

Trigonometry



Sameer Chincholikar
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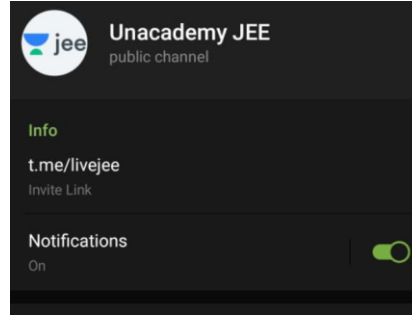
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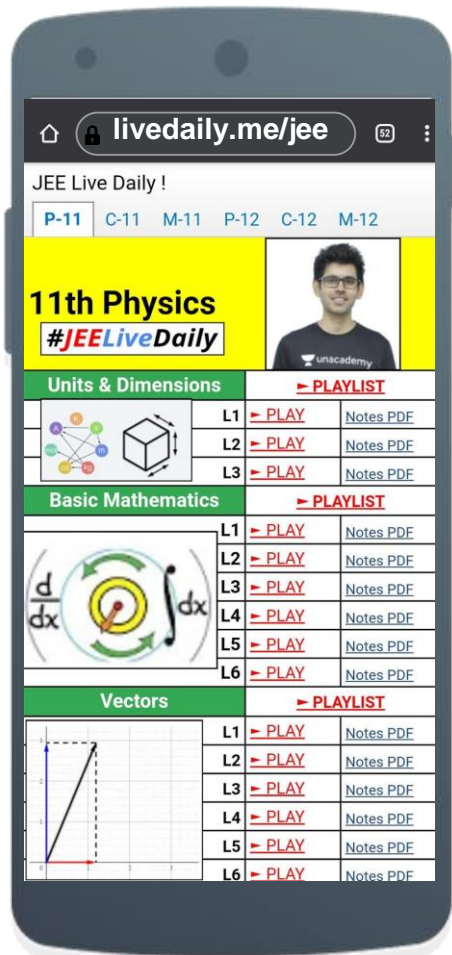
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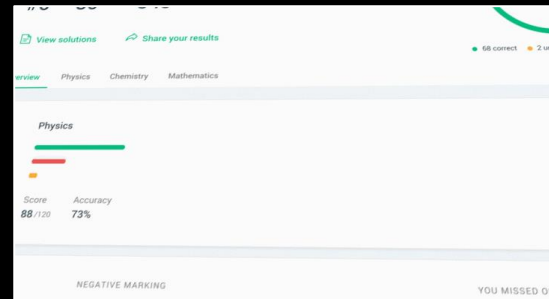
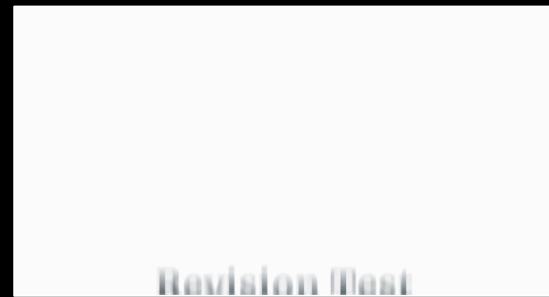
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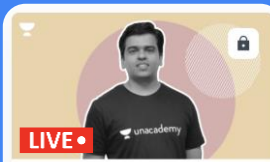


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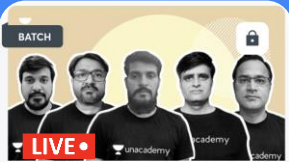
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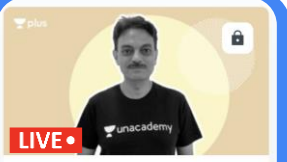
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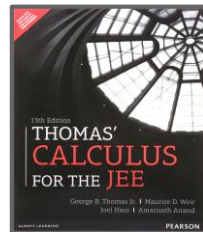
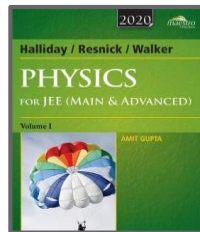
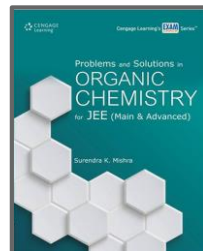
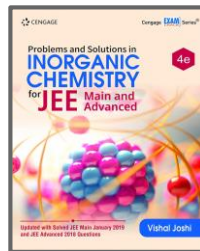
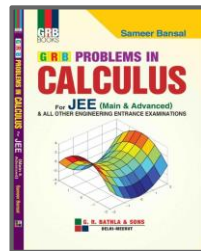
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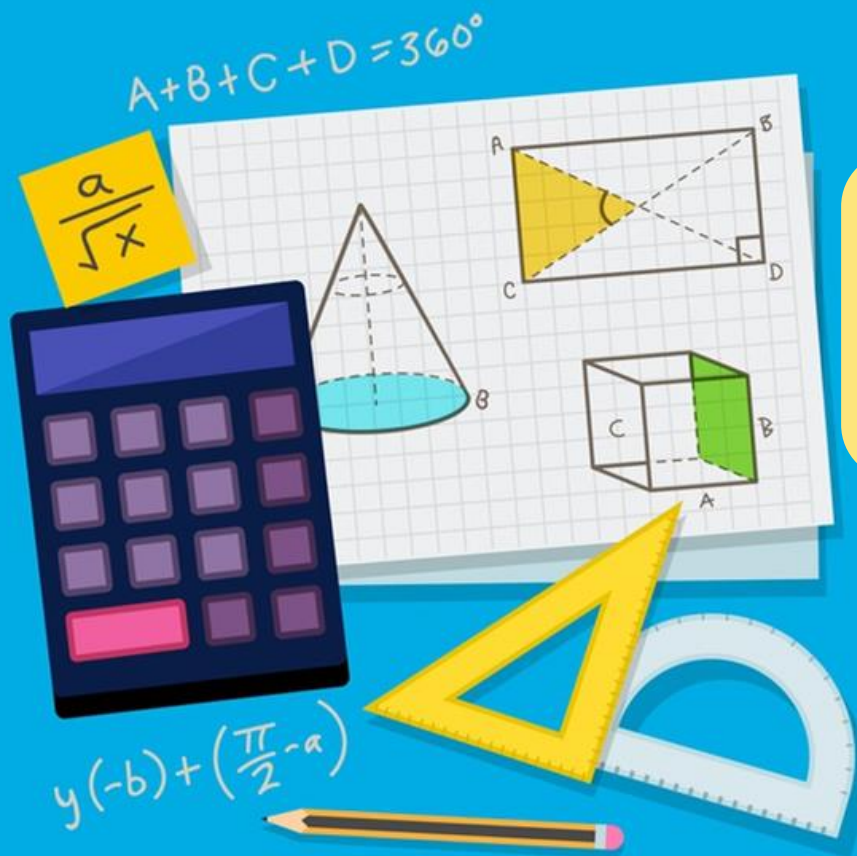
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LET'S BEGIN!!

Trigonometry

[illegible]

Homework Question



In a triangle ABC, angle A is an obtuse angle such

$$\sin A = \frac{3}{5} \text{ and } \sin B = \frac{5}{13} \text{ then } \sin C =$$

$$(A+B)+C=\pi$$

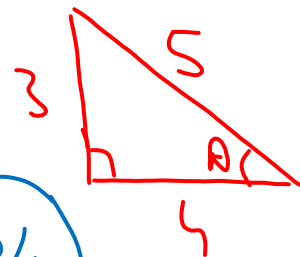
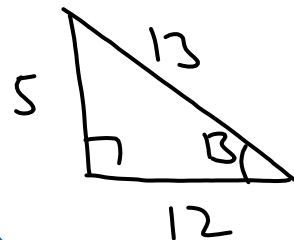
$$C = \pi - (A+B)$$

$$\begin{aligned} \sin C &= \sin(\pi - (A+B)) \\ &= \sin(A+B) \end{aligned}$$

$$\sin(A+B)$$

$$= \sin A \cos B + \cos A \sin B$$

$$\left(\frac{3}{5}\right)\left(\frac{12}{13}\right) + \left(-\frac{4}{5}\right)\left(\frac{5}{13}\right)$$



$$\frac{16}{65}$$

$$\boxed{\sin^2 A + \cos^2 A = 1}$$

$$\cos^2 A = 1 - \sin^2 A$$

$$\cos^2 A = 1 - \frac{9}{25}$$

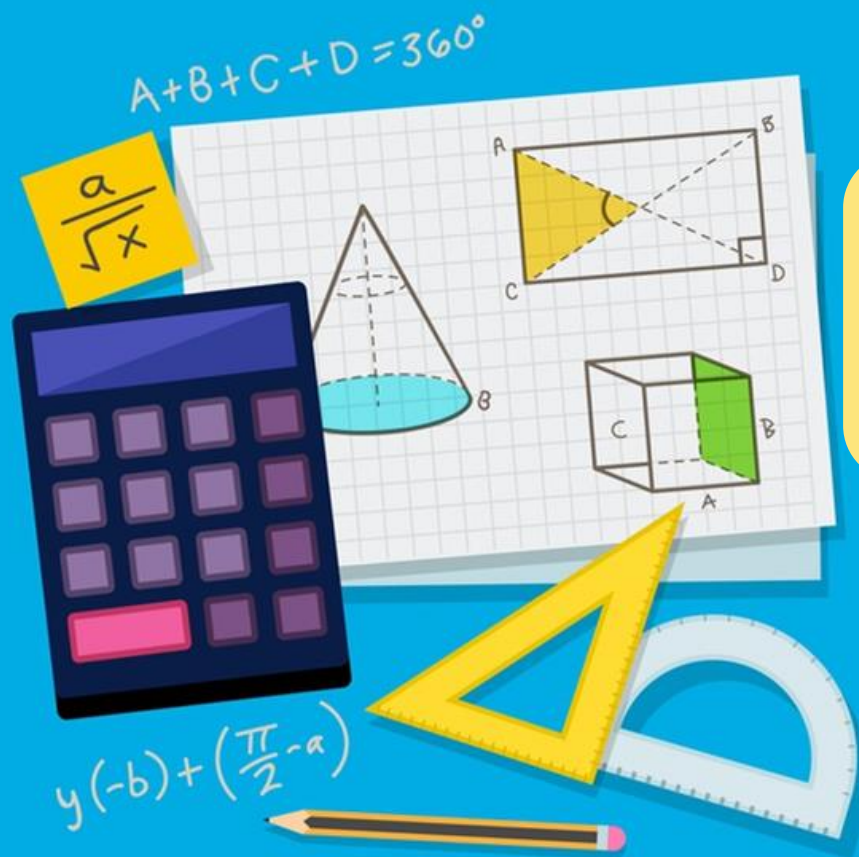
$$\cos^2 A = \frac{16}{25}$$

$$\cos A = \pm \frac{4}{5}$$

A is obtuse

\Rightarrow 2nd Quad

$\Rightarrow \cos A \rightarrow \textcircled{-ve}$



Compound Angles (contd..)

$(1 + \tan \alpha \tan \beta)^2 + (\tan \alpha - \tan \beta)^2$ is equal to

A. $\tan^2 \alpha + \tan^2 \beta$

B. $\cos^2 \alpha \cos^2 \beta$

✓ C. $\sec^2 \alpha \sec^2 \beta$

D. $\tan^2 \alpha \tan^2 \beta$

$$\left(1 + \frac{\sin \alpha \sin \beta}{\cos \alpha \cos \beta}\right)^2 + \left(\frac{\sin \alpha}{\cos \alpha} - \frac{\sin \beta}{\cos \beta}\right)^2$$

$$\frac{(\cos(\alpha - \beta))^2}{(\cos \alpha \cos \beta)^2} + \frac{(\sin(\alpha - \beta))^2}{(\cos \alpha \cos \beta)^2}$$

$$\frac{\cos^2(\alpha - \beta) + \sin^2(\alpha - \beta)}{\cos^2 \alpha \cos^2 \beta}$$

$$= \frac{1}{\cos^2 \alpha \cos^2 \beta}$$

If $\tan x \tan y = a$ and $x + y = \pi/6$, then $\tan x$ and $\tan y$ satisfy the equation

A. $t^2 - \sqrt{3}(1 - a)t + a = 0$

B. $\sqrt{3}t^2 - (1 - a)t + a\sqrt{3} = 0$

C. $t^2 + \sqrt{3}(1 + a)t - a = 0$

D. $\sqrt{3}t^2 - (1 + a)t - a\sqrt{3} = 0$

$\tan x \cdot \tan y = a$

And:

$x + y = \frac{\pi}{6}$

$\tan(x + y) = \tan \frac{\pi}{6}$

$\frac{\tan x + \tan y}{1 - \tan x \tan y} = \frac{1}{\sqrt{3}}$

$\tan x + \tan y = \frac{1 - a}{\sqrt{3}}$

$$(\alpha, \beta) : x^2 - (\alpha + \beta)x + \alpha\beta = 0$$

$$(\tan x, \tan y) : t^2 - (\tan x + \tan y)t + \tan x \cdot \tan y = 0$$

$$t^2 - \left(\frac{1-a}{\sqrt{3}} \right) t + a = 0$$

For $0 < \theta < \frac{\pi}{2}$, the solution (s) of is (are)

$$\sum_{m=1}^6 \operatorname{cosec}\left(\theta + \frac{(m-1)\pi}{4}\right) \operatorname{cosec}\left(\theta + \frac{m\pi}{4}\right) = 4\sqrt{2}$$

A. $\frac{\pi}{4}$

B. $\frac{\pi}{6}$

☒ **C.** $\frac{\pi}{12}$

☒ **D.** $\frac{5\pi}{12}$

$$\left(\theta + \frac{m\pi}{4} - \frac{\pi}{4}\right)$$

↓

$$\alpha$$

$$\theta + \frac{m\pi}{4}$$

↓

$$\left(\alpha + \frac{\pi}{4}\right)$$

JEE Adv. 2009

$$\sum \frac{1/\sqrt{2}}{\sin(\alpha) \sin(\alpha + \frac{\pi}{4})} = \frac{4\sqrt{2}}{\sqrt{2}}$$

$$\sum \frac{\sin(\frac{\pi}{4})}{\sin(\alpha) \sin(\alpha + \frac{\pi}{4})} = 4$$

$$\sum \frac{\sin((\alpha + \frac{\pi}{4}) - \alpha)}{\sin(\alpha) \sin(\alpha + \frac{\pi}{4})} = 4$$

$$\sum \frac{\cancel{\sin(\alpha + \frac{\pi}{4})} \cos \alpha - \cos(\alpha + \frac{\pi}{4}) \cancel{\sin \alpha}}{\sin \alpha \cancel{\sin(\alpha + \frac{\pi}{4})} \quad \cancel{\sin \alpha} \sin(\alpha + \frac{\pi}{4})} = 4$$

$$\sum (\cos \alpha - \cos(\alpha + \frac{\pi}{4})) = 4$$

$$\sum_{m=1}^6 (\cos(\theta + (m-1)\frac{\pi}{4}) - \cos(\theta + m\frac{\pi}{4})) = 4$$

$$\boxed{\cos \theta} - \cancel{\cos \left(\theta + \frac{\pi}{4} \right)}$$

$$+ \cancel{\cos \left(\theta + \frac{\pi}{4} \right)} - \cancel{\cos \left(\theta + 2\frac{\pi}{4} \right)}$$

$$+ \cancel{\cos \left(\theta + 2\frac{\pi}{4} \right)} - \cancel{\cos \left(\theta + 3\frac{\pi}{4} \right)}$$

$$\vdots$$

$$+ \cancel{\cos \left(\theta + 5\frac{\pi}{4} \right)} - \boxed{\cos \left(\theta + 6\frac{\pi}{4} \right)}$$

$$= 4$$

$$\cos \theta - \cos \left(\theta + \frac{\pi}{2} \right)$$

$$= 4$$

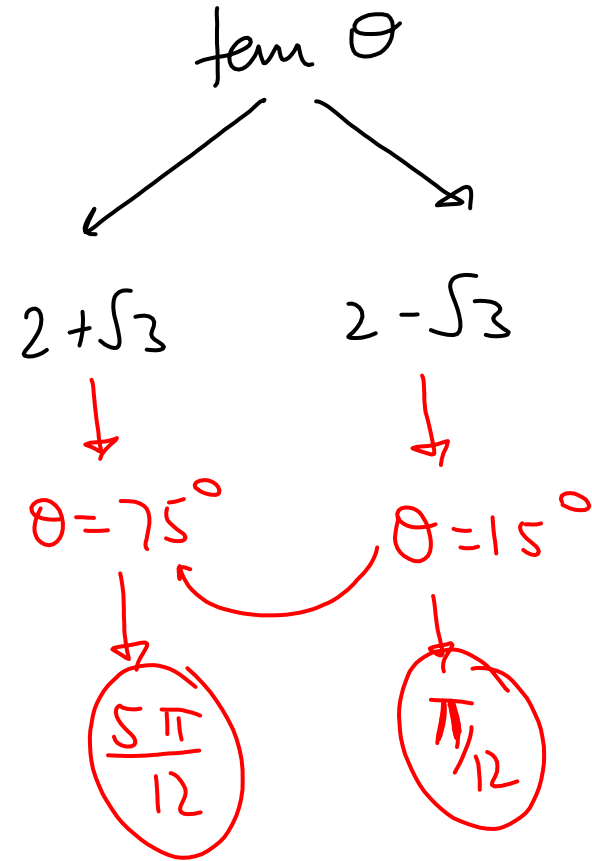
$$\cos \theta + \tan \theta = 4$$

$$\frac{1}{\tan \theta} + \tan \theta = 4$$

$$1 + \tan^2 \theta = 4 \tan \theta$$

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

$$\begin{aligned} \tan \theta &= \frac{4 \pm \sqrt{16 - 4}}{2} \\ &= \frac{4 \pm 2\sqrt{3}}{2} \end{aligned}$$



Extended Compound Angle Formulae





Extended Compound Angle Formulae

$$\sin(A + B + C) =$$

$$\sin A \cos B \cos C + \sin B \cos A \cos C + \sin C \cos A \cos B - \sin A \sin B \sin C$$

Formulas to remember

$$\sin(A + (B + C))$$

$$= \sin A \cos(B + C) + \cos A \sin(B + C)$$

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



$$\sin(A+B+C) \\ = \cos A \cos B \cos C \left[\tan A + \tan B + \tan C - \tan A \tan B \tan C \right]$$



Extended Compound Angle Formulae

$$\cos(A + B + C) = \cos A \cos B \cos C - \underline{\cos A} \sin B \sin C - \sin A \underline{\cos B} \sin C - \sin A \sin B \underline{\cos C}$$

$$\cos(A + B + C)$$

$$= \cos A \cos B \cos C \left[1 - \tan B \tan C - \tan A \tan C - \tan A \tan B \right]$$
$$= (\cos A \cos B \cos C) \left[1 - \sum \tan A \tan B \right]$$





Extended Compound Angle Formulae

$$\tan(A + B + C) = \frac{\tan A + \tan B + \tan C - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C - \tan C \tan A}$$

$$\tan(A + B + C) = \frac{\sin(A + B + C)}{\cos(A + B + C)}$$



$$\tan(A+B+C) = \frac{\sum \tan A - \boxed{\tan A \tan B \tan C}}{1 - (\sum \tan A \tan B)}$$

$$= \frac{\sum \tan A - \prod \tan A}{1 - \sum \tan A \tan B}$$

In a triangle ABC, if $\cos A \cos B \cos C = 1/3$, then the value of $\sum \tan B \tan C =$

A. 1

B. 2

C. 3

☒ D. 4

$$A + B + C = \pi$$

$$\boxed{\sum \tan A \tan B}$$

$$\cos(A + B + C) = \cos \pi$$

$$(\cos A \cos B \cos C)(1 - \sum \tan A \tan B) = -1$$

$$\frac{1}{3} (1 - (\sum \tan A \tan B)) = -1$$





In a triangle ABC, find the value of $\cot A \cot B + \cot B \cot C + \cot C \cot A$

A.

0

B.

1

C.

-1

D.

2

$$A + B + C = \pi$$

$$\tan(A + B + C) = \tan \pi$$

$$\frac{(\tan A + \tan B + \tan C) - \tan A \tan B \tan C}{1 - \tan A \tan B - \tan B \tan C - \tan C \tan A} = 0$$



$$\Rightarrow \frac{\tan A + \tan B + \tan C}{\tan A \tan B \tan C} = \frac{\tan A \tan B \tan C}{\tan A \tan B \tan C}$$

$$= 1$$





Important Results

1

$$\underline{\sin(A+B)} \cdot \underline{\sin(A-B)} = \underline{\sin^2 A} - \underline{\sin^2 B} = \cos^2 B - \cos^2 A$$

$$\sin(A+B) \cdot \sin(A-B)$$

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

$$= \sin^2 A \cos^2 B - \cos^2 A \sin^2 B$$



$$= \sin^2 A (1 - \sin^2 B) - (1 - \sin^2 A) \sin^2 B$$

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

$$= \boxed{\sin^2 A - \sin^2 B}$$



Important Results

2

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



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

$$= \cos^2 A \cos^2 B - \sin^2 A \sin^2 B$$

$$= \cos^2 A \cos^2 B - (1 - \cos^2 A)(1 - \cos^2 B)$$



$$-1 + \cos^2 A + \cos^2 B$$



$$\cos^2 B - \sin^2 A$$

$$\cos^2 A - \sin^2 B$$

Find the value of $\frac{\sin \theta}{\sin^2 \left(\frac{\theta}{2} + \frac{\pi}{12} \right) - \sin^2 \left(\frac{\theta}{2} - \frac{\pi}{12} \right)}$

A. $\frac{1}{2}$ **B.** -2 **C.** 2 **D.** $-\frac{1}{2}$

$$\begin{aligned}
 & \frac{\sin \theta}{\sin^2 \left(\frac{\theta}{2} + \frac{\pi}{12} \right) - \sin^2 \left(\frac{\theta}{2} - \frac{\pi}{12} \right)} \\
 &= \frac{\cancel{\sin \theta}}{\cancel{\sin \theta} \sin(\pi/6)} = 2
 \end{aligned}$$





If $A + B = \frac{\pi}{3}$, then find the value of

$$\cos^2 A + \cos^2 B - \cos A \cos B$$

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

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

C. $\frac{3}{4}$

D. 1

HW





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6:00 - 7:30 PM



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7:30 - 9:00 PM



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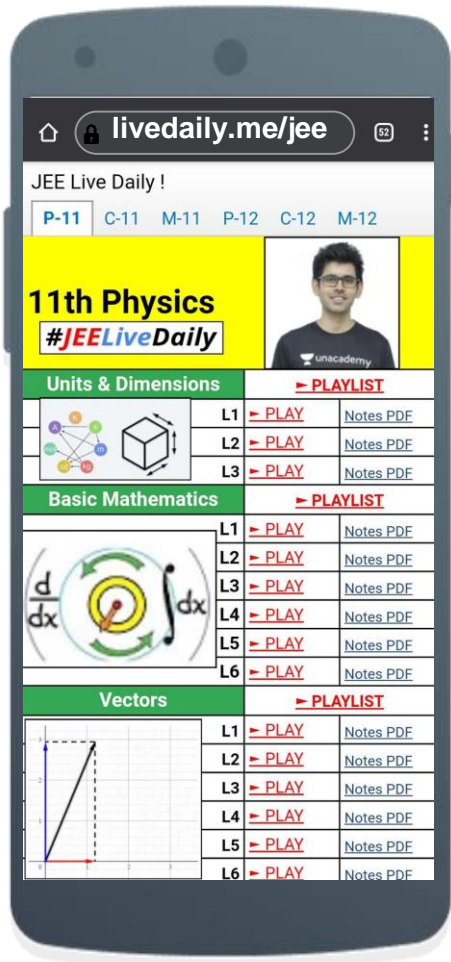
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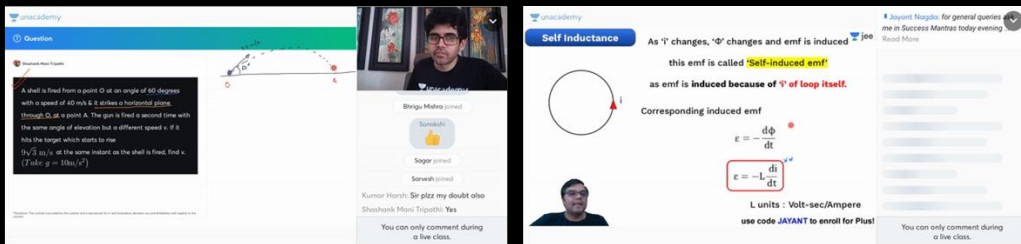
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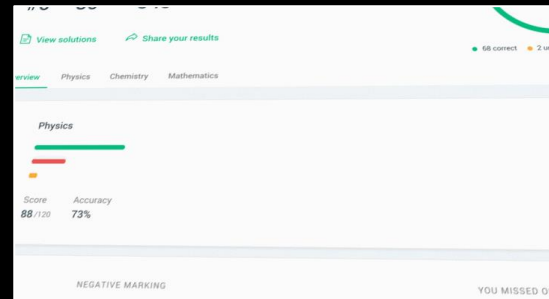
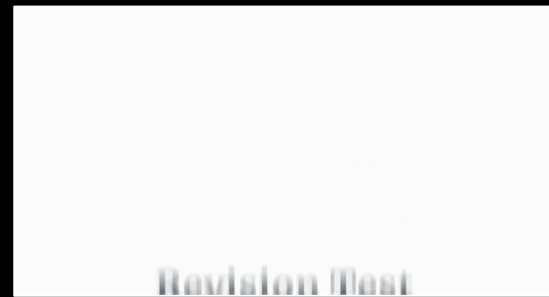


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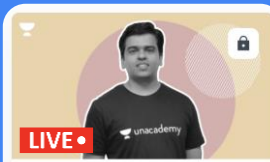


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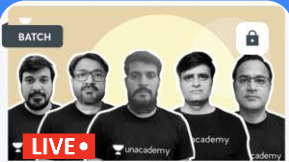
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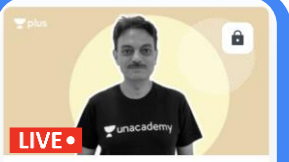
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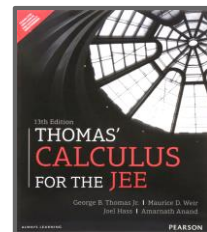
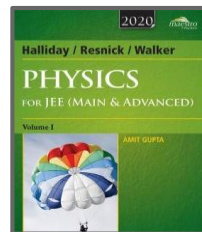
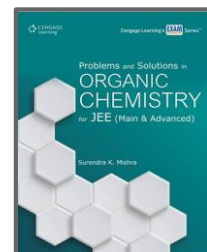
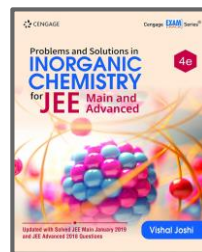
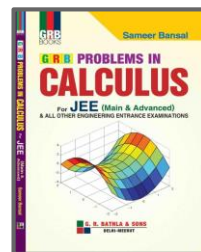
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99.63



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

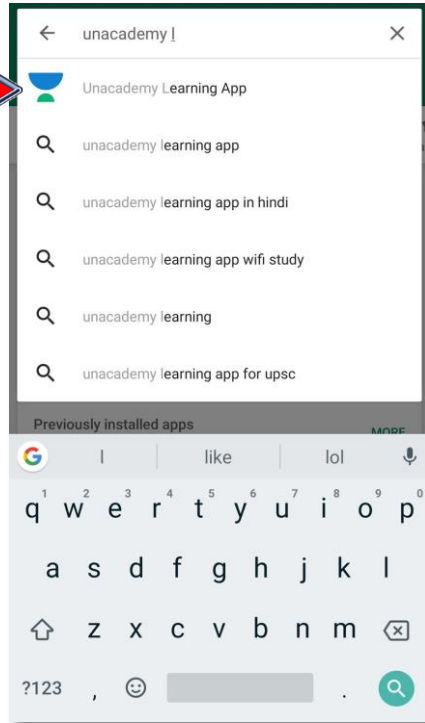


Naman Goyal
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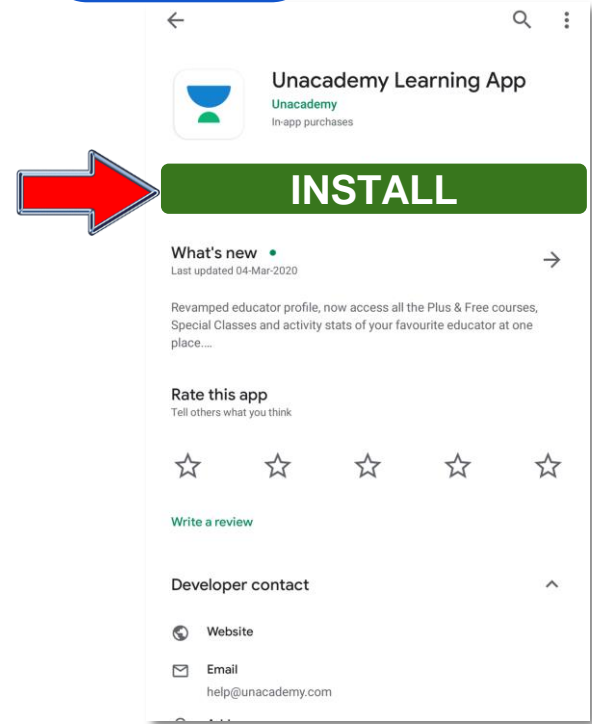


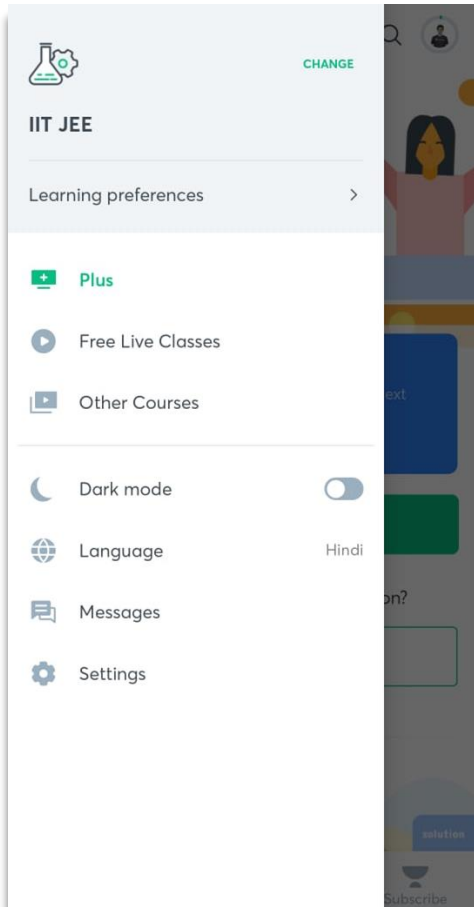
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