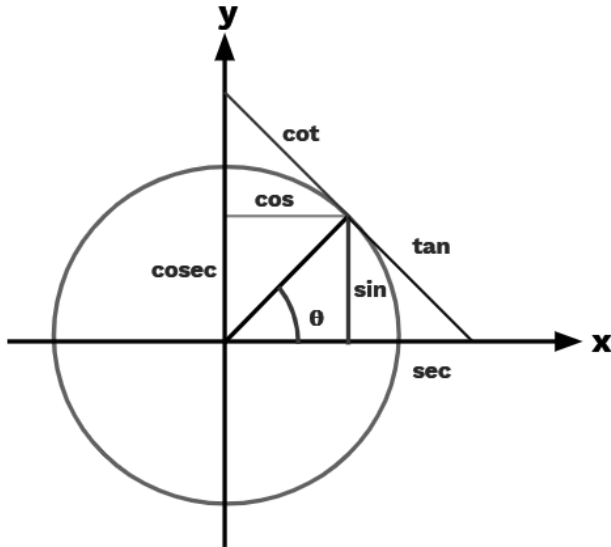


Trigonometric Equations

2



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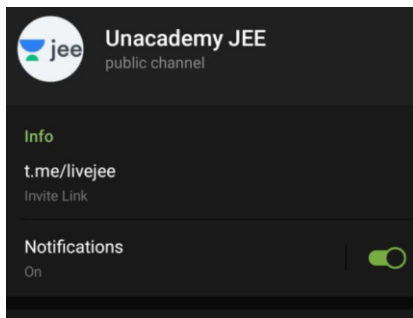
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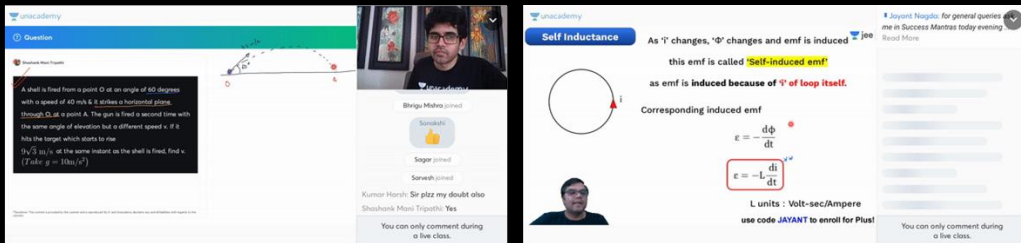
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Questions

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

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Self Inductance

As Φ changes, $\frac{d\Phi}{dt}$ changes and emf is induced

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

as emf is induced because of Φ of loop itself.

Corresponding induced emf

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

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

L units: Volt-sec/Ampere

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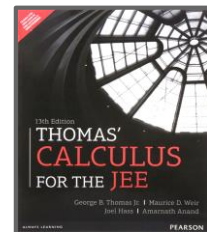
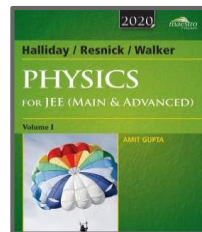
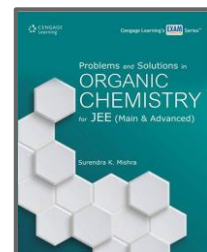
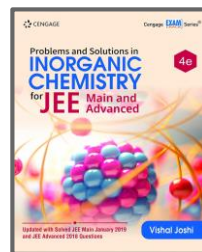
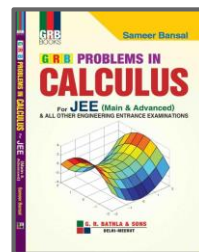
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LET'S BEGIN!!

Homework Question





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

$$\cos^2\left(x + \frac{\pi}{3}\right) = \cos^2\left(\frac{\pi}{2} - \underbrace{\left(\frac{\pi}{3} - x\right)}_{\pi/6}\right)$$

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

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

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

ignore

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

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

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

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.


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

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





Find the principle and general solution of the following equation:

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

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

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

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

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

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

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

$$\cos x = -1$$

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

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

Case-2:

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

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

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

$n \in \mathbb{I}$

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: $\sin x - 2 = 0$

$$\Rightarrow \sin x = 2$$

X Not possible

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

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

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

where $n \in \mathbb{I}$



Solve the following equation:

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

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

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

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

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

$$\boxed{\text{Let } \cos^2 x = t}$$

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

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

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

$$\boxed{8t^2 - 2t - 1 = 0}$$

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

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

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

Case-1

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

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

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

Case-2:

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

Reject



Solve the following equation:

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

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

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

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

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

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

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

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

Case-2:

$$\cos 2\theta = 1$$

$$2\theta = 2n\pi$$

$$\boxed{\theta = n\pi}$$

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



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

$$\Rightarrow \frac{1}{4} \sin^2 x = 1$$

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

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

Case-2: $\frac{1}{2} \sin^2 x = 2^3$

$$\frac{1}{4} \sin^2 x = 3$$

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

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

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

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

Principle values.

$$\begin{array}{l} \boxed{C-1} : \quad \frac{\pi}{6} ; \frac{5\pi}{6} ; \frac{7\pi}{6} ; 11\frac{\pi}{6} \\ \boxed{C-2} : \quad \frac{\pi}{3} ; \frac{2\pi}{3} ; \frac{4\pi}{3} ; \frac{5\pi}{3} \end{array} \quad \left. \vphantom{\begin{array}{l} \boxed{C-1} \\ \boxed{C-2} \end{array}} \right\}$$



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.

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

. $\cos x = \cos \alpha$

$$\boxed{x = 2n\pi \pm \alpha}$$

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

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



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 : $\sin x + \sin 5x = \sin 3x$ ($0 \leq x \leq \pi$)

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

↓

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

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

Case-1 $\sin 3x = 0$

$$3x = n\pi$$

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

$$n = \begin{matrix} 0 \\ 1 \\ 2 \\ 3 \end{matrix}$$

$$x \rightarrow \begin{matrix} 0 \\ \pi/3 \\ 2\pi/3 \\ \pi \end{matrix}$$

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

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

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

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

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



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

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

HW.



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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

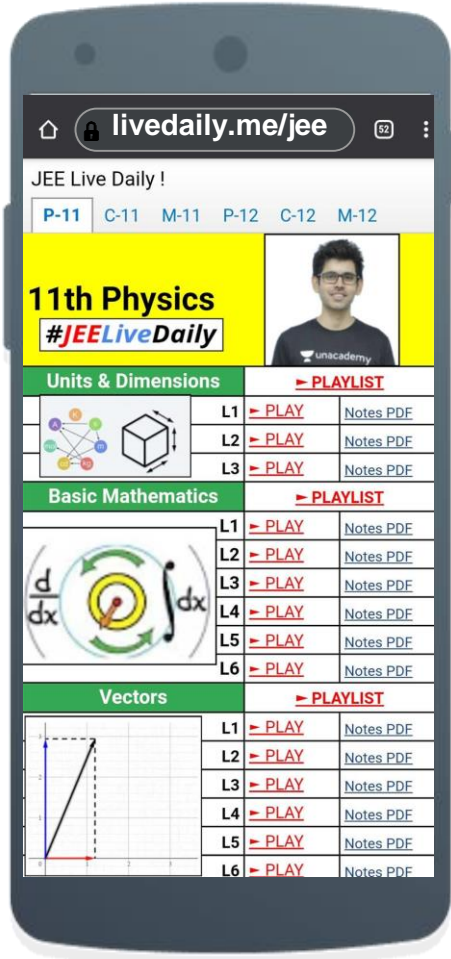
3:00 - 4:30 PM



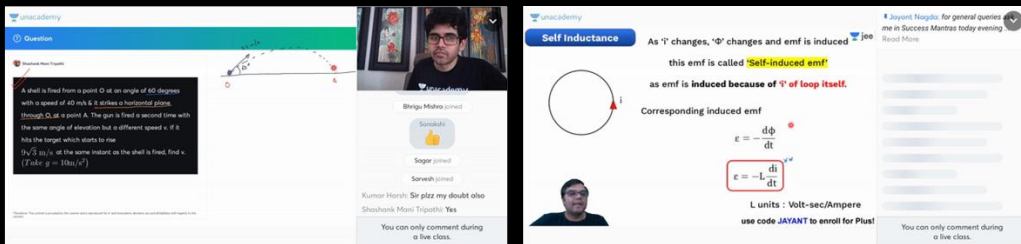
Nishant Sir | Maths

4:30 - 6:00 PM

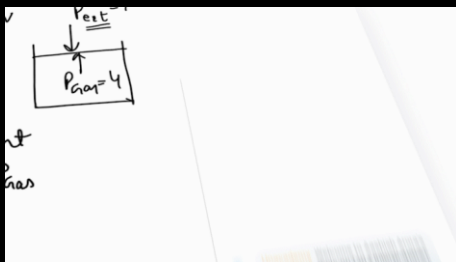
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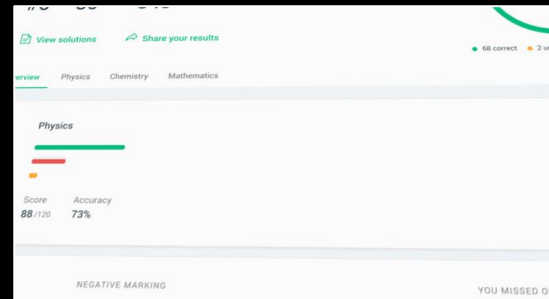
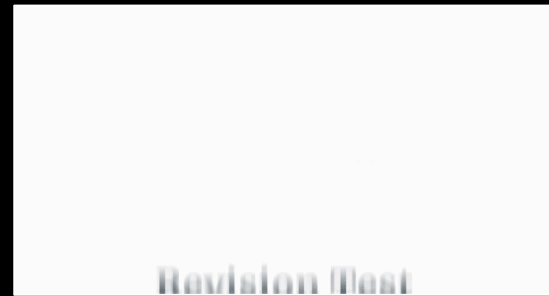


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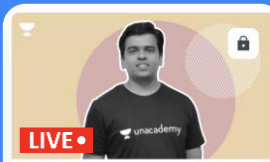


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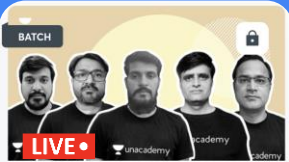
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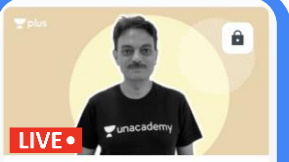
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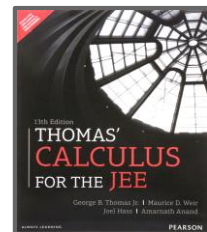
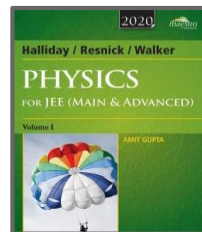
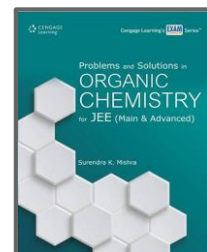
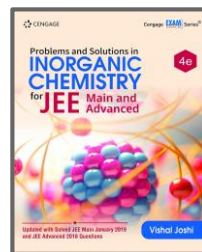
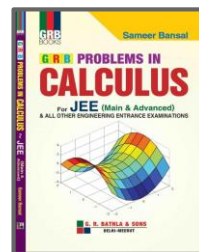
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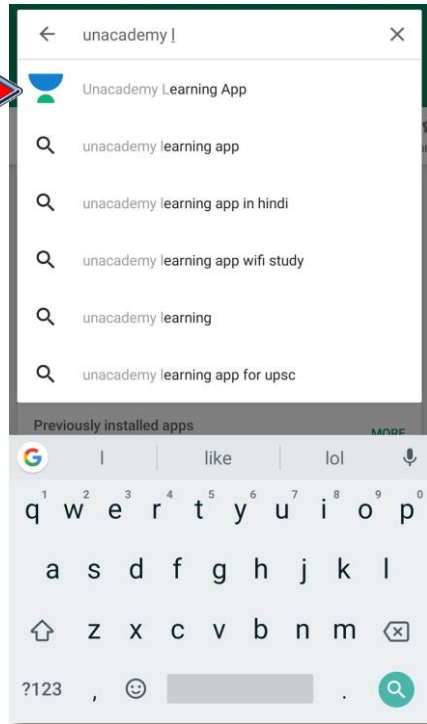


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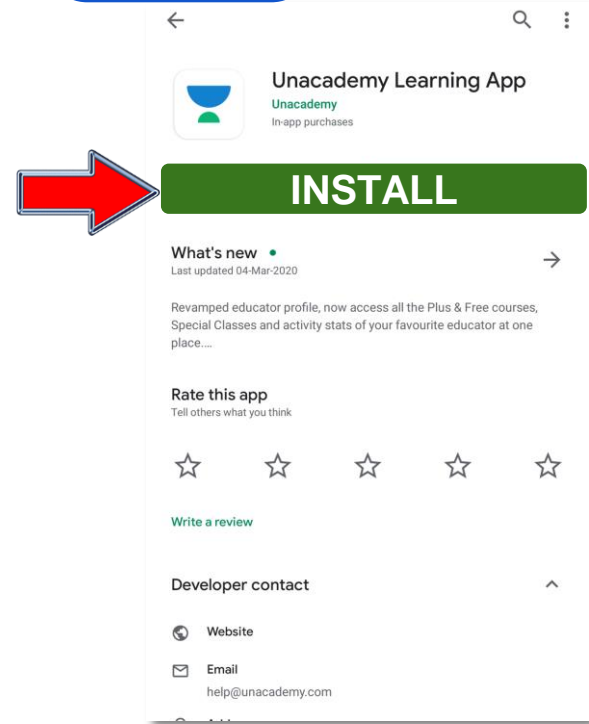


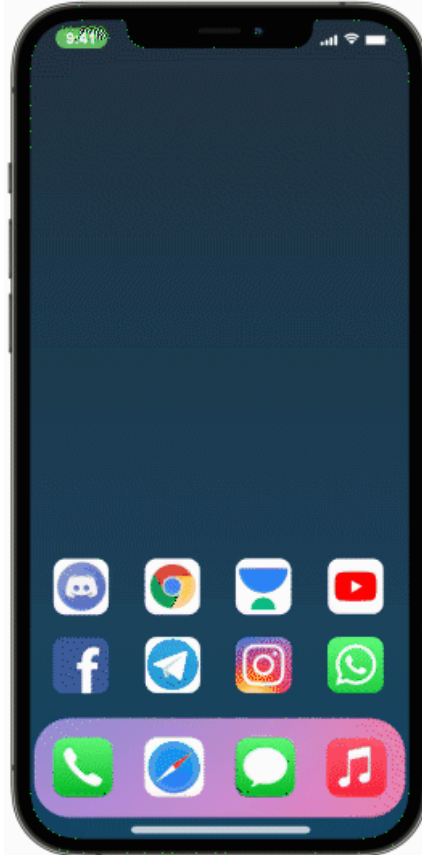
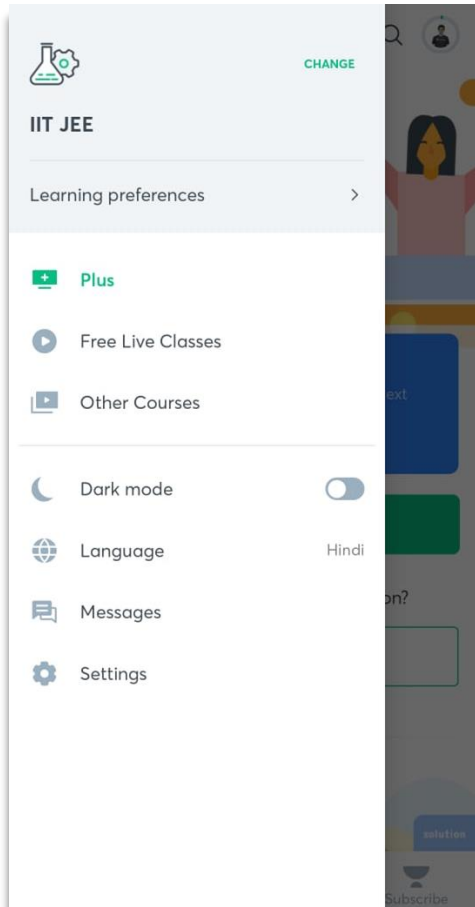
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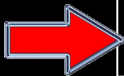
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
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