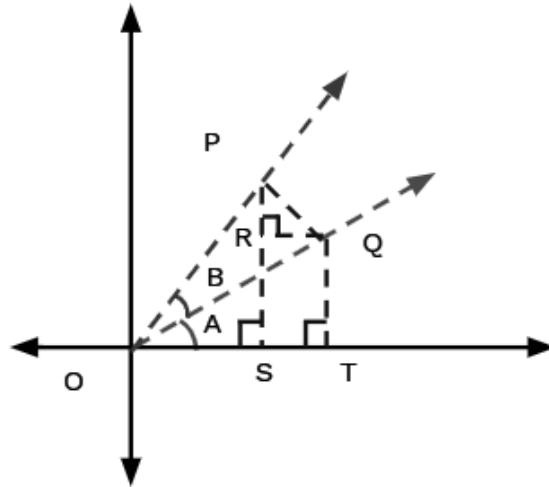


Transformation Formulas

Trigonometry

9



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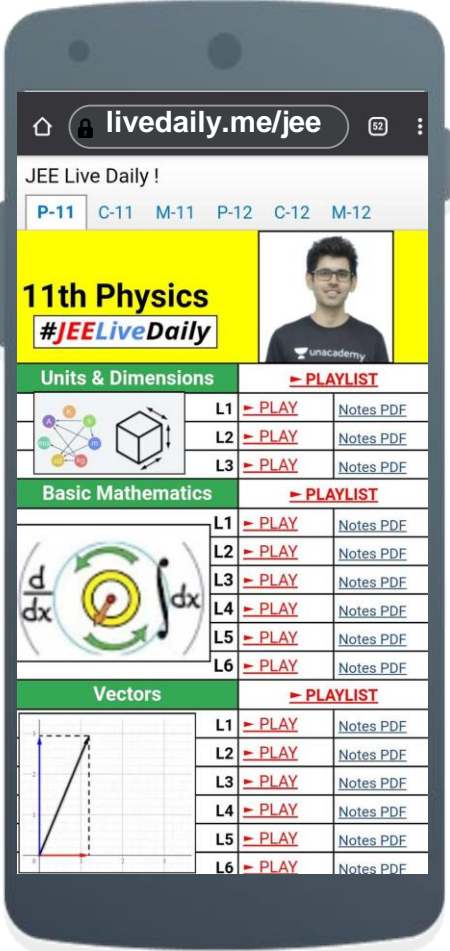
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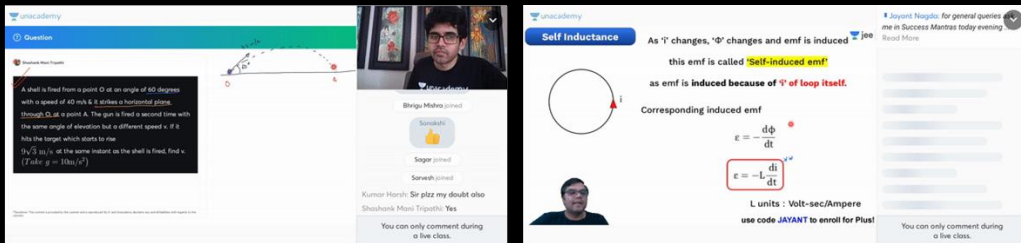
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Questions

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 $(\sqrt{3}/2) \sin t$ 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 \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

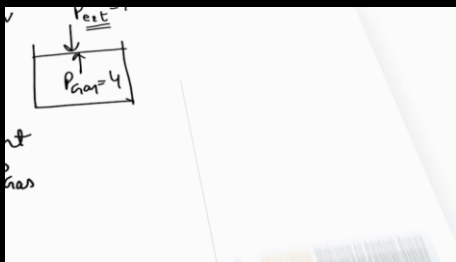
$$\mathcal{E} = -\frac{d\Phi}{dt}$$

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

Units: Volt-sec/Ampere

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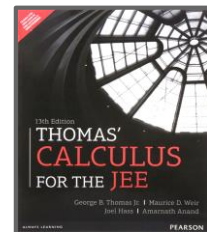
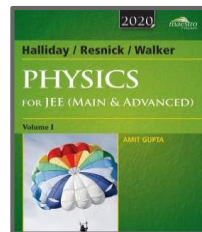
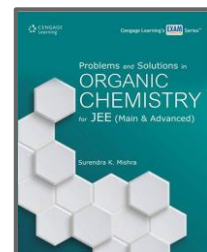
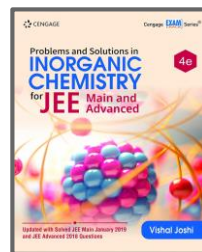
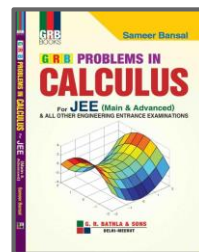
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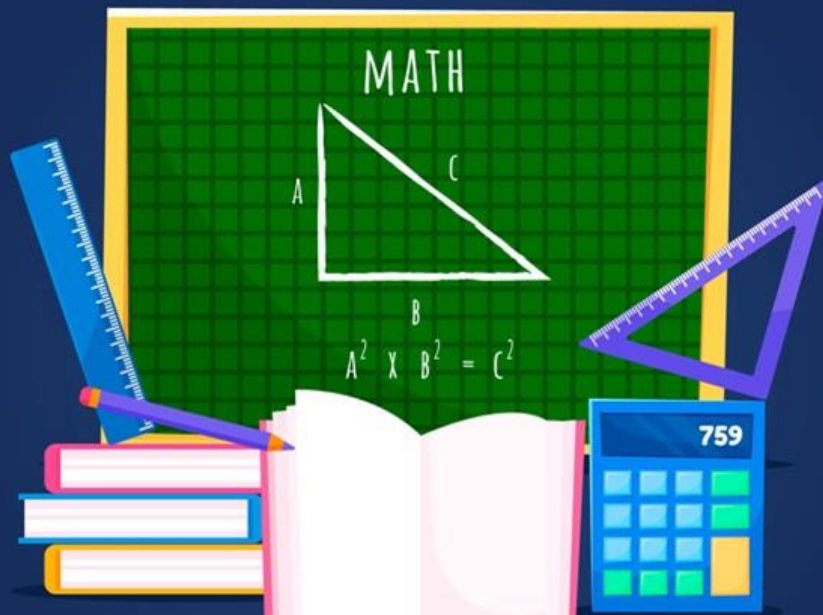
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LET'S BEGIN!!

Transformation Formulae

PART - 1





Transformation Formulae Part - 1

1

$$\sin(A + B) + \sin(A - B) = 2 \sin A \cos B$$

$$\begin{aligned} & (\sin A \cos B + \cancel{\cos A \sin B}) \\ & + (\sin A \cos B - \cancel{\cos A \sin B}) \end{aligned}$$



Transformation Formulae Part - 1

2

$$\sin(A + B) - \sin(A - B) = 2 \cos A \sin B$$

$$(\cancel{\sin A} \cos B + \underbrace{\cos A \sin B})$$

$$- (\cancel{\sin A} \cos B - \underbrace{\cos A \sin B})$$



Transformation Formulae Part - 1

3

$$\cos(A + B) + \cos(A - B) = 2 \cos A \cos B$$



Transformation Formulae Part - 1

4

$$\cos(A - B) - \cos(A + B) = 2 \sin A \sin B$$

Handwritten derivation:

$$\begin{aligned} & \downarrow \\ & (\cancel{\cos A \cos B} + \sin A \sin B) \\ & - (\cancel{\cos A \cos B} - \sin A \sin B) \end{aligned}$$

A red arrow points from the $\sin A \sin B$ term in the first line to the $\sin A \sin B$ term in the second line.



Value of $\sin 21^\circ \cos 9^\circ - \cos 84^\circ \cos 6^\circ$ is equal to:

A. 1

B. $\frac{3}{2}$

☒ C. $\frac{1}{4}$

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

$$\sin 21^\circ \cos 9^\circ - \cos 84^\circ \cos 6^\circ$$

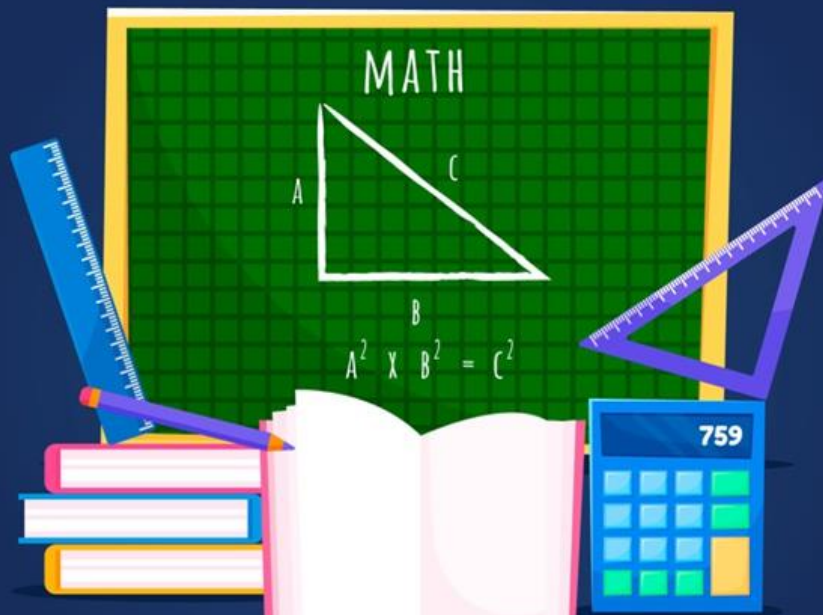
$$= \frac{1}{2} \left[(2 \sin \underline{21^\circ} \cdot \cos \underline{9^\circ}) - (2 \cos 84^\circ \cos 6^\circ) \right]$$

$$= \frac{1}{2} \left[(\sin(30^\circ) + \cancel{\sin(12^\circ)}) - (\cos(90^\circ) + \cancel{\cos(78^\circ)}) \right]$$

$$\therefore \cos 78^\circ = \cos(90^\circ - 12^\circ)$$
$$= \sin 12^\circ$$

Transformation Formulae

PART - 2





Transformation Formulae Part - 2

1

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

$$\sin(A+B) + \sin(A-B) = 2 \sin A \cos B$$

Let:
$$\begin{cases} A+B=C \\ A-B=D \end{cases}$$

$$\textcircled{+} \Rightarrow 2A = C+D$$

$$\sin C + \sin D = 2 \sin \left(\frac{C+D}{2} \right) \cos \left(\frac{C-D}{2} \right)$$



Transformation Formulae Part - 2

2

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

$$\sin(A+B) - \sin(A-B) = 2 \cos A \sin B$$



Transformation Formulae Part - 2

3

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

$$\cos(A+B) + \cos(A-B) = 2 \cos A \cos B$$



Transformation Formulae Part - 2

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

4

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

$$\cos(A-B) - \cos(A+B) = 2 \sin A \sin B$$



$$\Rightarrow \cos(D) - \cos(C) = 2 \sin\left(\frac{C+D}{2}\right) \sin\left(\frac{C-D}{2}\right)$$

$$\Rightarrow \cos C - \cos D = -2 \sin\left(\frac{C+D}{2}\right) \sin\left(\frac{C-D}{2}\right)$$

*

$$\textcircled{1} \sin C + \sin D = 2 \sin\left(\frac{C+D}{2}\right) \cos\left(\frac{C-D}{2}\right)$$

$$\textcircled{2} \sin C - \sin D = 2 \sin\left(\frac{C-D}{2}\right) \cos\left(\frac{C+D}{2}\right)$$

$$\textcircled{3} \cos C + \cos D = 2 \cos\left(\frac{C+D}{2}\right) \cos\left(\frac{C-D}{2}\right)$$

$$\textcircled{4} \cos C - \cos D = -2 \sin\left(\frac{C+D}{2}\right) \sin\left(\frac{C-D}{2}\right)$$



Value of $\frac{\sin 70^\circ + \cos 40^\circ}{\cos 70^\circ + \sin 40^\circ}$,

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

B. $\frac{1}{\sqrt{3}}$

☒ C. $\sqrt{3}$

D. 2

$$\begin{aligned} & \frac{\sin 70^\circ + \sin 50^\circ}{\cos 70^\circ + \cos 50^\circ} \\ &= \frac{2 \sin\left(\frac{120^\circ}{2}\right) \cos\left(\frac{20^\circ}{2}\right)}{2 \cos\left(\frac{120^\circ}{2}\right) \cos\left(\frac{20^\circ}{2}\right)} \end{aligned}$$

$$\begin{aligned} & \tan 60^\circ \\ &= (\sqrt{3}) \end{aligned}$$



$$\frac{\sin A + \sin 3A + \sin 5A + \sin 7A}{\cos A + \cos 3A + \cos 5A + \cos 7A} =$$

A. 1

✓ B. $\tan 4A$ C. $\cot 4A$ D. $\cot 2A$

$$\begin{aligned} &= \frac{(\sin A + \sin 7A) + (\sin 3A + \sin 5A)}{(\cos A + \cos 7A) + (\cos 3A + \cos 5A)} \\ &= \frac{2 \sin(4A) \cos(-3A) + 2 \sin(4A) \cos(-A)}{2 \cos(4A) \cos(-3A) + 2 \cos(4A) \cos(-A)} \end{aligned}$$

$$= \frac{(\cancel{2} \sin 4A) (\cancel{\cos 3A + \cos A})}{(\cancel{2} \cos 4A) (\cancel{\cos 3A + \cos A})}$$
$$= \tan 4A$$



Value of $\cos 2x + \cos 4x + \cos 6x - 4 \cos x \cos 2x \cos 3x$ is equal to:

A. 2

B. 3

C. 4

D. -1

$$(\cos 2x + \cos 6x) + \cos 4x - 4 \cos x \cos 2x \cos 3x$$

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

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

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

$$= \cancel{(2 \cos 2x)} \cancel{(2 \cos(3x) \cos(x))}$$
$$- 1 - 4 \cos x \cos 2x \cancel{\cos 3x}$$

$$= (-1)$$



If $\sin \theta + \sin 2\theta + \sin 3\theta = \sin \alpha$ and $\cos \theta + \cos 2\theta + \cos 3\theta = \cos \alpha$,
then θ is equal to

~~A.~~ $\alpha/2$

B. α

C. 2α

D. $\alpha/6$

$$\begin{cases} \underline{2\sin(2\theta)} \cos(-\theta) + \underline{\sin 2\theta} = \sin \alpha \\ (\sin 2\theta)(\underline{2\cos \theta + 1}) = \sin \alpha \quad \text{--- (1)} \end{cases}$$

$$\begin{cases} \underline{2\cos(2\theta)} \cos(-\theta) + \underline{\cos 2\theta} = \cos \alpha \\ \cos 2\theta (\underline{2\cos \theta + 1}) = \cos \alpha \quad \text{--- (2)} \end{cases}$$

$$\textcircled{1} \div \textcircled{2}$$

$$\frac{\sin 2\theta (\cancel{2\cos\theta + 1})}{\cos 2\theta (\cancel{2\cos\theta + 1})} = \tan \alpha$$

$$\tan 2\theta = \tan \alpha$$

$$2\theta = \alpha$$



If $\sin \alpha + \sin \beta = 1/3$ and $\cos \alpha + \cos \beta = 1/4$. The value of $\sin(\alpha + \beta)$ is

A. 24/25

B. 13/25

C. 12/13

D. None of these

$$\begin{cases} 2 \sin\left(\frac{\alpha + \beta}{2}\right) \cos\left(\frac{\alpha - \beta}{2}\right) = \frac{1}{3} \\ 2 \cos\left(\frac{\alpha + \beta}{2}\right) \cos\left(\frac{\alpha - \beta}{2}\right) = \frac{1}{4} \end{cases}$$

Divide : $\tan\left(\frac{\alpha + \beta}{2}\right) = \frac{1/3}{1/4} = \left(\frac{4}{3}\right)$

$$\sin 2\theta = \frac{2 \tan \theta}{1 + \tan^2 \theta}$$

$$\sin \theta = \frac{2 \tan(\theta/2)}{1 + \tan^2(\theta/2)}$$

$$\Rightarrow \sin(A+B) = \frac{2 \tan\left(\frac{A+B}{2}\right)}{1 + \tan^2\left(\frac{A+B}{2}\right)}$$

$$= \frac{2 \left(\frac{4}{3}\right)}{1 + \left(\frac{16}{9}\right)}$$

$$= \frac{24}{25}$$



If $\sin 2\theta + \sin 2\phi = 1/2$ and $\cos 2\theta + \cos 2\phi = 3/2$, then $\cos^2(\theta - \phi) =$

A. $3/8$

B. $5/8$

C. $3/4$

D. $5/4$

Square

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

Square

$$\cos^2 2\theta + \cos^2 2\phi + 2 \cos 2\theta \cos 2\phi = \frac{9}{4}$$

$$\text{Add: } 1 + 1 + 2(\cos 2\theta \cos 2\phi + \sin 2\theta \sin 2\phi) = \frac{10}{4}$$

$$2 \cos(2\theta - 2\phi) = \frac{1}{2}$$

$$\cos(2(\theta - \phi)) = \frac{1}{4}$$

$$2 \cos^2(\theta - \phi) - 1 = \frac{1}{4}$$

$$\cos^2(\theta - \phi) = \frac{5}{8}$$



$\sin^2 A + \sin^2 (A - B) + 2 \sin A \cos B \sin (B - A)$ is equal to -

A. $\sin^2 A$

☒ B. $\sin^2 B$

C. $\cos^2 A$

D. $\cos^2 B$

$$\sin^2 A + \sin^2 (A - B) + (\sin(A + B) + \sin(A - B)) \sin(B - A)$$

$$= \sin^2 A + \sin^2 (A - B) - (\sin(A + B) + \sin(A - B)) \sin(A - B)$$

$$= \sin^2 A + \cancel{\sin^2 (A - B)} - \sin(A + B) \sin(A - B) - \cancel{\sin^2 (A - B)}$$

$$= \sin^2 A - \sin(A+B) \sin(A-B)$$

$$= \cancel{\sin^2 A} - (\cancel{\sin^2 A} - \sin^2 B)$$

$$= \sin^2 B$$



If $\cos^3 x \sin 2x = \sum_{r=0}^n a_r \sin(rx)$, $\forall x \in \mathbb{R}$ then find a_3/a_1 :

H.W

$$\underbrace{\sum_{r=0}^n a_r \sin(rx)}_{\rightarrow}$$

$$a_1 \sin x + a_2 \sin 2x$$

$$+ \dots + a_n \sin nx$$

multiplication to addition



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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

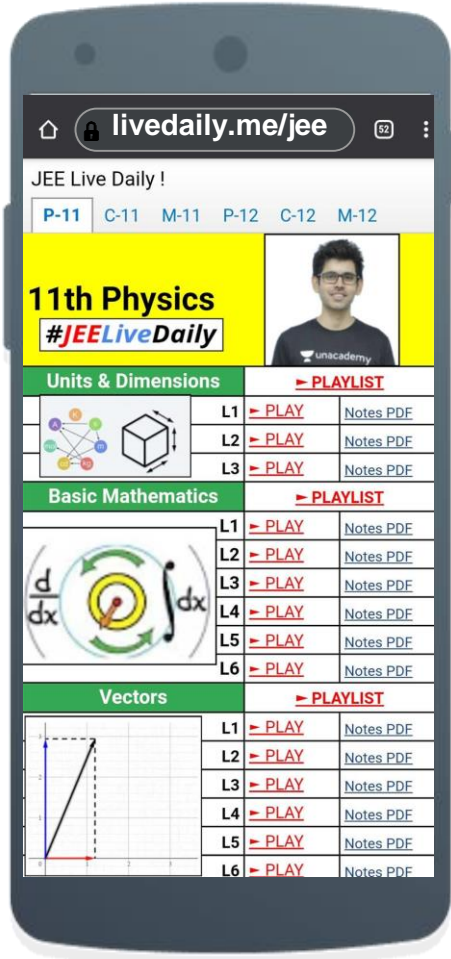
3:00 - 4:30 PM



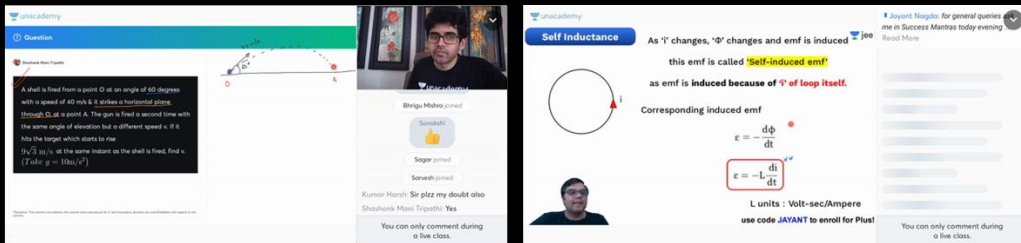
Nishant Sir | Maths

4:30 - 6:00 PM

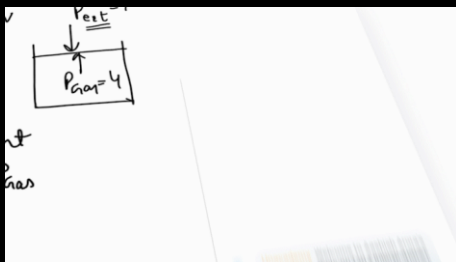
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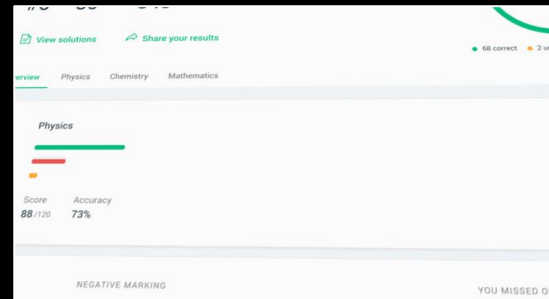
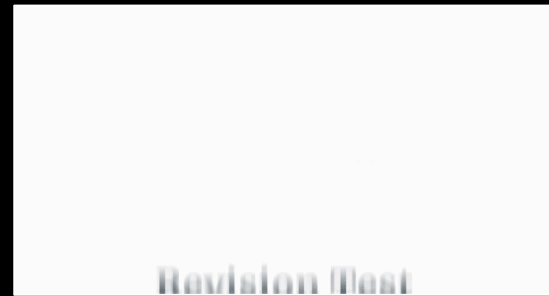


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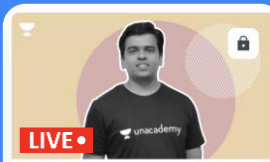


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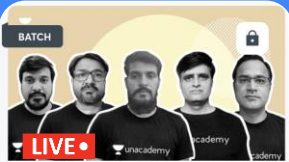
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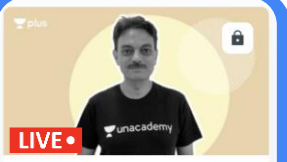
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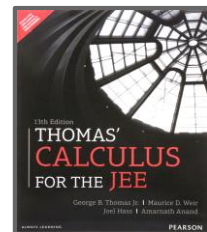
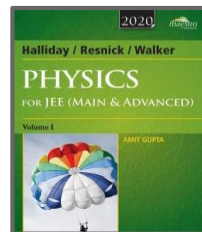
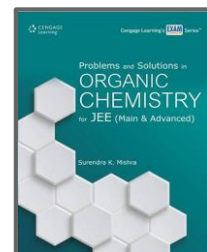
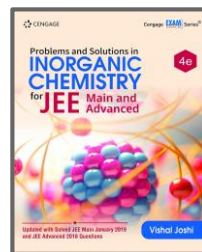
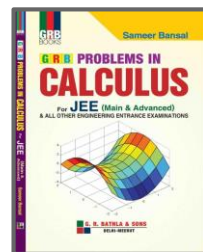
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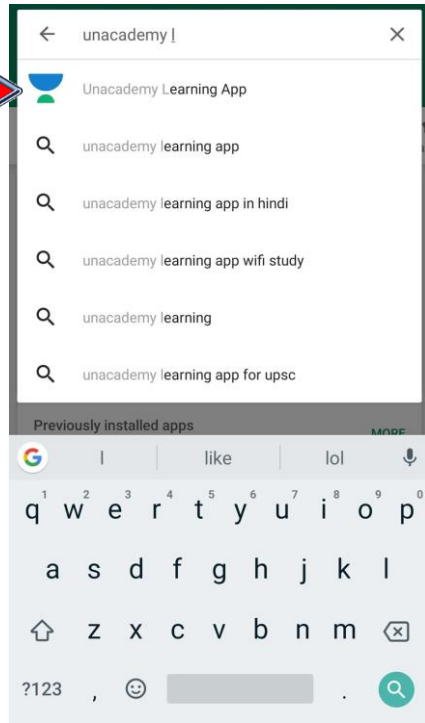


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98.48

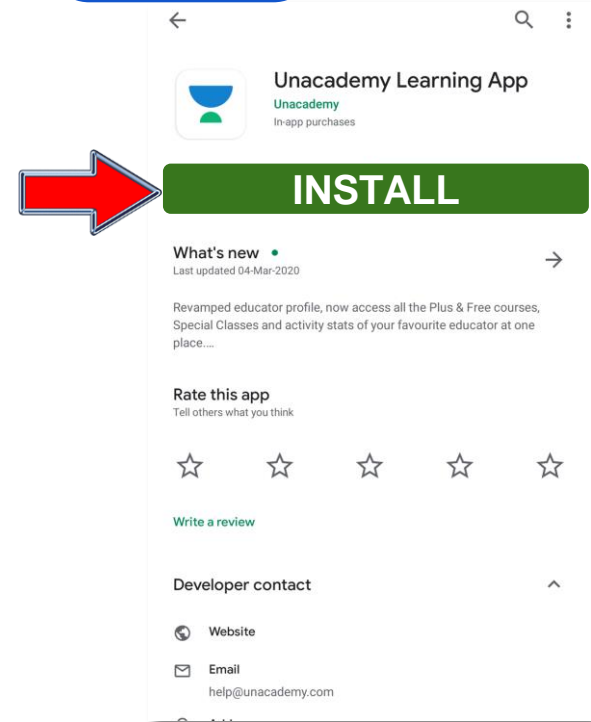


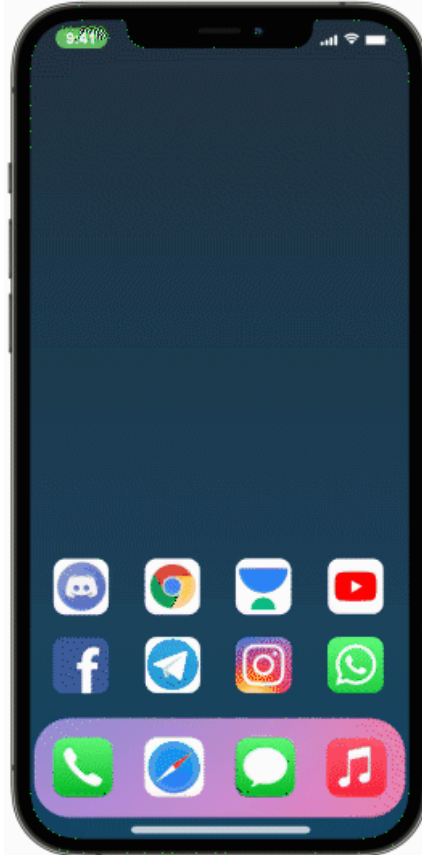
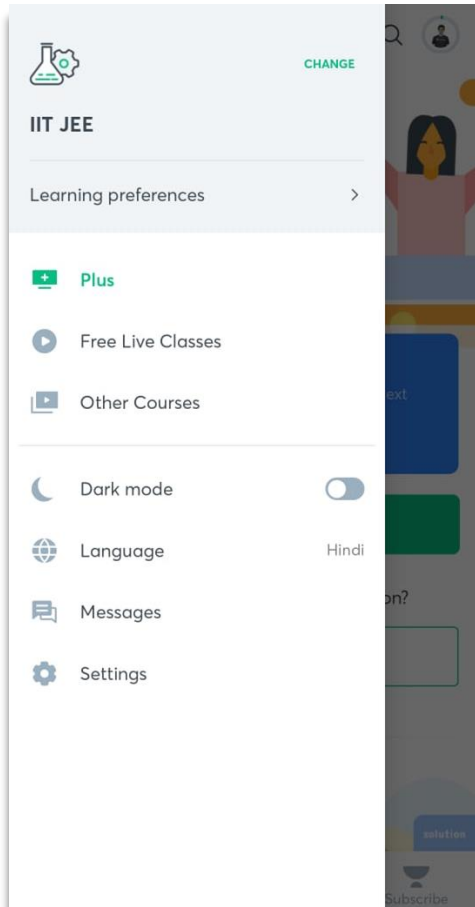
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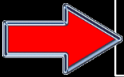


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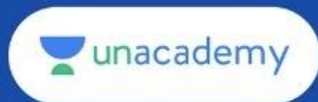
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