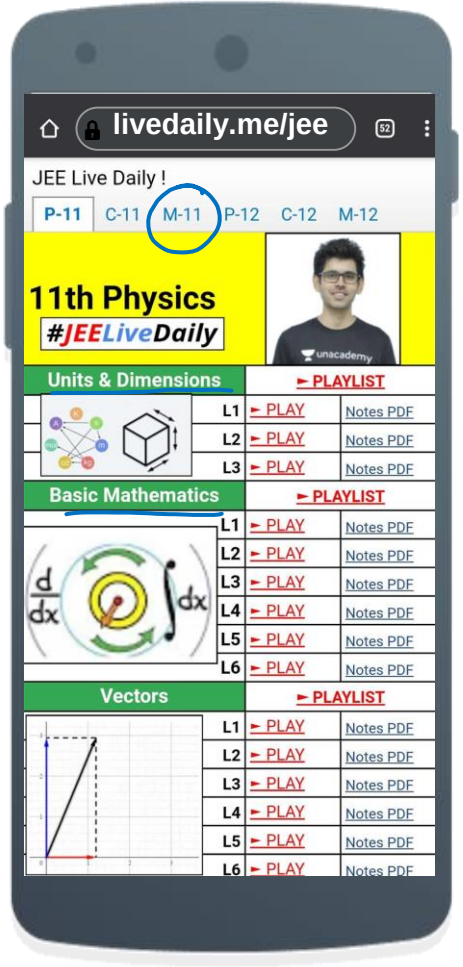
#JEE Live Daily

Telegram Channel



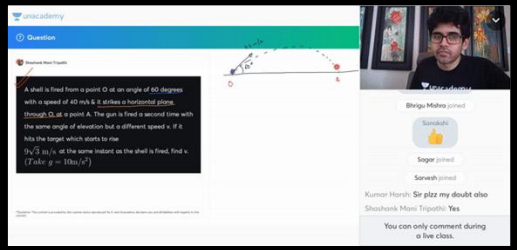
livedaily.me/jee

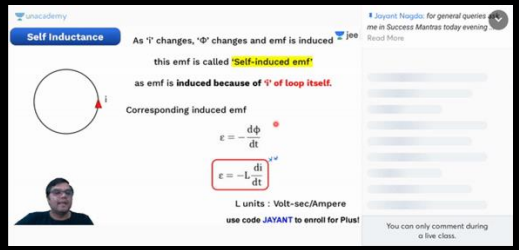
jee

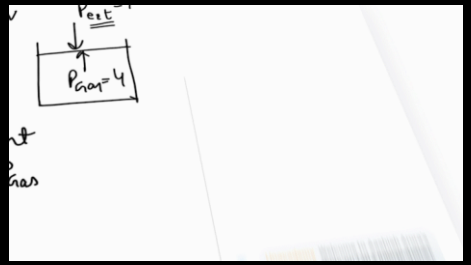


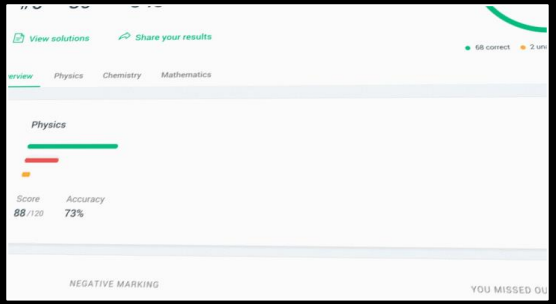
Unacademy Subscription

jee









+ LIVE Class Environment

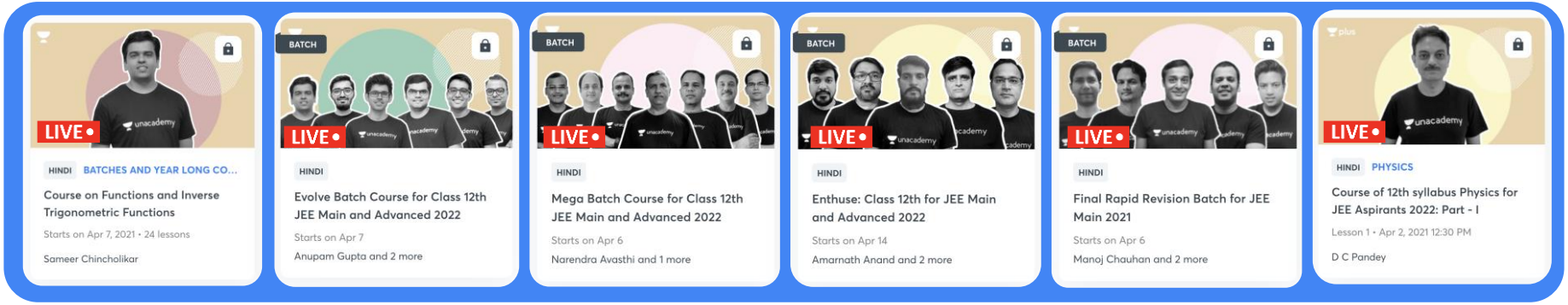
- + **LIVE Polls** & **Leaderboard**
- + **LIVE Doubt** Solving
- + **LIVE** Interaction

+ Performance Analysis

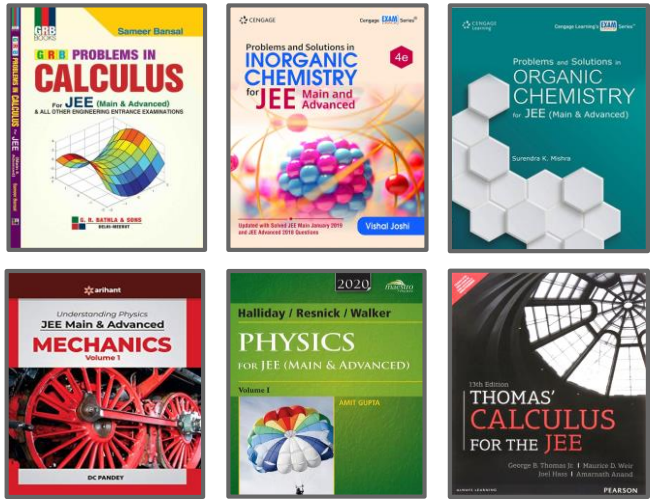
- + **Weekly Test Series**
- + **DPPs** & **Quizzes**

India's **BEST** Educators

Unacademy Subscription



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



jee

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

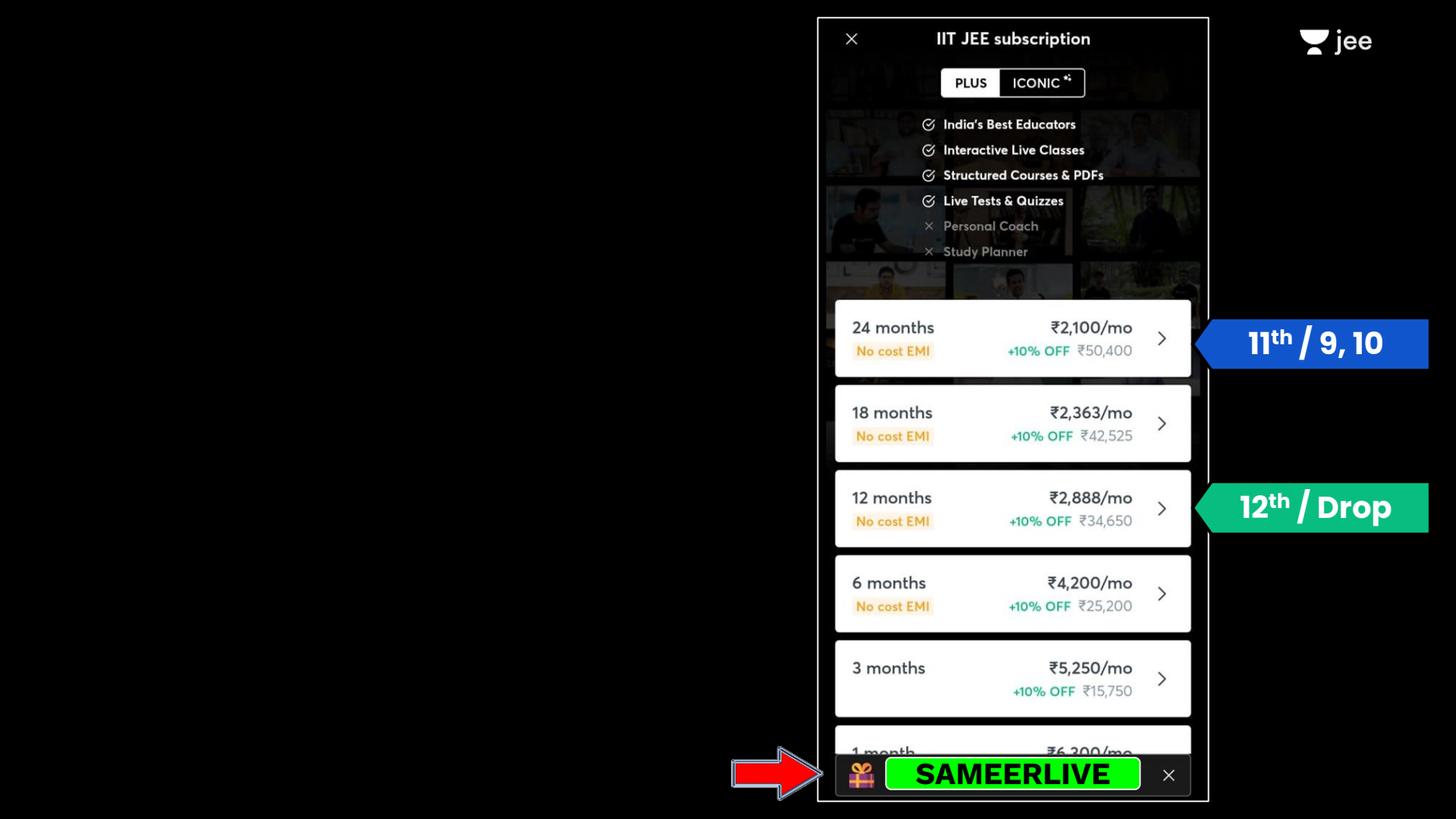
Ayush Kale
98.85

Ayush Gupta
98.67

Megh Gupta
98.59

Naman Goyal
98.48

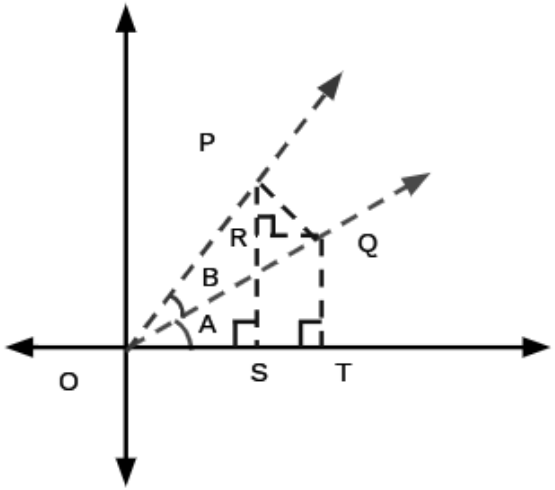
MIHIR PRAJAPATI
98.16


IIT JEE subscription
PLUS
ICONIC
India's Best Educators
Interactive Live Classes
Structured Courses & PDFs
Live Tests & Quizzes
Personal Coach
Study Planner
24 months
No cost EMI
₹2,100/mo
+10% OFF ₹50,400
18 months
No cost EMI
₹2,363/mo
+10% OFF ₹42,525
12 months
No cost EMI
₹2,888/mo
+10% OFF ₹34,650
6 months
No cost EMI
₹4,200/mo
+10% OFF ₹25,200
3 months
₹5,250/mo
+10% OFF ₹15,750
SAMEERLIVE
jee
11th / 9, 10
12th / Drop

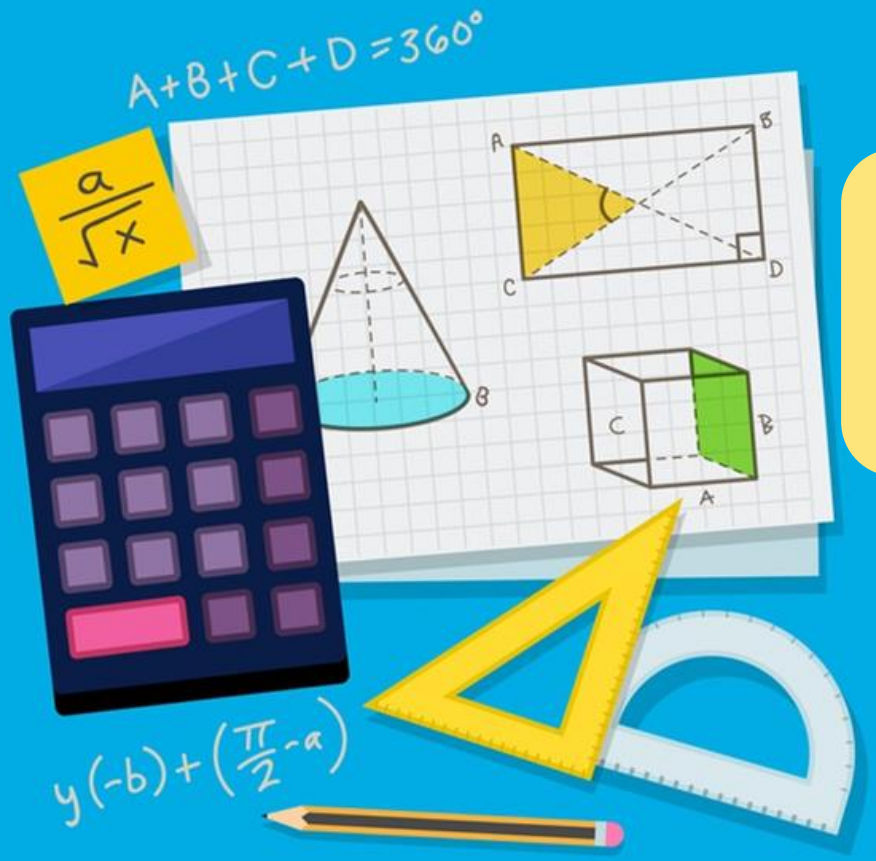
jee LIVE daily 3.0

Multiple & Submultiple Angle Formulas - 2

Trigonometry 8



LET'S BEGIN!!



Homework Question

The value of $\cos^3\left(\frac{\pi}{8}\right).\cos\left(\frac{3\pi}{8}\right)+\sin^3\left(\frac{\pi}{8}\right).\sin\left(\frac{3\pi}{8}\right)$ is

JEE Main 2020 (Jan)

A. $\frac{1}{\sqrt{2}}$

B. $\frac{1}{2\sqrt{2}}$

C. $\frac{1}{2}$

D. $\frac{1}{4}$

$\frac{\pi}{8}+\frac{3\pi}{8}=\frac{4\pi}{8}=\frac{\pi}{2}$

$\left(\cos^3\frac{\pi}{8}\right)\left(\cos\left(\frac{\pi}{2}-\frac{\pi}{8}\right)\right)$

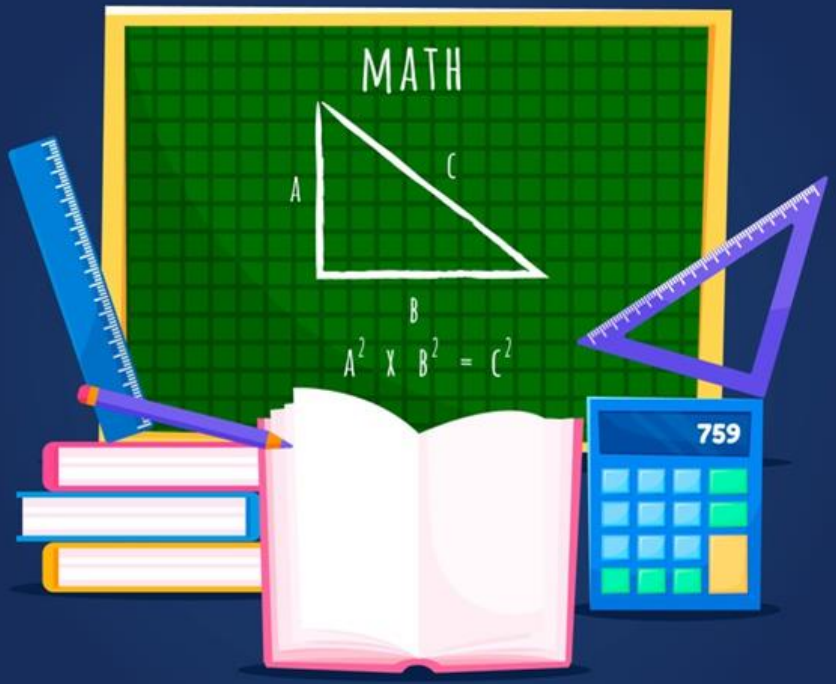
$+\left(\sin^3\left(\frac{\pi}{8}\right)\right)\left(\sin\left(\frac{\pi}{2}-\frac{\pi}{8}\right)\right)$

$=\cos^3\frac{\pi}{8}\sin\frac{\pi}{8}+\sin^3\frac{\pi}{8}\cos\frac{\pi}{8}$

$$\sin\frac{\pi}{8}\cdot\cos\frac{\pi}{8}\left(\underbrace{\cos^2\frac{\pi}{8}+\sin^2\frac{\pi}{8}}_{=1}\right)$$

$$\frac{2\sin\frac{\pi}{8}\cos\frac{\pi}{8}}{2}\rightarrow\frac{1}{2}\sin\left(\frac{\pi}{4}\right)\rightarrow\frac{1}{2\sqrt{2}}$$

T-Ratios of Standard Angles



T-Ratios of standard angles

1

$$\sin 22.5^0 = \frac{\sqrt{2-\sqrt{2}}}{2}$$

$\theta = 22.5^\circ$

$2\theta = 45^\circ$

$\cos 2\theta = \cos 45^\circ$

$1 - 2\sin^2\theta = \frac{1}{\sqrt{2}}$

$2\sin^2\theta = 1 - \frac{1}{\sqrt{2}}$

$\sin^2\theta = \frac{\sqrt{2}-1}{2\sqrt{2}}$

$$\sin\theta = \pm\sqrt{\frac{\sqrt{2}-1}{2\sqrt{2}}}$$

(ignore -ve value
$\because$ θ is in 1st Quad)

$$\sin\theta = \frac{\sqrt{2-\sqrt{2}}}{2}$$

T-Ratios of standard angles

2

$$\cos 22.5^0 = \frac{\sqrt{2+\sqrt{2}}}{2}$$

$\theta = 22.5^\circ$

$2\theta = 45^\circ$

$\cos 2\theta = \frac{1}{\sqrt{2}}$

$2\cos^2\theta - 1 = \frac{1}{\sqrt{2}}$

$\cos^2\theta = \frac{1+\sqrt{2}}{2\sqrt{2}}$

$\cos\theta = \sqrt{\frac{\sqrt{2}+2}{2}}$

T-Ratios of standard angles

3

$$\tan 22.5^0 = \sqrt{2} - 1$$

$$\tan 22.5^\circ = \frac{\sin 22.5}{\cos 22.5}$$

$$= \sqrt{\frac{2-\sqrt{2}}{2+\sqrt{2}}}$$

$$= \sqrt{\frac{\sqrt{2}-1}{\sqrt{2}+1}}$$

$$= \sqrt{2} - 1$$

T-Ratios of standard angles

4

$$\sin 18^0 = \frac{\sqrt{5}-1}{4} = \cos 72^\circ$$

$\theta = 18^\circ$

$5\theta = 90^\circ$

$2\theta + 3\theta = 90^\circ$

$2\theta = 90^\circ - 3\theta$

$\sin 2\theta = \sin(90^\circ - 3\theta)$

$\sin 2\theta = \cos 3\theta$

$2\sin\theta\cos\theta = 4\cos^3\theta - 3\cos\theta$

$\cos\theta \neq 0 \ (\because \theta = 18^\circ)$

$2\sin\theta = 4\cos^2\theta - 3$

$$2\sin\theta = 4(1-\sin^2\theta) - 3$$

$$2\sin\theta = 4 - 4\sin^2\theta - 3$$

$$4\sin^2\theta + 2\sin\theta - 1 = 0$$

$$\sin\theta = \frac{-2 \pm \sqrt{4+16}}{8}$$

$$\sin\theta = \frac{-2 \pm 2\sqrt{5}}{8}$$

$$= \frac{-1 \pm \sqrt{5}}{4}$$

$$\Rightarrow \sin 18^\circ = \frac{\sqrt{5}-1}{4}$$

T-Ratios of standard angles

5

$$\cos 36^0 = \frac{\sqrt{5}+1}{4} = \sin 54^\circ$$

$\cos 36^\circ$

$= \cos(2(18^\circ))$

$= 1 - 2\sin^2 18^\circ$

$= 1 - 2\left(\frac{\sqrt{5}-1}{4}\right)^2$

$= 1 - 2\frac{(\sqrt{5}-1)^2}{16}$

$= \frac{8 - (5+1-2\sqrt{5})}{8}$

$= \frac{2+2\sqrt{5}}{8} \longrightarrow \boxed{\frac{\sqrt{5}+1}{4}}$

Find the value of **tan 9⁰ - tan 27⁰ - tan 63⁰ + tan 81⁰**

A. 2 **B.** 4 **C.** 8 **D.** 0

$$(\tan 9^\circ + \tan 81^\circ) - (\tan 27^\circ + \tan 63^\circ)$$

$$(\tan 9^\circ + \cot 9^\circ) - (\tan 27^\circ + \cot 27^\circ)$$

$$= \left(\frac{\sin 9^\circ}{\cos 9^\circ} + \frac{\cos 9^\circ}{\sin 9^\circ}\right) - \left(\frac{\sin 27^\circ}{\cos 27^\circ} + \frac{\cos 27^\circ}{\sin 27^\circ}\right)$$

$$= \frac{1 \times 2}{2\sin 9^\circ \cos 9^\circ} - \frac{1 \times 2}{2\sin 27^\circ \cos 27^\circ}$$

$$= \frac{2}{\sin 18^\circ} - \frac{2}{\sin 54^\circ}$$

$$= \frac{2}{\left(\frac{\sqrt{5}-1}{4}\right)} - \frac{2}{\left(\frac{\sqrt{5}+1}{4}\right)}$$

$$8\left(\frac{1}{\sqrt{5}-1} - \frac{1}{\sqrt{5}+1}\right)$$

$$2\cancel{8}\left(\frac{\cancel{\sqrt{5}}+1-\cancel{\sqrt{5}}+1}{\cancel{4}}\right)$$

4

Value of $\sin^4\frac{\pi}{8}+\sin^4\frac{3\pi}{8}+\sin^4\frac{5\pi}{8}+\sin^4\frac{7\pi}{8}$ is equal to:

A. 1 **B.** 2 **C.** 3/2 **D.** 1/2

$\frac{\pi}{8}+\frac{7\pi}{8}=\pi$

$\frac{3\pi}{8}+\frac{5\pi}{8}=\pi$

$\sin^4\frac{\pi}{8}+\sin^4\frac{3\pi}{8}+\sin^4\left(\pi-\frac{3\pi}{8}\right)+\sin^4\left(\pi-\frac{\pi}{8}\right)$

$=\sin^4\frac{\pi}{8}+\sin^4\frac{3\pi}{8}+\sin^4\frac{3\pi}{8}+\sin^4\frac{\pi}{8}$

$$= 2\left(\sin^4\frac{\pi}{8} + \sin^4\frac{3\pi}{8}\right)$$

Note: $\frac{\pi}{8} + \boxed{\frac{3\pi}{8}} = \frac{4\pi}{8} = \frac{\pi}{2}$

$$= 2\left(\sin^4\frac{\pi}{8} + \sin^4\left(\frac{\pi}{2} - \frac{\pi}{8}\right)\right)$$

$$= 2\left(\sin^4\frac{\pi}{8} + \cos^4\frac{\pi}{8}\right)$$

Let: $\theta = \pi/8$

$$= 2\left(\sin^4\theta + \cos^4\theta\right)$$

$$= 2\left(\left(\sin^2\theta + \cos^2\theta\right)^2 - 2\sin^2\theta\cos^2\theta\right)$$

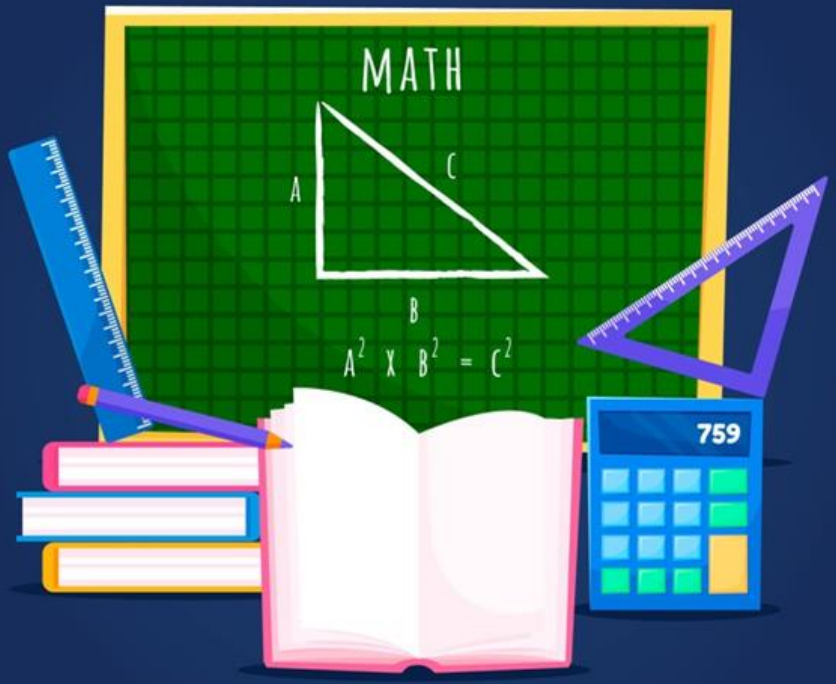
$$= 2\left(1 - \frac{4}{2}\sin^2\theta\cos^2\theta\right)$$

$$= 2\left(1 - \frac{1}{2}(\sin 2\theta)^2\right)$$

$\sin 2\theta = \pi/4$

$$= 3/2$$

Some Important Results



Some Important Results

1

$$\sin\theta \sin(60^0 - \theta)\sin(60^0 + \theta) = \frac{1}{4}\sin 3\theta$$

LHS =

$$\sin\theta\left(\frac{\sqrt{3}}{2}\cos\theta - \frac{1}{2}\sin\theta\right)\left(\frac{\sqrt{3}}{2}\cos\theta - \frac{1}{2}\sin\theta\right)$$

$$\sin\theta\left(\frac{3}{4}\cos^2\theta - \frac{\sin^2\theta}{4}\right)$$

Eg:

$\sin 20^\circ \sin 40^\circ \sin 80^\circ$

$(60-20)^\circ$ $(60+20)^\circ$

$= \frac{1}{4}\sin 60^\circ$

$$\frac{1}{4}\sin\theta\left(3(1-\sin^2\theta)-\sin^2\theta\right)$$

$$\frac{1}{4}\sin\theta\left(3-3\sin^2\theta-\sin^2\theta\right)$$

$$\frac{1}{4}\left(3\sin\theta-4\sin^3\theta\right)$$

$$\frac{1}{4}\sin 3\theta$$

Some Important Results

2

$$\cos\theta\cos\left(60^{\theta}-\theta\right)\cos(60^{0}+\theta)=\frac{1}{4}\cos 3\theta$$

Some Important Results

3

$$\tan\theta\tan(60^{\theta}-\theta)\tan(60^{0}+\theta)=\tan 3\theta$$

$$= \frac{\sin\theta\sin(60-\theta)\sin(60+\theta)}{\cos\theta\cos(60-\theta)\cos(60+\theta)}$$

$$= \frac{\sin 3\theta}{\cos 3\theta} = \boxed{\tan 3\theta}$$

Some Important Results

4

$$\cot\theta \cot(60^{\theta} - \theta) \cot(60^{0} + \theta) = \cot 3\theta$$

Value of $\dfrac{\cos 20^0 + 8\sin 10^0 \sin 50^0 \sin 70^0}{\sin^2 80^0}$ equal to

$$\frac{\cos 20^\circ + 8\left(\frac{1}{4}\sin 3(10^\circ)\right)}{\sin^2 80^\circ}$$

$$\frac{\cos 20^\circ + 8\left(\frac{1}{4}\times\frac{1}{2}\right)}{\sin^2 80}$$

$$\frac{\cos 20^\circ + 1}{\sin^2 80^\circ}$$

$$= \frac{2\cos^2 10^\circ}{\sin^2 80^\circ}$$

$$= 2$$

$$\cos 2\theta = 2\cos^2\theta - 1$$

$$1 + \cos 2\theta = 2\cos^2\theta$$

$$1 + \cos 20^\circ = 2\cos^2 10^\circ$$

#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

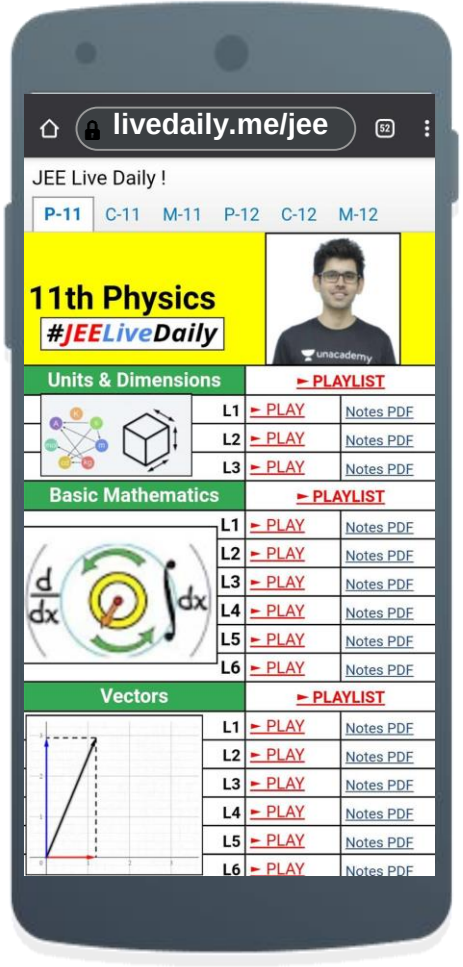
Anupam Sir | Chemistry

3:00 - 4:30 PM

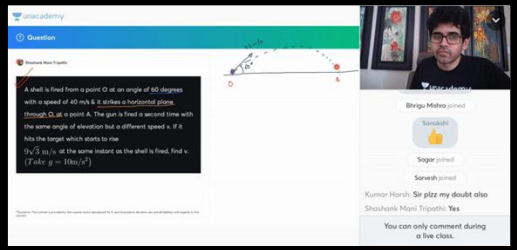
Nishant Sir | Maths

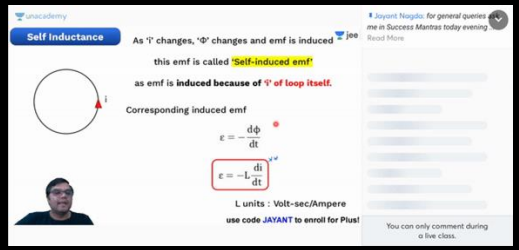
4:30 - 6:00 PM

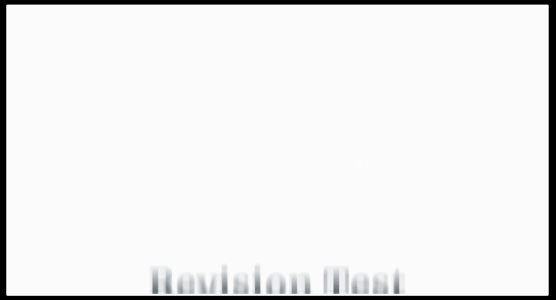
livedaily.me/jee

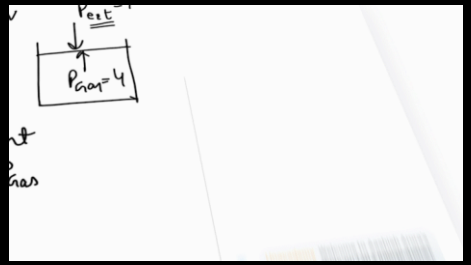


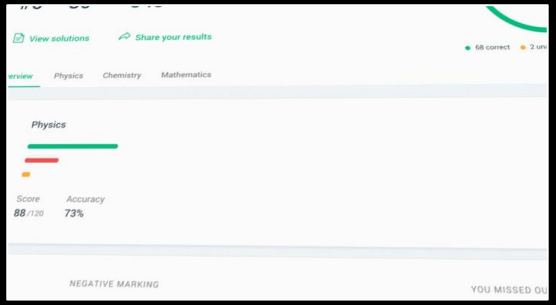
Unacademy Subscription











+ LIVE Class Environment

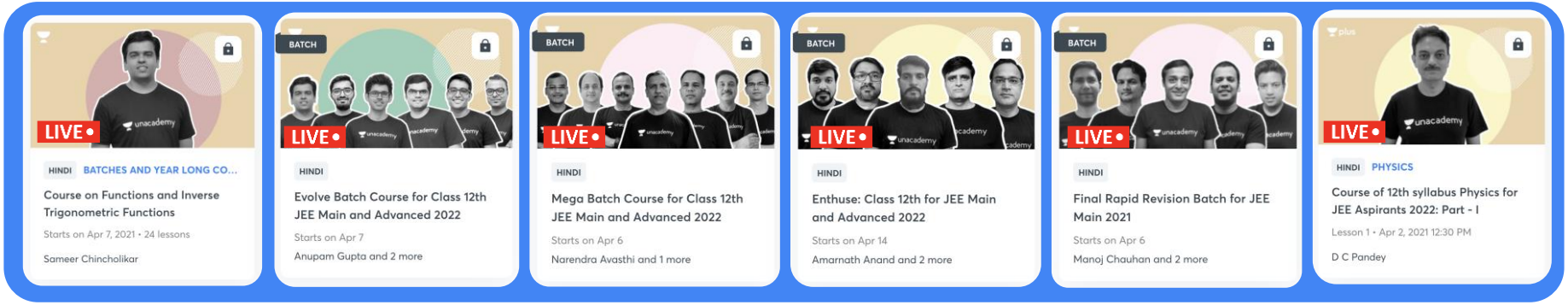
- **LIVE Polls** & **Leaderboard**
- **LIVE Doubt** Solving
- **LIVE** Interaction

+ Performance Analysis

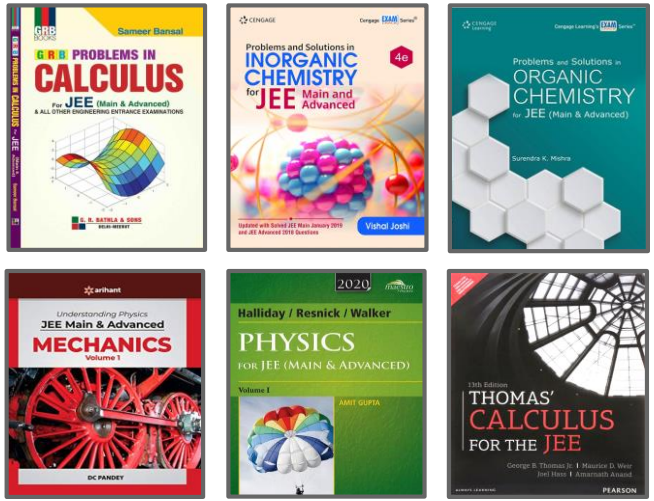
- **Weekly Test Series**
- **DPPs** & **Quizzes**

India's **BEST** Educators

Unacademy Subscription



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



jee

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

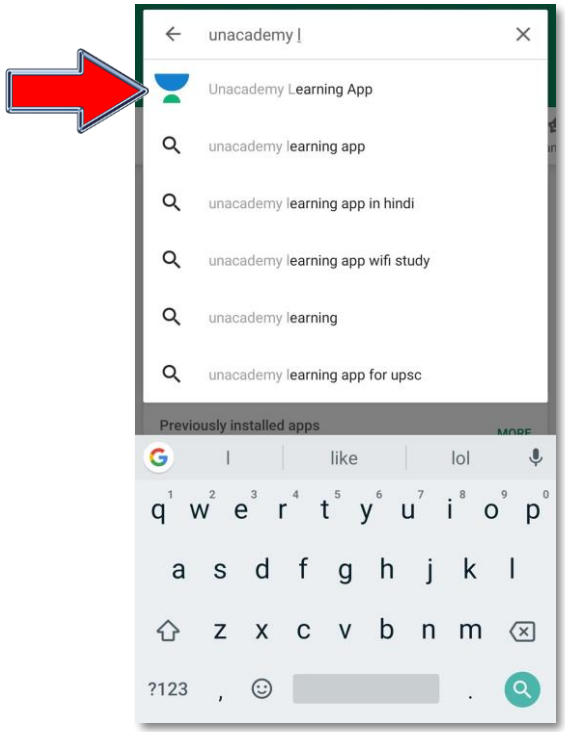
Megh Gupta
98.59

Naman Goyal
98.48

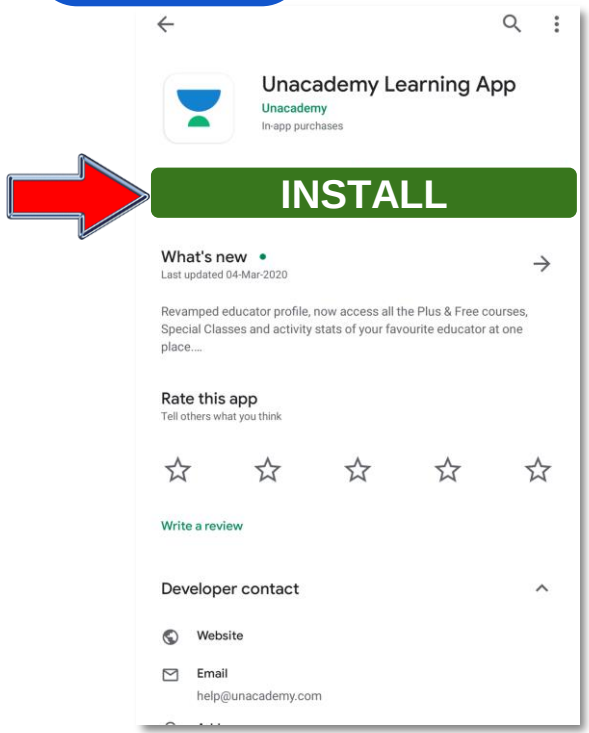
MIHIR PRAJAPATI
98.16

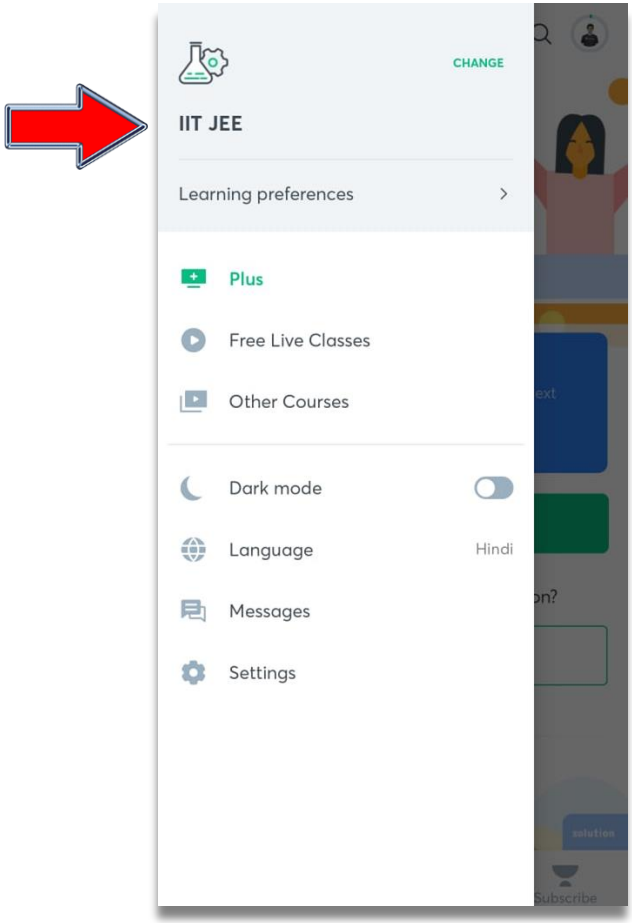
jee

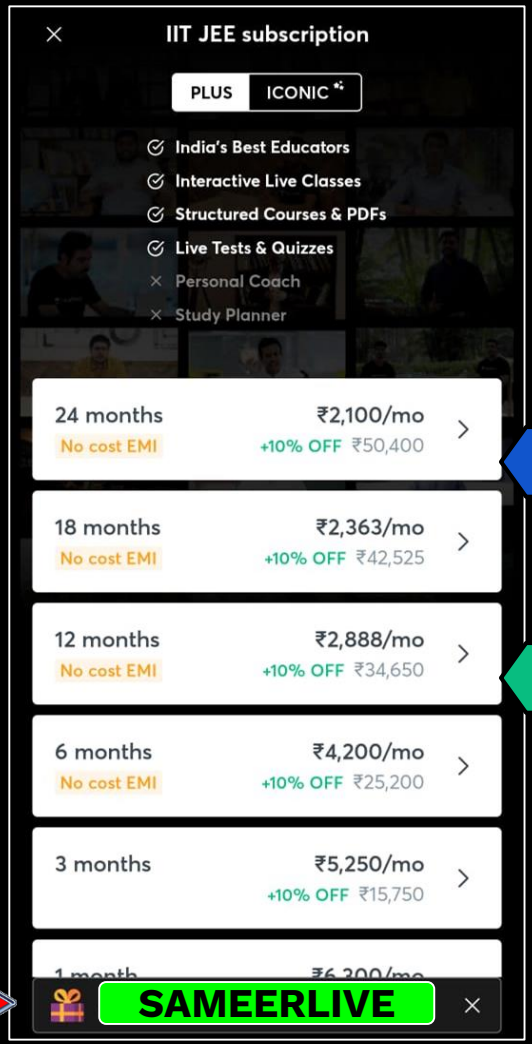
Step 1



Step 2




CHANGE
IIT JEE
Learning preferences
Plus
Free Live Classes
Other Courses
Dark mode
Language
Hindi
Messages
Settings



jee

11th / 9, 10

12th / Drop

jee

EMERGE 3.0 BATCH

JEE Main & Advanced 2023

Starting on 12th May

unacademy

jee

UNACADEMY COMBAT

Every Sunday |
11 am Onwards

Win Scholarships
worth 4 Cr+

IIT JEE T-20
Test Series

May 10 |
6:30 PM Onwards

Win Daily Amazon vouchers
and Scholarship worth
Rs 3 CR*

Enroll Now for FREE

Use Code - SAMEERLIVE

Thank You

+ SUBSCRIBE

@sameer_iitr

#JEE Live Daily

jee

LIKE & SHARE

PDF Download Now !