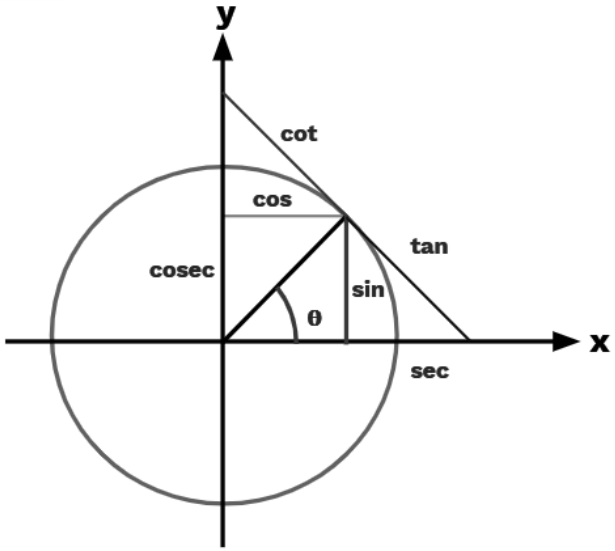
jee LIVE daily 3.0

Trigonometric Equations 2



jee LIVE daily 3.0

Sameer Chincholikar

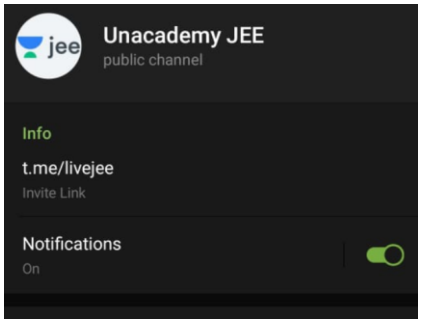
B.Tech, M.Tech - IIT-Roorkee

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

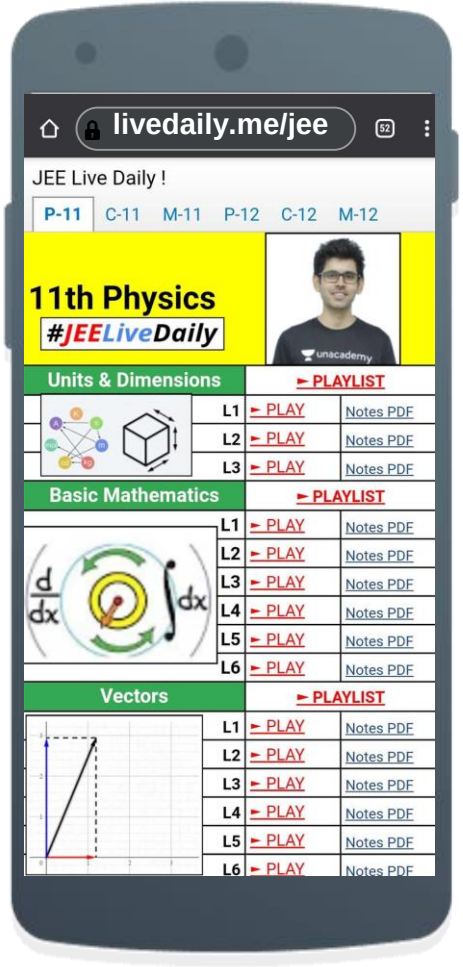
sameer_iitr

#JEE Live Daily

Telegram Channel

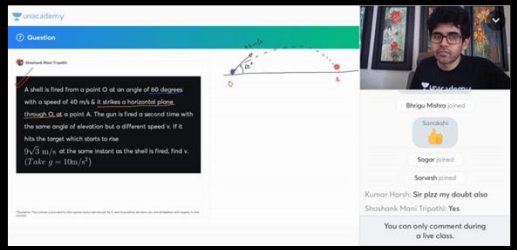


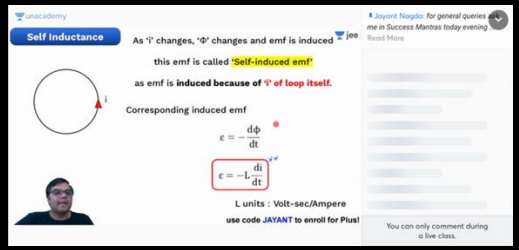
livedaily.me/jee

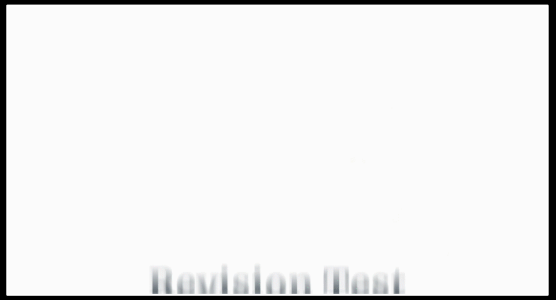


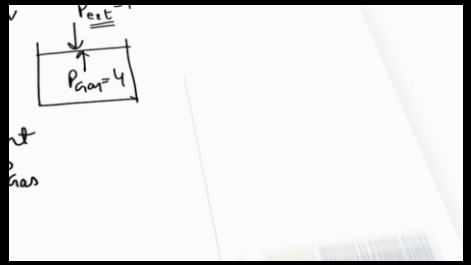
Unacademy Subscription

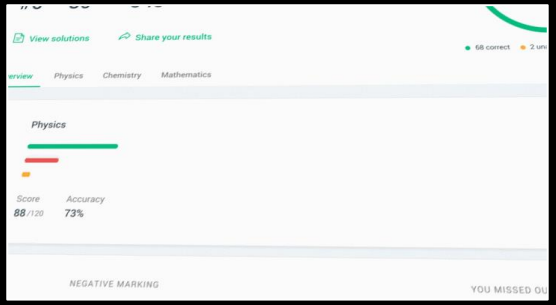
jee











+ LIVE Class Environment

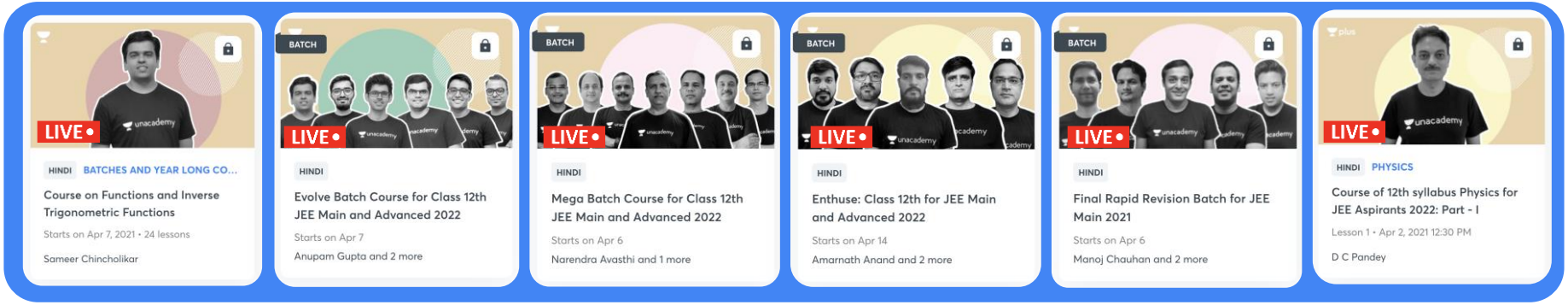
- **LIVE Polls** & **Leaderboard**
- **LIVE Doubt** Solving
- **LIVE** Interaction

+ Performance Analysis

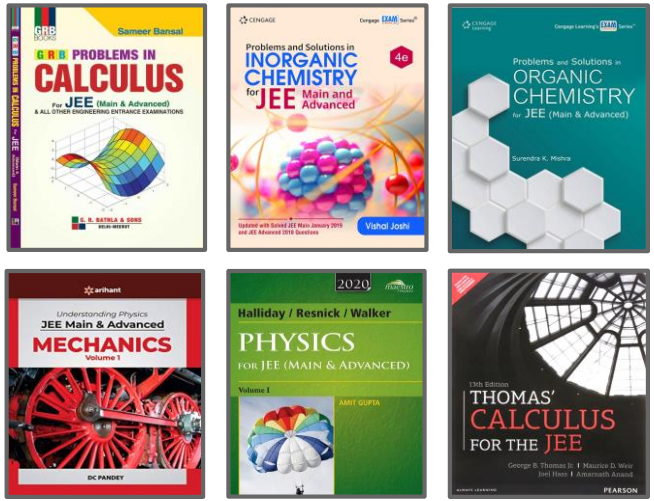
- **Weekly Test Series**
- **DPPs** & **Quizzes**

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

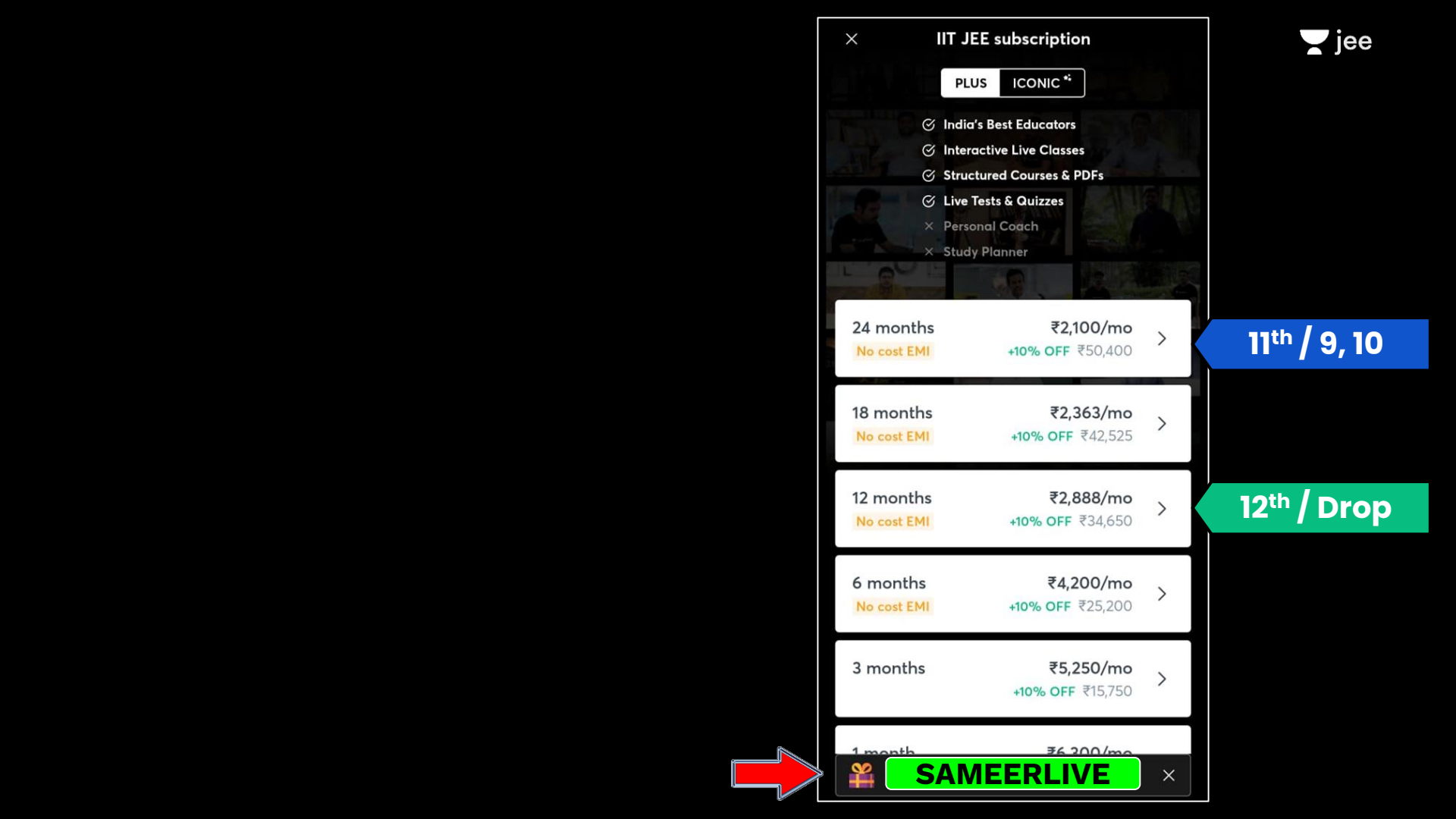
Ayush Kale
98.85

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

LET'S BEGIN!!

Homework Question

Solve: $\cos^2\left(x+\frac{\pi}{3}\right)=\sin^2\left(\frac{\pi}{3}-x\right)$

$$\cos^2\left(x+\frac{\pi}{3}\right)=\cos^2\left(\frac{\pi}{2}-\left(\frac{\pi}{3}-x\right)\right)$$

$$\Rightarrow \cos^2\left(x+\frac{\pi}{3}\right)=\cos^2\left(\frac{\pi}{6}+x\right)$$

$$\left(x+\frac{\pi}{3}\right)=n\pi\pm\left(\frac{\pi}{6}+x\right)$$

$(+)$: $\cancel{x} + \frac{\pi}{3} = n\pi + \frac{\pi}{6} + \cancel{x}$

ignore

$(-)$: $x + \frac{\pi}{3} = n\pi - \frac{\pi}{6} - x$

$2x = n\pi - \frac{\pi}{2}$

$$\boxed{x = n\frac{\pi}{2} - \frac{\pi}{4}} \; ; \; n \in I$$

Methods to solve T-Equations

1. Use of Factorization

- Factorization gives us smaller equations which can then be solved easily.
- Equations in quadratic form or equations that can be converted to quadratic form can be factorized by 'splitting the middle term' method.

$$AB + B \cdot C = 0$$

$$B(A + C) = 0$$

Find the principle and general solution of the following equation:
$(2\sin x - \cos x)(1 + \cos x) = \sin^2 x$

$$(2\sin x - \cos x)(1+\cos x) = \sin^2 x$$

$$(2\sin x - \cos x)(1+\cos x) - \sin^2 x = 0$$

$$(2\sin x - \cos x)(1+\cos x) - (1 - \cos^2 x) = 0$$

$$(1+\cos x)\left[(2\sin x - \cos x) - (1 - \cos x)\right] = 0$$

$(1+\cos x)(2\sin x-1)=0$

Case-1: $1+\cos x=0$

$\cos x=-1$

$x=(2n+1)\pi \quad n\in I$

at $n=0 \Rightarrow x=\pi$

Case-2:

$2\sin x-1=0$

$\sin x=\frac{1}{2}$

$x=n\pi+(-1)^n\frac{\pi}{6} \quad n\in I$

at $n=0 \Rightarrow x=\frac{\pi}{6}$

$n=1 \Rightarrow x=\frac{5\pi}{6}$

Solve: $2\cos^2 x + 3\sin x = 0$

$2\cos^2 x + 3\sin x = 0$

$2(1-\sin^2 x) + 3\sin x = 0$

$2 - 2\sin^2 x + 3\sin x = 0$

$2\sin^2 x - 3\sin x - 2 = 0$

$2\sin^2 x - 4\sin x + \sin x - 2 = 0$

$2\sin x(\sin x - 2) + 1(\sin x - 2) = 0$

$(\sin x - 2)(2\sin x + 1) = 0$

Case-1: $\sin x - 2 = 0$

$\Rightarrow \sin x = 2$

✗ Not possible

jee

C-2: $2\sin x + 1 = 0$

$$\sin x = \frac{-1}{2}$$

$$\boxed{x = n\pi + (-1)^n \left(-\frac{\pi}{6}\right)}$$

where $n \in I$

Solve the following equation:
$2\sin^2 2x - 6\cos^2 x + 1 = 0$

$$2\sin^2 2x - 6\cos^2 x + 1 = 0$$

$$\Rightarrow 2(2\sin x \cos x)^2 - 6\cos^2 x + 1 = 0$$

$$\Rightarrow 8\sin^2 x \cos^2 x - 6\cos^2 x + 1 = 0$$

$$\Rightarrow 8(1 - \cos^2 x)\cos^2 x - 6\cos^2 x + 1 = 0$$

Let $\cos^2 x = t$

$8(1-t)(t) - 6t + 1 = 0$

$8t - 8t^2 - 6t + 1 = 0$

$-8t^2 + 2t + 1 = 0$

$8t^2 - 2t - 1 = 0$

$8t^2 - 4t + 2t - 1 = 0$

$4t(2t-1) + 1(2t-1) = 0$

$(2t-1)(4t+1) = 0$

Case-1

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

$\Rightarrow \cos^2 x = \frac{1}{2}$

$x = n\pi \pm \frac{\pi}{4}$

Case-2:

$t = -\frac{1}{4}$

Reject

Solve the following equation:
$(1 + \tan\theta)(1 - \sin 2\theta) = (1 - \tan\theta)$

$$(1+\tan\theta)(1-\sin 2\theta) = (1-\tan\theta)$$

$$\Rightarrow (1+\tan\theta)\left(1 - \frac{2\tan\theta}{1+\tan^2\theta}\right) = (1-\tan\theta)$$

$$(1+\tan\theta)\left(\frac{(1-\tan\theta)^2}{(1+\tan^2\theta)}\right) - (1-\tan\theta) = 0$$

$$(1-\tan\theta)\left[\frac{1-\tan^2\theta}{1+\tan^2\theta}-1\right]=0$$

$$(1-\tan\theta)\left[\cos 2\theta-1\right]=0$$

Case-1: $\tan\theta = 1$

$$\theta = n\pi + \frac{\pi}{4}, \quad n \in I$$

Case-2:

$\cos 2\theta = 1$

$2\theta = 2n\pi$

$$\theta = n\pi$$

where; $n \in I$

Find the principle solutions of the following equation:

$$16^{\sin^2 x} + 16^{\cos^2 x} = 10$$

$$16^{\sin^2 x} + 16^{(1-\sin^2 x)} = 10$$

$$16^{\sin^2 x} + \frac{16}{16^{\sin^2 x}} = 10$$

Let $16^{\sin^2 x} = t$

$$t + \frac{16}{t} = 10$$

$$t^2 - 10t + 16 = 0$$

$$(t-2)(t-8) = 0$$

$t = 2$; $t = 8$

Case-1 , $t = 2^{4\sin^2 x} = 2^1$

$\Rightarrow 4\sin^2 x = 1$

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

$x = n\pi \pm \frac{\pi}{6}$, $n \in I$

Case-2: $2^{4\sin^2 x} = 2^3$

$4\sin^2 x = 3$

$\Rightarrow \sin^2 x = \frac{3}{4}$

$\sin^2 x = \left(\frac{\sqrt{3}}{2}\right)^2$

$x = n\pi \pm \frac{\pi}{3}$

$n \in I$

Principle values:

C-1: $\frac{\pi}{6}$; $\frac{5\pi}{6}$; $\frac{7\pi}{6}$; $\frac{11\pi}{6}$

C-2: $\frac{\pi}{3}$; $\frac{2\pi}{3}$; $\frac{4\pi}{3}$; $\frac{5\pi}{3}$

2. Use of Quadratic Formula

- Equations in quadratic form can be simplified by using ‘quadratic formula’.

Solve: $2\cos^2 x + 4\cos x = 3\sin^2 x$

$$2\cos^2 x + 4\cos x = 3\sin^2 x$$

$$2\cos^2 x + 4\cos x = 3(1 - \cos^2 x)$$

$$5\cos^2 x + 4\cos x - 3 = 0$$

$$\cos x = \frac{-4 \pm \sqrt{16 - 4(5)(-3)}}{2(5)}$$

$$\cos x = \frac{-4 \pm 2\sqrt{19}}{10}$$

$$\cos x = \frac{-2 \pm \sqrt{19}}{5}$$

Case-1 : $\cos x = \frac{-2-\sqrt{19}}{5}$

X reject

Case-2 :

$$\cos x = \frac{-2+\sqrt{19}}{5}$$

Let.

$$\cos\alpha = \frac{\sqrt{19}-2}{5}$$

$\therefore \cos x = \cos\alpha$

$$x = 2n\pi \pm \alpha$$

where: $n \in I$

& $\alpha = \cos^{-1}\left(\frac{\sqrt{19} - 2}{5}\right)$

3. Use of Transformation Formula (Trigonometry)

1. $$\sin C + \sin D = 2 \sin \frac{C + D}{2} \cos \frac{C - D}{2}$$

2. $$\sin C - \sin D = 2 \cos \frac{C + D}{2} \sin \frac{C - D}{2}$$

3. $$\cos C + \cos D = 2 \cos \frac{C + D}{2} \cos \frac{C - D}{2}$$

4. $$\cos C - \cos D = 2 \sin \frac{C + D}{2} \sin \frac{D - C}{2}$$

Solve: cos 3x + sin 2x - sin 4x = 0

$$\cos 3x + \sin 2x - \sin 4x = 0$$

$$\cos 3x + 2\sin\left(\frac{2x-4x}{2}\right)\cos\left(\frac{2x+4x}{2}\right) = 0$$

$$(\cos 3x)(1 - 2\sin x) = 0$$

Case-1 : $\cos 3x = 0$

$$3x = (2n+1)\frac{\pi}{2}$$

$$x = (2n+1)\frac{\pi}{6}$$

Case-2 : $1 - 2\sin x = 0$

$$\sin x = \frac{1}{2}$$

$$x = n\pi + (-1)^n \frac{\pi}{6}$$

Solve : sin x + sin 5x = sin 3x (0 ≤ x ≤ π)

$$\sin x + \sin 5x = \sin 3x \; ; \; (0 \le x \le \pi)$$

$$2\sin(3x)\cos(-2x) - \sin 3x = 0$$

$$(\sin 3x)(2\cos 2x - 1) = 0$$

Case-1: $\sin 3x = 0$

$3x = n\pi$

$$x = \frac{n\pi}{3} \; ; n \in I$$

n	x
0	0
1	$\pi/3$
2	$2\pi/3$
3	π

Case-2: $\cos 2x = \frac{1}{2}$

$2x = 2n\pi \pm \pi$

$$x = n\pi \pm \frac{\pi}{6}$$

$n = 0 \; ; \; \pi/6$

$= 1 \; ; \; 5\pi/6$

Solve: 5sinx + 6sin2x + 5sin3x + sin4x = 0

$$5\sin x + 6\sin 2x + 5\sin 3x + \sin 4x = 0$$

HW.

#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

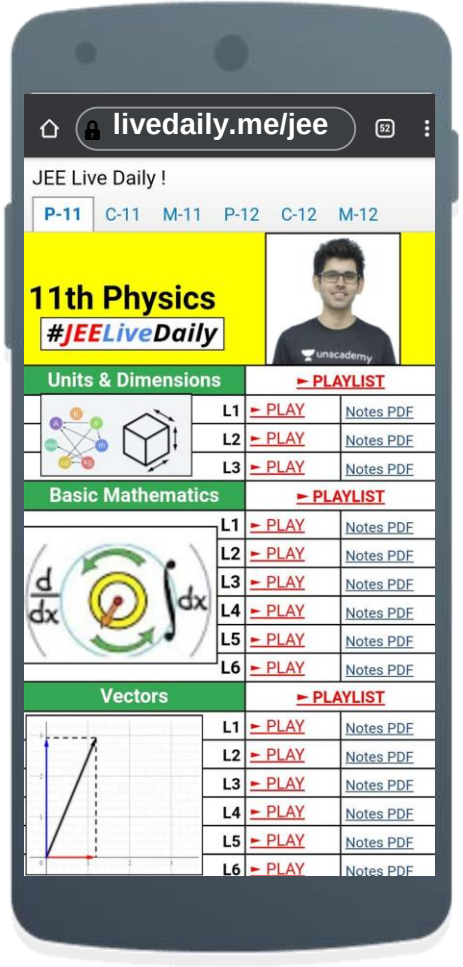
Anupam Sir | Chemistry

3:00 - 4:30 PM

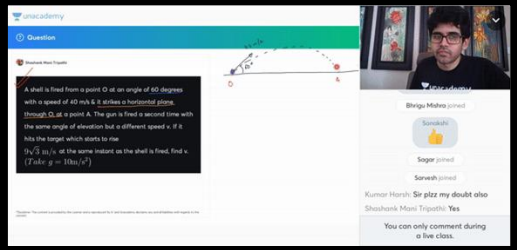
Nishant Sir | Maths

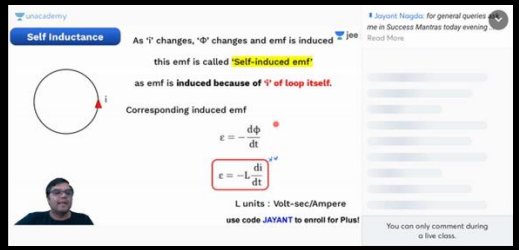
4:30 - 6:00 PM

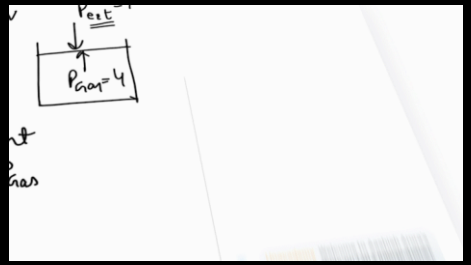
livedaily.me/jee

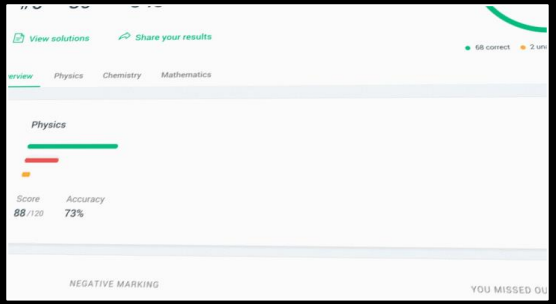


Unacademy Subscription









+ LIVE Class Environment

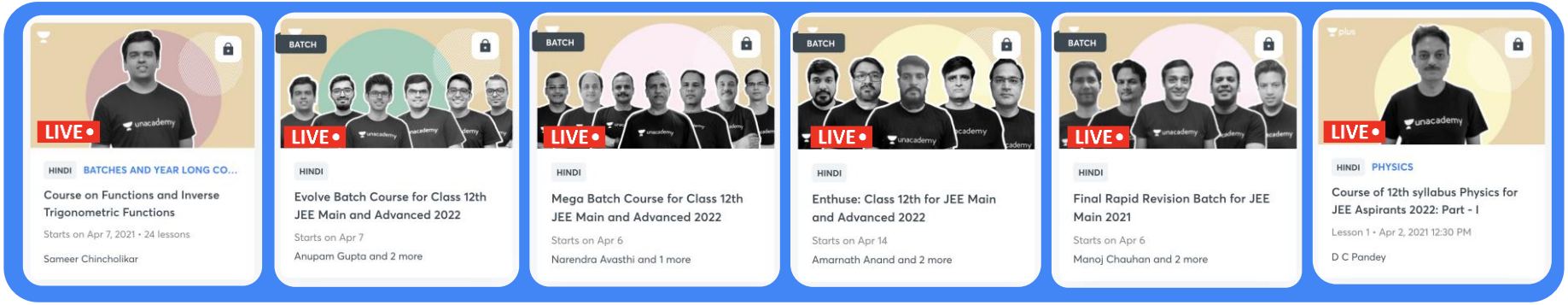
- **LIVE Polls** & **Leaderboard**
- **LIVE Doubt** Solving
- **LIVE** Interaction

+ Performance Analysis

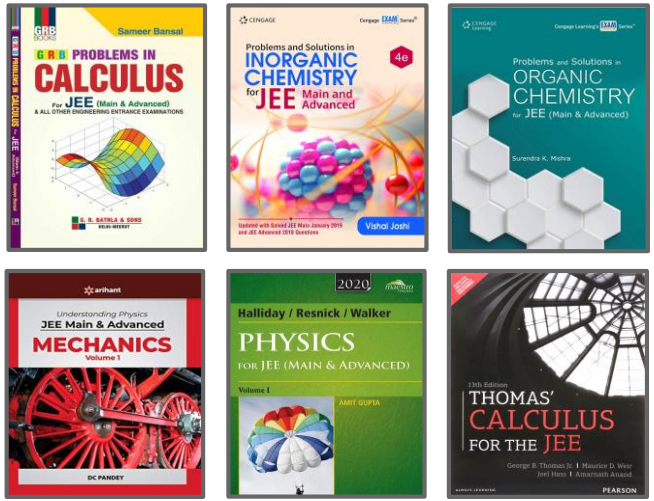
- **Weekly Test Series**
- **DPPs** & **Quizzes**

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

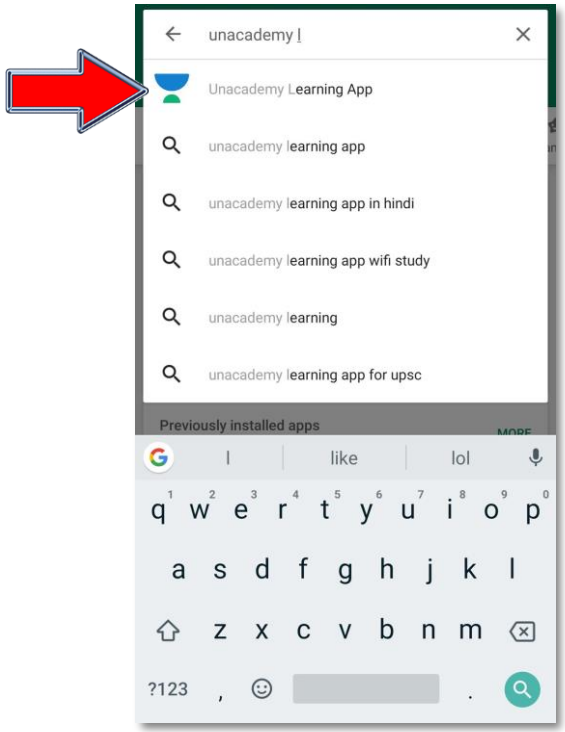
Megh Gupta
98.59

Naman Goyal
98.48

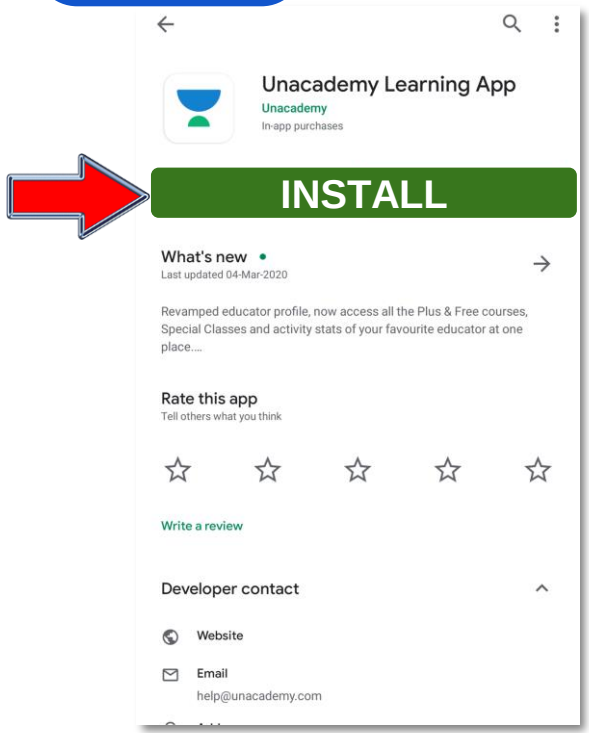
MIHIR PRAJAPATI
98.16

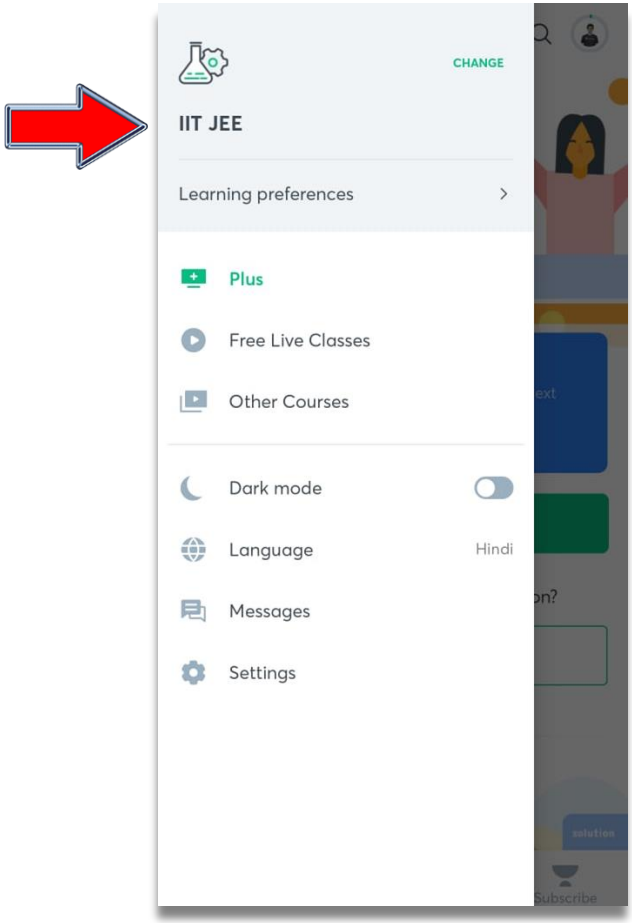
jee

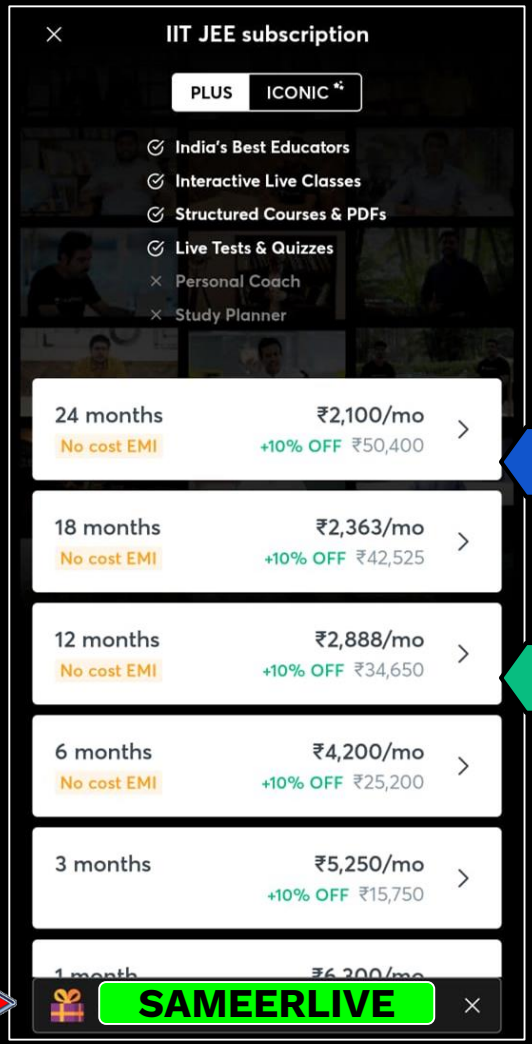
Step 1



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

unacademy

IIT JEE MEGA SUBSCRIPTION OFFER

For 2022 Aspirants

Buy 1 Year Unacademy Subscription and get additional

3 MONTHS FREE

For 2023 Aspirants

Buy 2 Year Unacademy Subscription and get additional

4 MONTHS FREE

Last Date 26th May

jee

EMERGE 3.0 BATCH

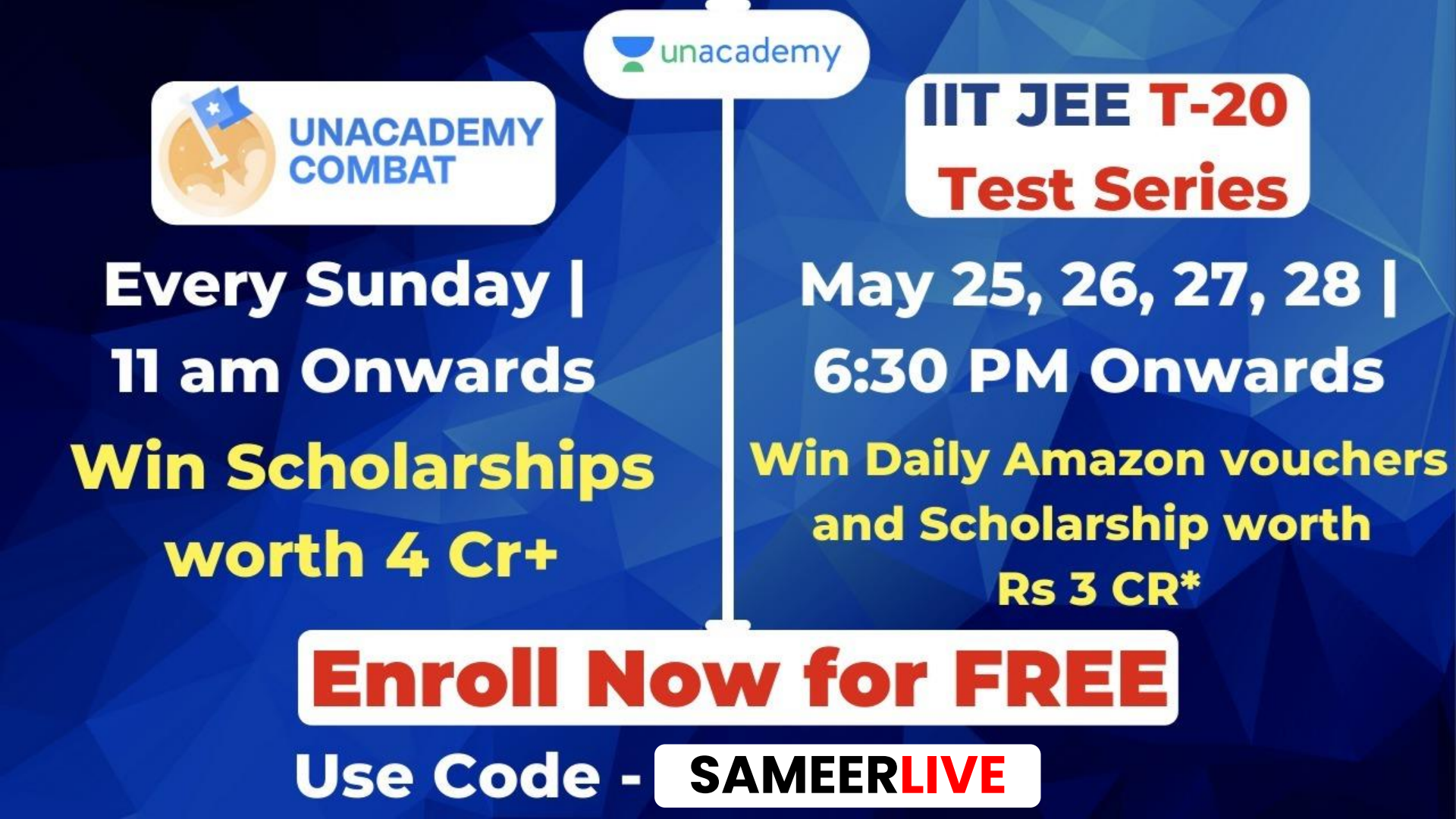
JEE Main & Advanced 2023

Started on 12th May

Upcoming Batches in May

unacademy

Spark 3.0 Batch : JEE Main & Advanced 2023	Starts on 26th May 2021
Emerge Batch (Class 11th) : JEE Main & Advanced 2023	Starts on 26th May 2021
Emerge Batch (Class 11th) : JEE Main & Advanced 2023	Starts on 26th May 2021
Emerge Batch (Class 11th) : JEE Main & Advanced 2023	Starts on 27th May 2021
Bull Eye Batch (Class 11th) : JEE Main & Advanced 2023	Starts on 26th May 2021
Sanjivani Batch : MHT-CET 2021	Started on 26th May 2021


unacademy
UNACADEMY COMBAT
IIT JEE T-20 Test Series
Every Sunday | 11 am Onwards
May 25, 26, 27, 28 | 6:30 PM Onwards
Win Scholarships worth 4 Cr+
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 !