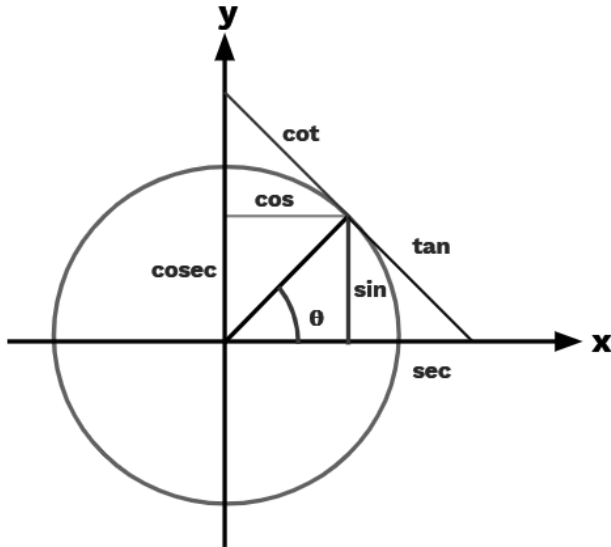


Trigonometric Equations

1



Sameer Chincholikar
B.Tech, M.Tech - IIT-Roorkee

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

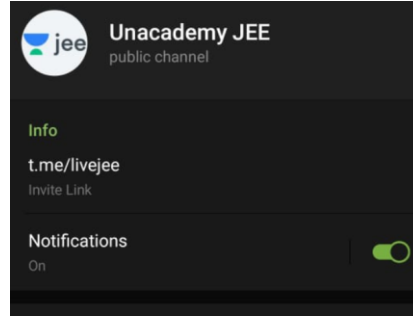
 **sameer_iitr**

 **#JEE** *Live* **Daily**





Telegram Channel



Search



Sameer Chincholikar ✓

#1 Educator in Mathematics · IIT JEE

#Follow for JEE Advanced and JEE Main Courses #10+ years of experience online
#Mentor to Aspiring JEE teachers # IIT Roorkee

Follow

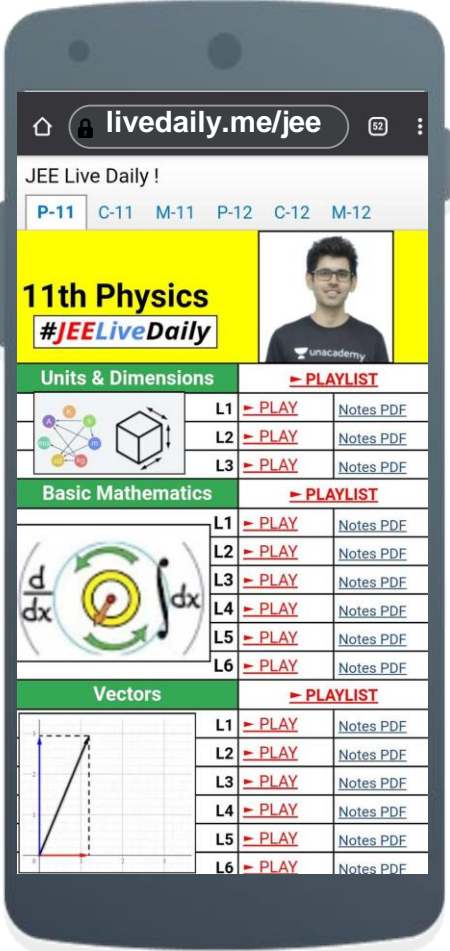
49M Watch mins

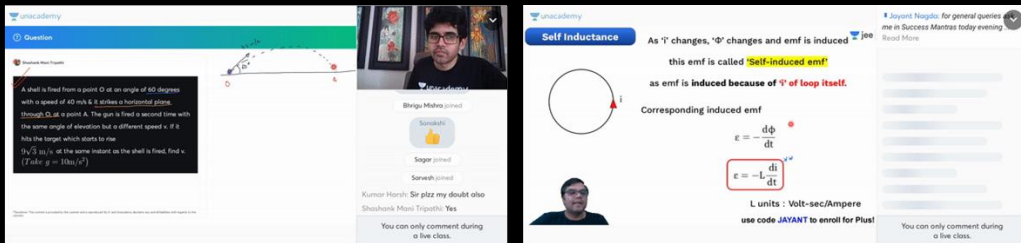
2M Watch mins (last 30 days)

79K Followers

10K Dedications







Unacademy

Questions

A shell is fired from a point O at an angle of 60 degrees with a speed of 40 m/s & it strikes a horizontal plane through O at a point A. The gun is fired a second time with the same angle of elevation but a different speed v . If it hits the target which starts to rise $(\sqrt{3}/2) \text{ m/s}^2$ at the same instant as the shell is fired, find v . (Take $g = 10 \text{ m/s}^2$)

Shruti Mishra joined

Sagar joined

Saravali joined

Kumar Harsh: Sir plz my doubt also

Shashank Masi Tripathi: Yes

You can only comment during a live class.

Self Inductance

As \vec{I} changes, $\vec{\Phi}$ changes and emf is induced

this emf is called **Self-induced emf**

as emf is induced because of \vec{I} of loop itself.

Corresponding induced emf

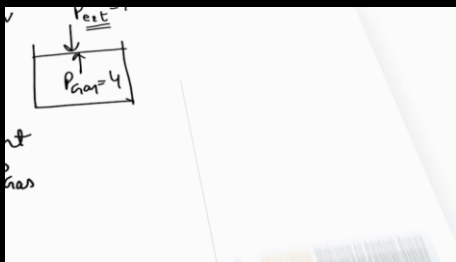
$$\mathcal{E} = -\frac{d\Phi}{dt}$$

$$\mathcal{E} = -L \frac{dI}{dt}$$

Units: Volt-sec/Ampere

use code JAYANT to enroll for Plus!

You can only comment during a live class.



+ LIVE Class Environment

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



+ Performance Analysis

- + Weekly Test Series
- + DPPs & Quizzes

+ India's BEST Educators

Unacademy Subscription



LIVE

HINDI BATCHES AND YEAR LONG CO...

Course on Functions and Inverse Trigonometric Functions

Starts on Apr 7, 2021 • 24 lessons

Sameer Chincholikar



LIVE

HINDI

Evolve Batch Course for Class 12th JEE Main and Advanced 2022

Starts on Apr 7

Anupam Gupta and 2 more



LIVE

HINDI

Mega Batch Course for Class 12th JEE Main and Advanced 2022

Starts on Apr 6

Narendra Avasthi and 1 more



LIVE

HINDI

Enthuse: Class 12th for JEE Main and Advanced 2022

Starts on Apr 14

Amarnath Anand and 2 more



LIVE

HINDI

Final Rapid Revision Batch for JEE Main 2021

Starts on Apr 6

Manoj Chauhan and 2 more



LIVE

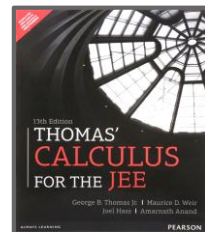
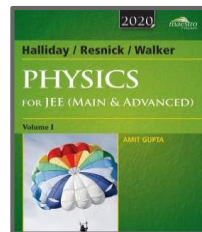
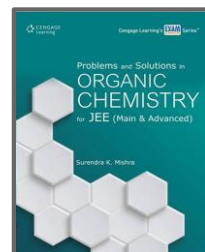
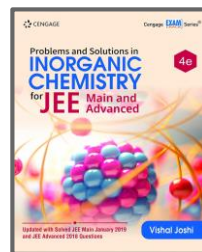
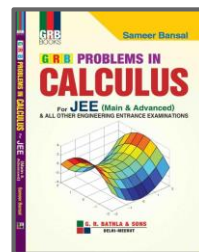
HINDI PHYSICS

Course of 12th syllabus Physics for JEE Aspirants 2022: Part - I

Lesson 1 • Apr 2, 2021 12:30 PM

D C Pandey

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



Vaishnavi 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

₹2,100/mo



No cost EMI

+10% OFF ₹50,400

18 months

₹2,363/mo



No cost EMI

+10% OFF ₹42,525

12 months

₹2,888/mo



No cost EMI

+10% OFF ₹34,650

6 months

₹4,200/mo



No cost EMI

+10% OFF ₹25,200

3 months

₹5,250/mo



+10% OFF ₹15,750

1 month

₹6,200/mo



SAMEERLIVE



11th / 9, 10

12th / Drop



LET'S BEGIN!!

Trigonometric Equations





Examples of Trigonometric Equations

1

$$\sin \theta = \frac{\sqrt{3}}{2}$$

2

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



Examples of Trigonometric Equations

1

$$\sin \theta = \frac{\sqrt{3}}{2}$$

$$\theta = \frac{\pi}{3}, \frac{2\pi}{3}, (2\pi + \frac{\pi}{3}), (2\pi + \frac{2\pi}{3})$$

$$* \sin(\pi - \theta) = \sin \theta$$

$$* \sin(2n\pi + \theta) = \sin \theta$$

$$\theta = 2n\pi + \frac{\pi}{3}, n \in \mathbb{I}$$

$$\theta = 2n\pi + \frac{2\pi}{3}; n \in \mathbb{I}$$

$$\theta = \underline{(2n)}\pi + \frac{\pi}{3}$$

$$\theta = 2n\pi + \pi - \frac{\pi}{3}$$

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

$$\theta = m\pi + (-1)^m \frac{\pi}{3}$$

$$m \in \mathbb{I}$$



Principle solution and General Solution

$$\left(\text{eg. } \sin \theta = \frac{\sqrt{3}}{2} \right)$$

$$\theta \in [0, 2\pi]$$

$$\rightarrow \left\{ \frac{\pi}{3}, \frac{2\pi}{3} \right\}$$

$$\theta = m\pi + (-1)^m \frac{\pi}{3}$$

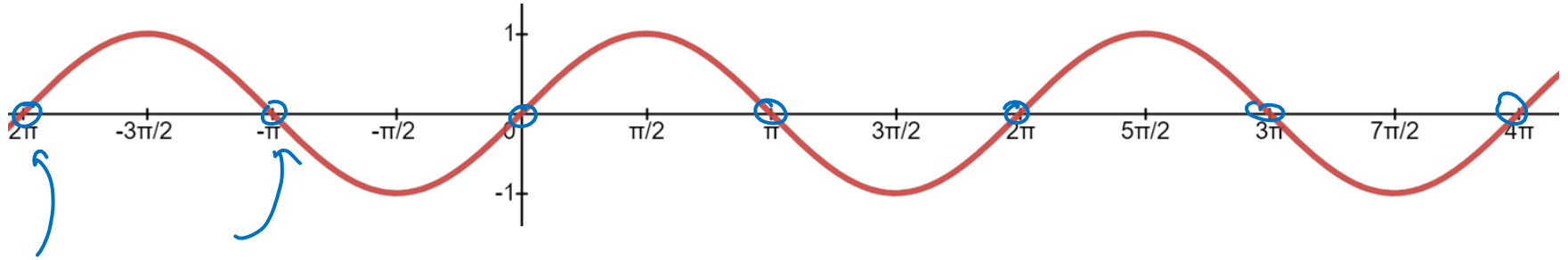
$$m \in \mathbb{I}$$

Simple T-Equations



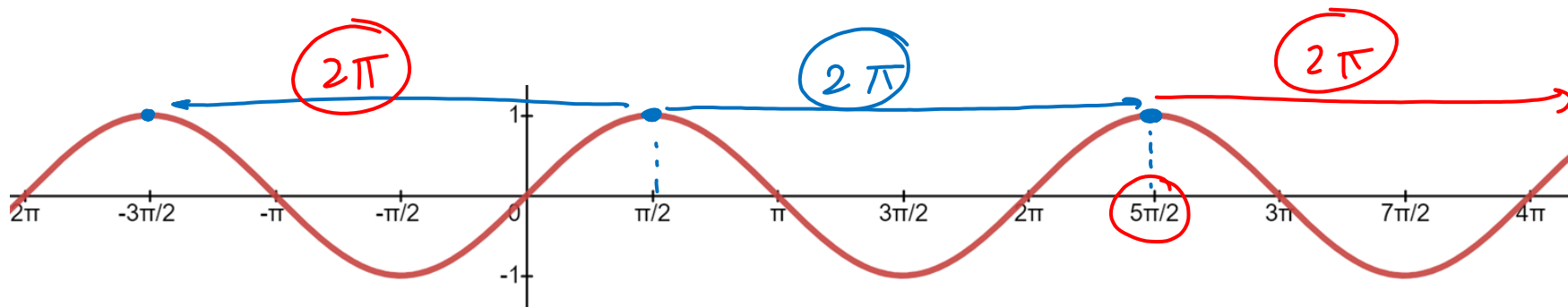


$$1. \sin \theta = 0 \Rightarrow \theta = n\pi, n \in \mathbb{I}$$



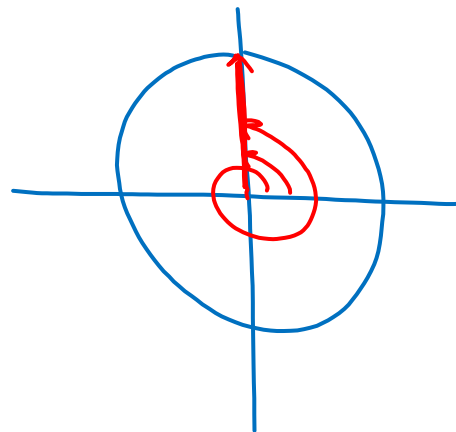


$$2. \sin \theta = 1 \Rightarrow \theta = (4n + 1) \frac{\pi}{2}, n \in \mathbb{I}$$



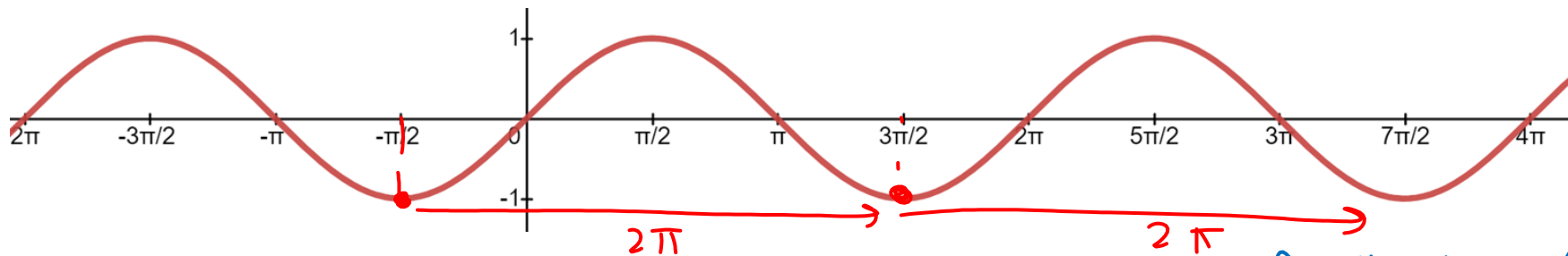
$$2n\pi + \frac{\pi}{2}$$

$$(4n+1) \frac{\pi}{2} \quad n \in \mathbb{I}$$





$$3. \sin \theta = -1 \Rightarrow \theta = (4n - 1) \frac{\pi}{2}, n \in \mathbb{I}$$



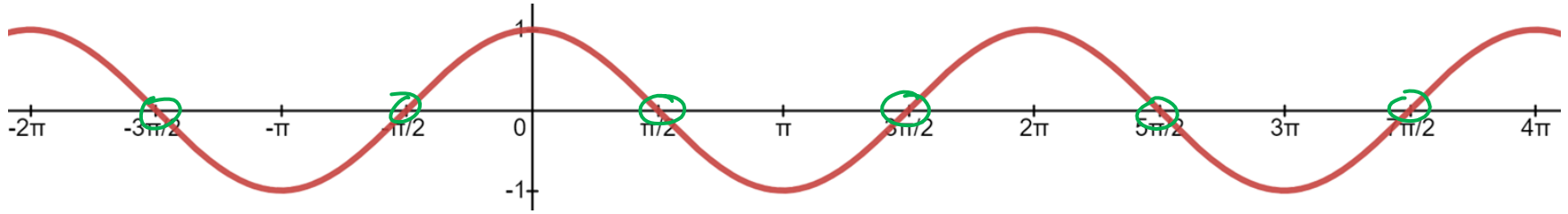
$$\left\{ \begin{array}{l} 2n\pi - \boxed{\frac{\pi}{2}}; n \in \mathbb{I} \\ (4n-1) \frac{\pi}{2}; n \in \mathbb{I} \end{array} \right.$$

Another format

$$\left\{ \begin{array}{l} 2n\pi + \frac{3\pi}{2}; n \in \mathbb{I} \\ (4n+3) \frac{\pi}{2}; n \in \mathbb{I} \end{array} \right.$$



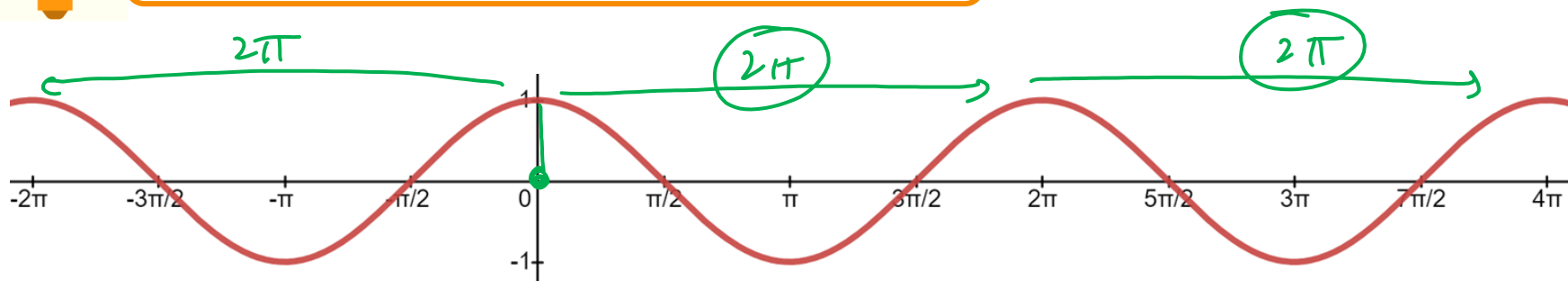
$$4. \cos \theta = 0 \Rightarrow \theta = (2n + 1) \frac{\pi}{2}, n \in \mathbb{I}$$



odd multiples of " $\frac{\pi}{2}$ "



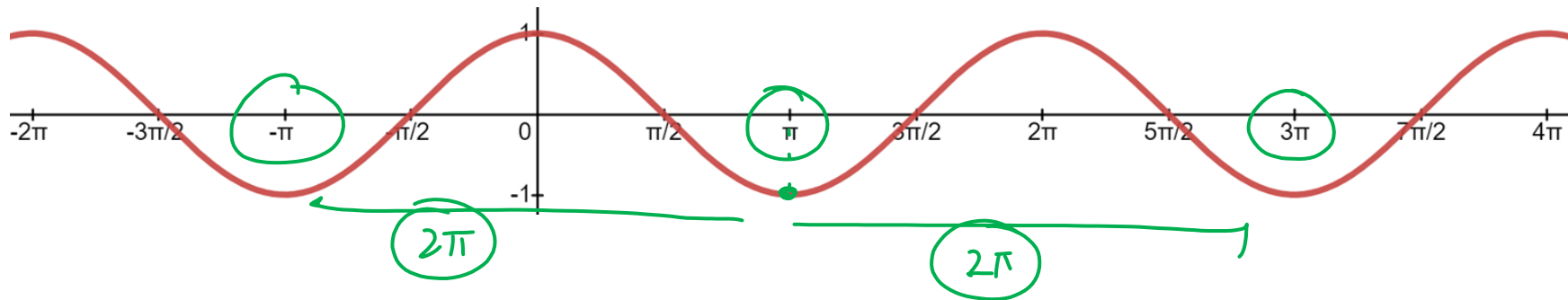
$$5. \cos \theta = 1 \Rightarrow \theta = 2n\pi, n \in \mathbb{I}$$



$$2n\pi + 0, n \in \mathbb{I}$$



$$6. \cos \theta = -1 \Rightarrow \theta = (2n + 1)\pi, n \in \mathbb{I}$$



$$2n\pi + \pi ; n \in \mathbb{I}$$

$$(2n+1)\pi ; n \in \mathbb{I}$$

General Solution of Standard T-Equations





1. $\sin \theta = \sin \alpha$

$$\Rightarrow \theta = n\pi + (-1)^n \alpha \quad \text{where } \alpha \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right], n \in \mathbb{I}$$

Eg: $\sin \theta = \frac{\sqrt{3}}{2}$

$$\sin \theta = \sin \frac{\pi}{3}$$

$$\Rightarrow \boxed{\theta = n\pi + (-1)^n \frac{\pi}{3}}$$

$n \in \mathbb{I}$

Proof:

$$\sin \theta = \sin \alpha$$

$$\sin \theta - \sin \alpha = 0$$

$$\sin\left(\frac{\theta - \alpha}{2}\right) \cdot \cos\left(\frac{\theta + \alpha}{2}\right) = 0$$

Case-1 : $\sin\left(\frac{\theta-\alpha}{2}\right) = 0$

$$\frac{\theta-\alpha}{2} = n\pi$$

$$\theta = 2n\pi + \alpha$$

Case-2 : $\cos\left(\frac{\theta+\alpha}{2}\right) = 0$

$$\frac{\theta+\alpha}{2} = (2n+1)\frac{\pi}{2}$$

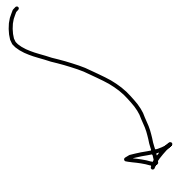
$$\theta = (2n+1)\pi - \alpha$$

$$\theta = n\pi + (-1)^n \alpha$$

$$n \in \mathbb{I}$$



Solve: $\sin \theta = \frac{1}{2}$



$$\sin \theta = \sin \frac{\pi}{6}$$

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

$$n \in \mathbb{I}$$

$$\left\{ \frac{\pi}{6}, \frac{5\pi}{6} \right\}$$



Solve: $\sin\left(\theta + \frac{\pi}{6}\right) = -\frac{1}{\sqrt{2}}$

$$\sin\left(\theta + \frac{\pi}{6}\right) = \sin\left(-\frac{\pi}{4}\right)$$

$$\left(\theta + \frac{\pi}{6}\right) = n\pi + (-1)^n \left(-\frac{\pi}{4}\right)$$

$$\theta = n\pi + (-1)^n \left(-\frac{\pi}{4}\right) - \frac{\pi}{6} \quad \text{Where: } n \in \mathbb{I}$$



$$2. \cos \theta = \cos \alpha$$

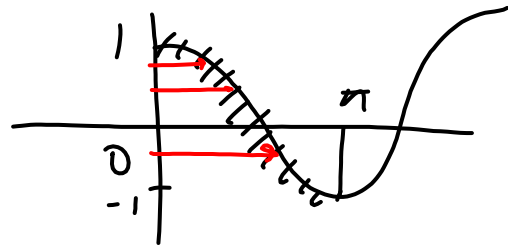
$$\Rightarrow \theta = 2n\pi \pm \alpha \text{ where } \alpha \in [0, \pi], n \in \mathbb{I}$$

$$\cos \theta - \cos \alpha = 0$$

$$-2 \sin\left(\frac{\theta + \alpha}{2}\right) \sin\left(\frac{\theta - \alpha}{2}\right) = 0$$

$$\text{Case-1: } \sin\left(\frac{\theta + \alpha}{2}\right) = 0$$

$$\frac{\theta + \alpha}{2} = n\pi$$



$$\theta = 2n\pi - \alpha ; n \in \mathbb{I}$$

$$\text{Case-2: } \sin\left(\frac{\theta - \alpha}{2}\right) = 0$$

$$\frac{\theta - \alpha}{2} = n\pi$$

$$\theta = 2n\pi + \alpha , n \in \mathbb{I}$$



Solve: $\cos 3\theta = \frac{\sqrt{3}}{2}$

$$\cos(3\theta) = \cos\left(\frac{\pi}{6}\right)$$

$$3\theta = 2n\pi \pm \left(\frac{\pi}{6}\right)$$

$$\boxed{\theta = \frac{2n\pi}{3} \pm \frac{\pi}{18}} \quad n \in \mathbb{I}$$



Solve: $\sec 2x = -2$

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

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

$$2x = 2n\pi \pm \frac{2\pi}{3}$$

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

$$a \in [0, \pi]$$

\oplus

\ominus

$$\left(0, \frac{\pi}{2}\right)$$

$$\left(\frac{\pi}{2}, \pi\right)$$

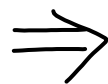
$$\cos \frac{\pi}{3} = \frac{1}{2}$$

$$\cos\left(\pi - \frac{\pi}{3}\right) = -\cos \frac{\pi}{3} = \left(-\frac{1}{2}\right)$$



Solve: $\cos 2\theta = \frac{1}{3}$

Let: $\cos \alpha = \frac{1}{3}$



$$\boxed{\alpha = \cos^{-1} \frac{1}{3}}$$

$\cos 2\theta = \cos \alpha$

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

$$\boxed{\theta = n\pi \pm \frac{\alpha}{2}}$$

, where: $\alpha = \cos^{-1} \frac{1}{3}$ & $n \in \mathbb{I}$



$$3. \tan \theta = \tan \alpha$$

$$\Rightarrow \theta = \underline{n\pi + \alpha} \text{ where } \alpha \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right), n \in \mathbb{I}$$

$$\frac{\sin \theta}{\cos \theta} = \frac{\sin \alpha}{\cos \alpha}$$

$$\sin \theta \cos \alpha = \sin \alpha \cos \theta$$

$$\sin \theta \cos \alpha - \sin \alpha \cos \theta = 0$$

$$\sin(\theta - \alpha) = 0$$

$$\theta - \alpha = n\pi$$

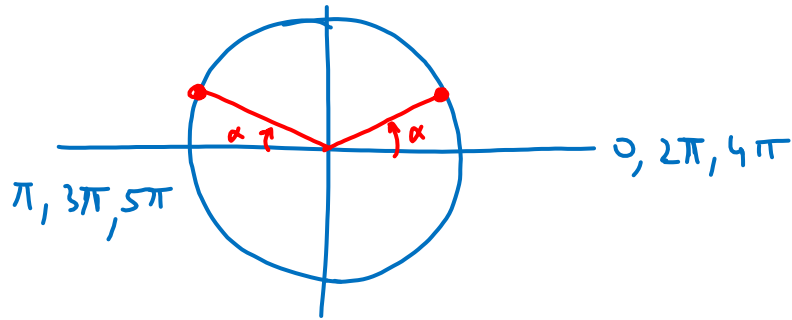
$$\theta = n\pi + \alpha$$

$$n \in \mathbb{I}$$

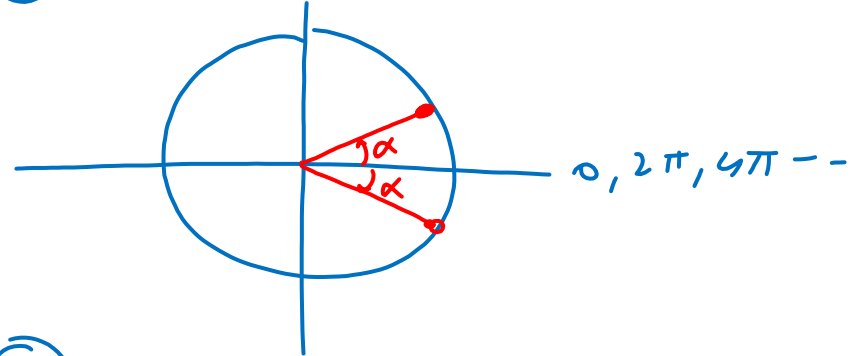


* Location:

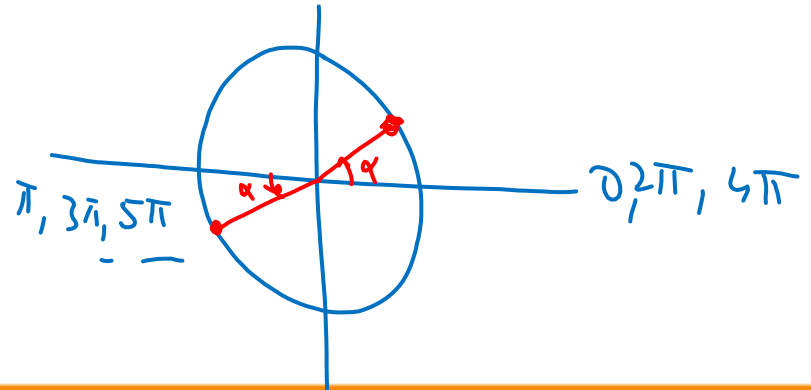
① $\sin \theta = \sin \alpha$



② $\cos \theta = \cos \alpha$



③ $\tan \theta = \tan \alpha$





Solve: $\tan 3x = -\cot \left(x + \frac{\pi}{6} \right)$

$$\tan \left(\frac{\pi}{2} + \theta \right) = -\cot \theta$$

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

$$\tan 3x = \tan \left(x + \frac{2\pi}{3} \right)$$

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

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

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

$$; n \in \mathbb{I}$$

4

If $\sin^2 \theta = \sin^2 \alpha$

$$\Rightarrow \theta = n\pi \pm \alpha, n \in \mathbb{I}$$

$$\sin^2 \theta - \sin^2 \alpha = 0$$

$$\sin(\theta + \alpha) \sin(\theta - \alpha) = 0$$

Case-1. $\sin(\theta + \alpha) = 0$

$$\theta + \alpha = n\pi$$

$$\theta = n\pi - \alpha$$

Case-2. $\sin(\theta - \alpha) = 0$

$$\theta - \alpha = n\pi$$

$$\theta = n\pi + \alpha$$

5

If $\cos^2 \theta = \cos^2 \alpha$

$$\Rightarrow \theta = n\pi \pm \alpha, n \in \mathbb{I}$$

$$1 - \sin^2 \theta = 1 - \sin^2 \alpha$$

$$\sin^2 \theta = \sin^2 \alpha$$

6

If $\tan^2 \theta = \tan^2 \alpha$

$$\Rightarrow \theta = n\pi \pm \alpha, n \in \mathbb{I}$$

$$\cancel{\sin^2 \theta} = \cancel{\sin^2 \alpha}$$

$$\cos^2 \theta = \cos^2 \alpha$$



Solve: $\cos^2 \frac{\theta}{2} = \frac{1}{2}$

$$\cos^2 \frac{\theta}{2} = \left(\frac{1}{\sqrt{2}} \right)^2$$

$$\cos^2 \frac{\theta}{2} = \cos^2 \left(\frac{\pi}{4} \right)$$

$$\frac{\theta}{2} = n\pi \pm \frac{\pi}{4}$$

$$\theta = 2n\pi \pm \frac{\pi}{2}$$

$$; n \in \mathbb{I}$$



Solve: $7 \sin^2 \theta + 3 \cos^2 \theta = 4$

$$\underline{7 \sin^2 \theta + 3(1 - \sin^2 \theta) = 4}$$

$$4 \sin^2 \theta = 1$$

$$\sin^2 \theta = \frac{1}{4}$$

$$\boxed{\sin^2 \theta = \sin^2 \frac{\pi}{6}}$$

$$\boxed{\theta = n\pi \pm \frac{\pi}{6}}$$

$$; n \in \mathbb{I}$$



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

HW



#JEELiveDaily Schedule



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

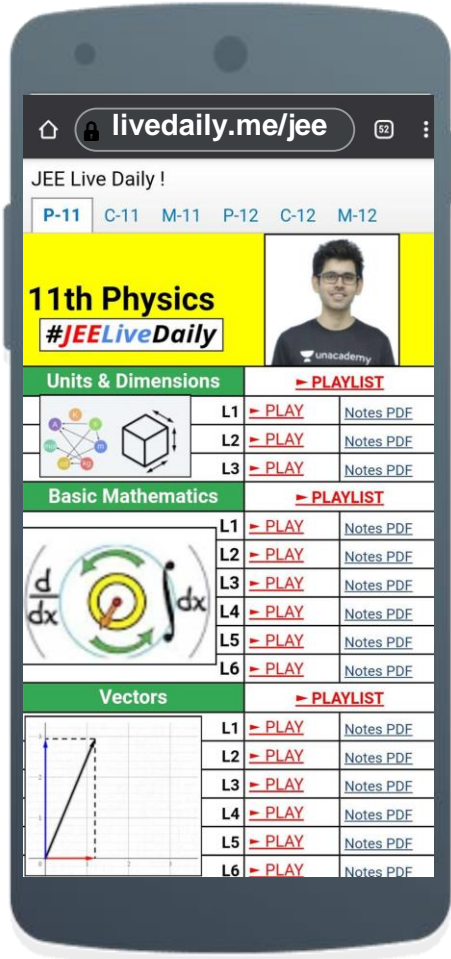
3:00 - 4:30 PM



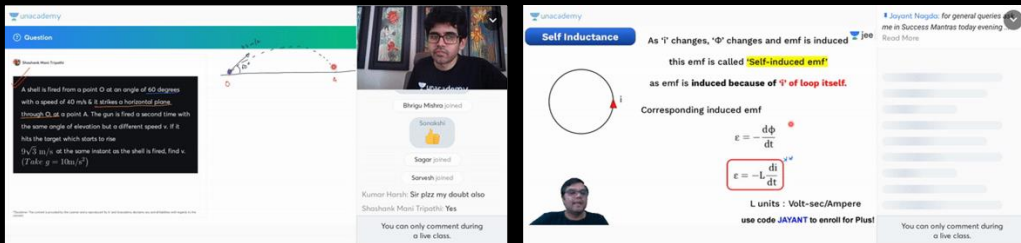
Nishant Sir | Maths

4:30 - 6:00 PM

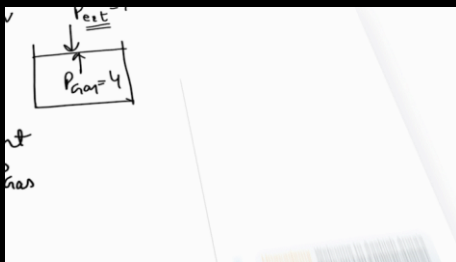
livedaily.me/jee



Unacademy Subscription

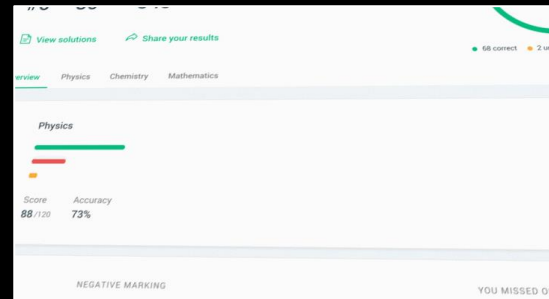
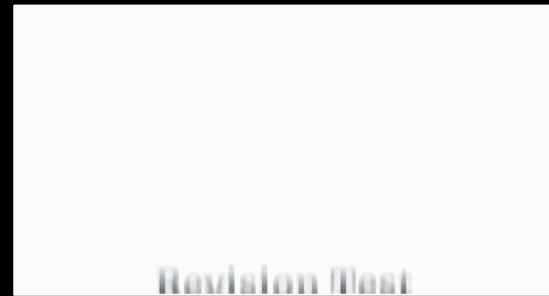


The image shows two screenshots from the Unacademy live class interface. The left screenshot displays a physics problem: "A shell is fired from a point O at an angle of 60 degrees with a speed of 40 m/s. It strikes a horizontal plane through O at a point A. The gun is fired a second time with the same angle of elevation but a different speed v . If it hits the target which starts to rise $(\sqrt{3}/2) \text{ m/s}^2$ at the same instant as the shell is fired, find v . (Take $g = 10 \text{ m/s}^2$)". The right screenshot shows a lecture on "Self Inductance" with the text: "As \vec{I} changes, $\vec{\Phi}$ changes and emf is induced. This emf is called **Self-induced emf** as emf is induced because of \vec{I} of loop itself." It also includes the formula for induced emf: $\mathcal{E} = -\frac{d\Phi}{dt}$ and $\mathcal{E} = -L \frac{di}{dt}$, and mentions "L units: Volt-sec/Ampere".



+ **LIVE** Class Environment

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

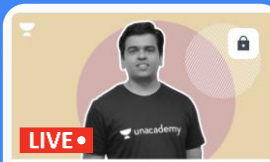


+ **Performance Analysis**

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

+ India's **BEST** Educators

Unacademy Subscription




LIVE

HINDI BATCHES AND YEAR LONG CO...

Course on Functions and Inverse Trigonometric Functions

Starts on Apr 7, 2021 • 24 lessons

Sameer Chincholikar




LIVE

HINDI

Evolve Batch Course for Class 12th JEE Main and Advanced 2022

Starts on Apr 7

Anupam Gupta and 2 more



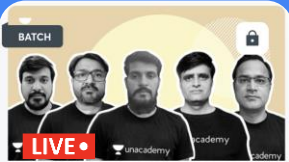
LIVE

HINDI

Mega Batch Course for Class 12th JEE Main and Advanced 2022

Starts on Apr 6

Narendra Avasthi and 1 more




LIVE

HINDI

Enthuse: Class 12th for JEE Main and Advanced 2022

Starts on Apr 14

Amarnath Anand and 2 more



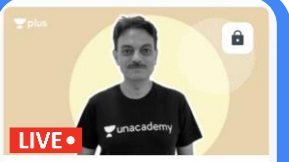
LIVE

HINDI

Final Rapid Revision Batch for JEE Main 2021

Starts on Apr 6

Manoj Chauhan and 2 more



LIVE

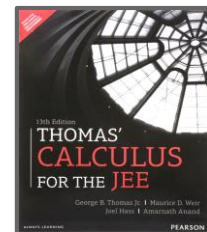
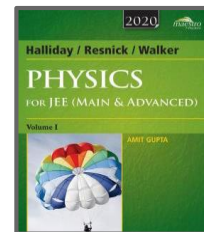
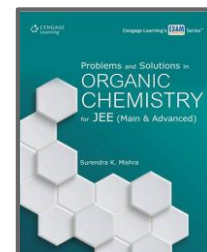
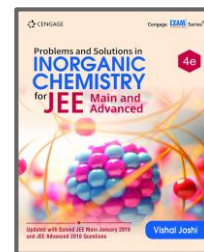
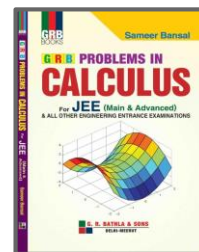
HINDI PHYSICS

Course of 12th syllabus Physics for JEE Aspirants 2022: Part - I

Lesson 1 • Apr 2, 2021 12:30 PM

D C Pandey

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



Vaishnavi 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

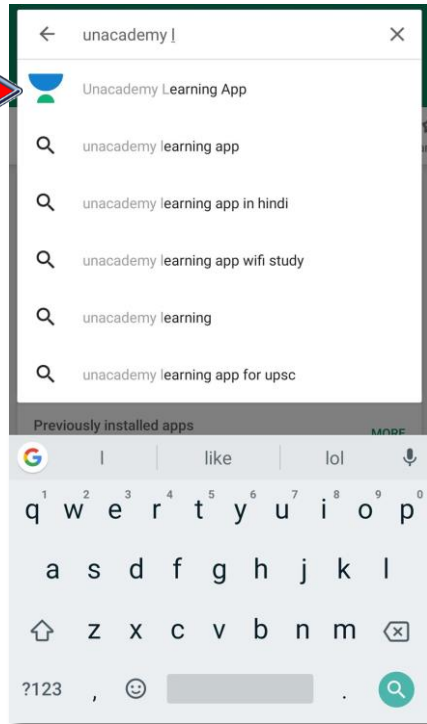


Naman Goyal
98.48

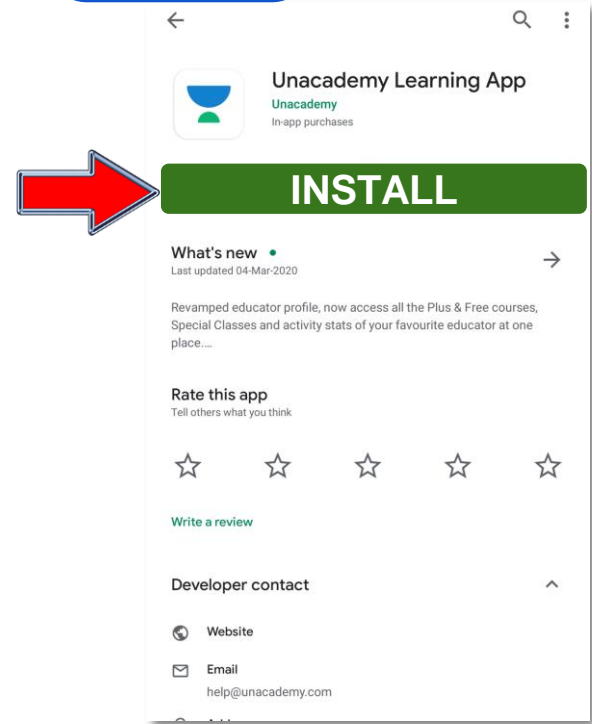


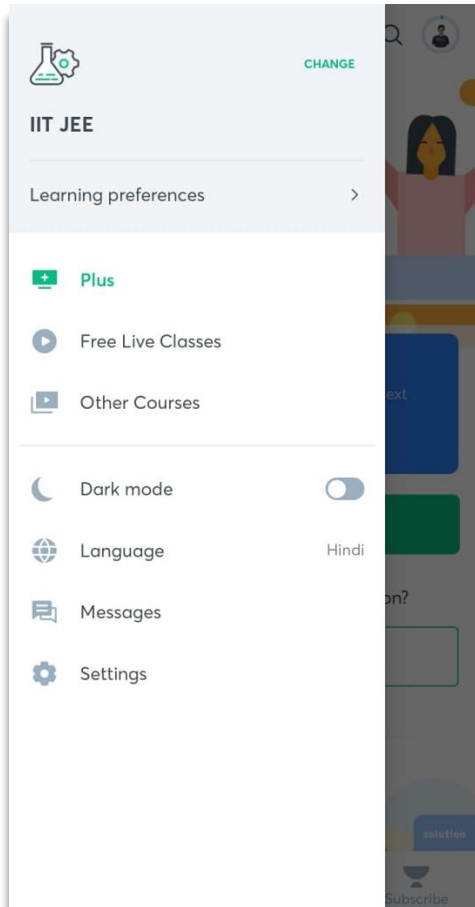
MIHIR PRAJAPATI
98.16

Step 1



Step 2







IIT JEE subscription

PLUS

ICONIC

- ✓ India's Best Educators
- ✓ Interactive Live Classes
- ✓ Structured Courses & PDFs
- ✓ Live Tests & Quizzes
- × Personal Coach
- × Study Planner

24 months

₹2,100/mo



No cost EMI

+10% OFF ₹50,400

11th / 9, 10

18 months

₹2,363/mo



No cost EMI

+10% OFF ₹42,525

12 months

₹2,888/mo



No cost EMI

+10% OFF ₹34,650

12th / Drop

6 months

₹4,200/mo



No cost EMI

+10% OFF ₹25,200

3 months

₹5,250/mo



+10% OFF ₹15,750

1 month

₹6,200/mo



SAMEERLIVE





IIT JEE MEGA SUBSCRIPTION OFFER

For 2022 Aspirants

Buy 1 Year Unacademy Subscription and get additional

2 MONTHS FREE

For 2023 Aspirants

Buy 2 Year Unacademy Subscription and get additional

3 MONTHS FREE

 **Last Date
26th May**



EMERGE 3.0 BATCH

JEE Main & Advanced 2023
Started on 12th May



Upcoming Batches in May



Emerge Batch (Class 11th) : JEE Main & Advanced 2023  Starts on **18th May 2021**

Evolve Batch (Class 12th) : JEE Main & Advanced 2022  Starts on **19th May 2021**

Micro Batch : JEE Main & Advanced 2023  Starts on **19th May 2021**

Legend 3.0 Batch : JEE Main & Advanced 2022  Starts on **19th May 2021**

Emerge Batch (Class 11th) : JEE Main & Advanced 2023  Starts on **20th May 2021**

Spark 3.0 Batch : JEE Main & Advanced 2023  Started on **26th May 2021**



Upcoming Tests in May



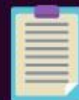
Unacademy COMBAT - 23rd May



T 20 Test Series - Target JEE 2022 - 18, 19, 20, 21, 22nd May



T 20 Test Series - Target JEE 2023 - 18, 19, 20, 21, 22nd May



JEE Live Daily Test Series - 2022 - 19th May



JEE Live Daily Test Series - 2023 - 19th May



Chem-O-Legends by Kashif Alam - 24th May





**UNACADEMY
COMBAT**

**IIT JEE T-20
Test Series**

**Every Sunday |
11 am Onwards**

**Win Scholarships
worth 4 Cr+**

**May 25, 26, 27, 28 |
6:30 PM Onwards**

**Win Daily Amazon vouchers
and Scholarship worth
Rs 3 CR***

Enroll Now for FREE

Use Code - SAMEERLIVE

Thank You



@sameer_iitr



#JEE Live Daily



+ SUBSCRIBE



jee

PDF



Download Now !

