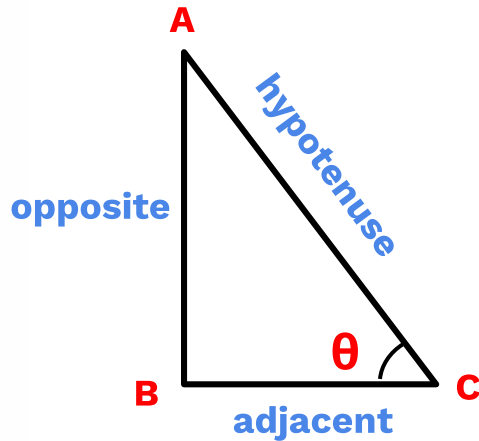


Trigonometry in Right angled Triangle

Trigonometry

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1

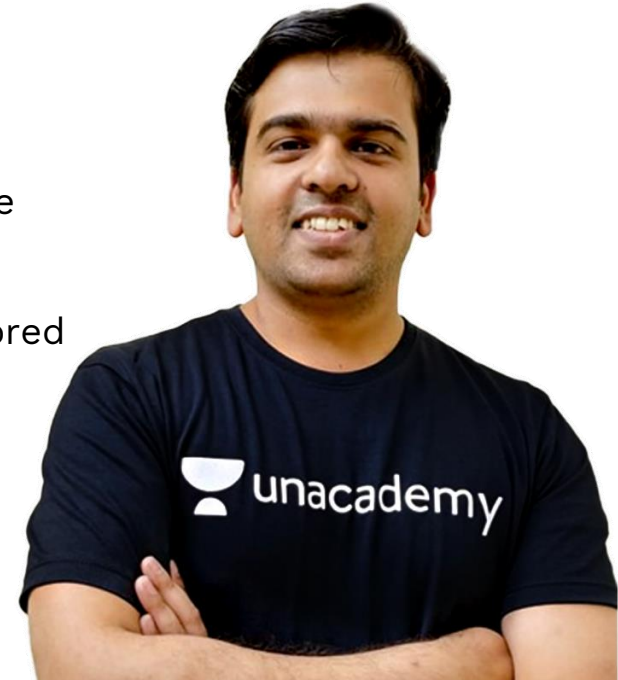


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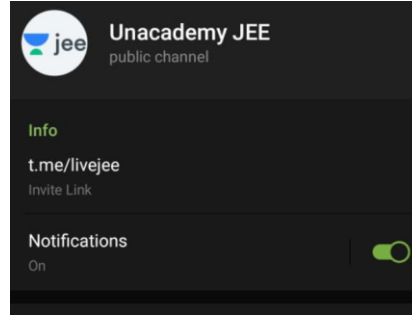
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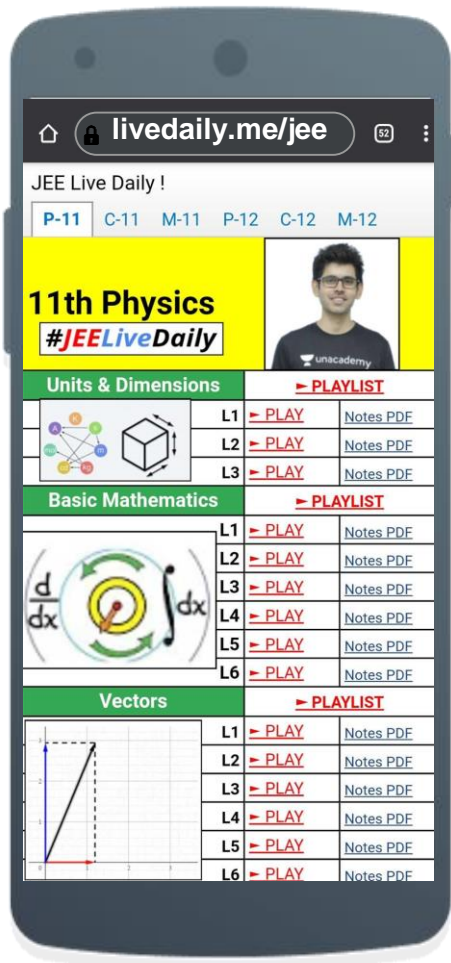
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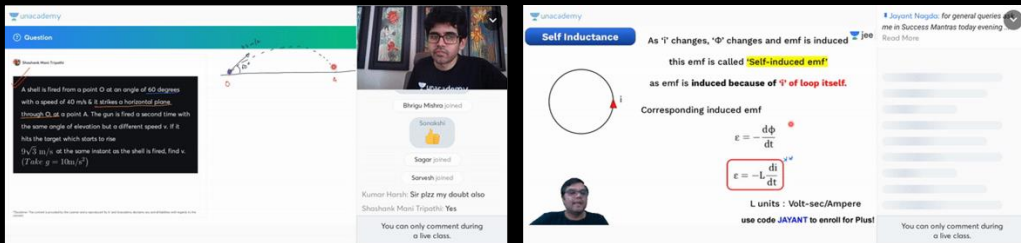
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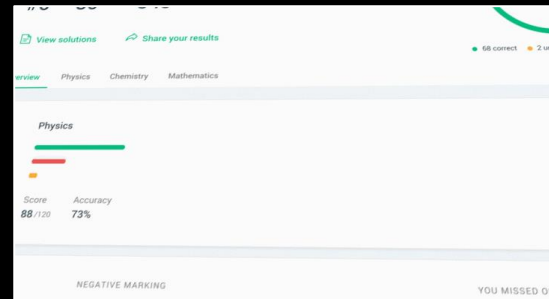
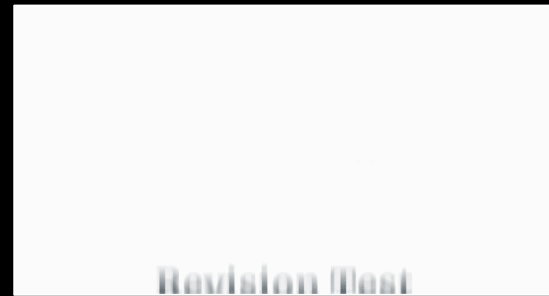


The image shows two screenshots from the Unacademy live class interface. The left screenshot displays a physics problem: "A shell is fired from a point O at an angle of 60 degrees with a speed of 40 m/s. It strikes a horizontal plane through O at a point A. The gun is fired a second time with the same 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".



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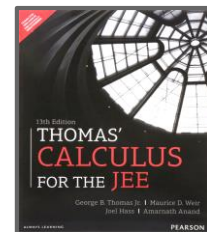
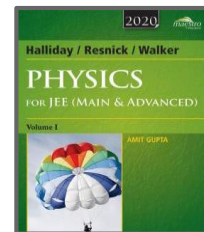
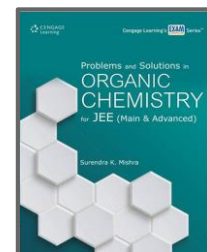
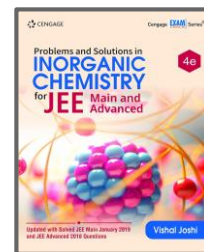
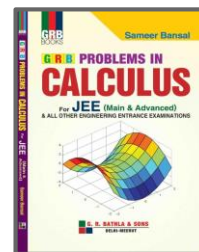
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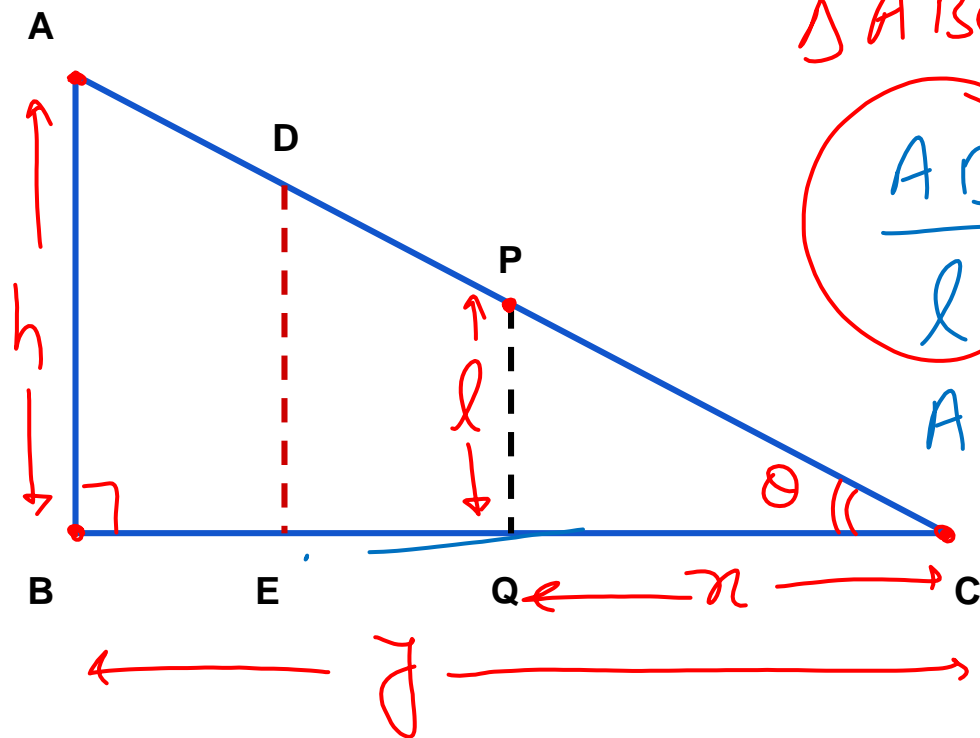
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LET'S BEGIN!!





Observation



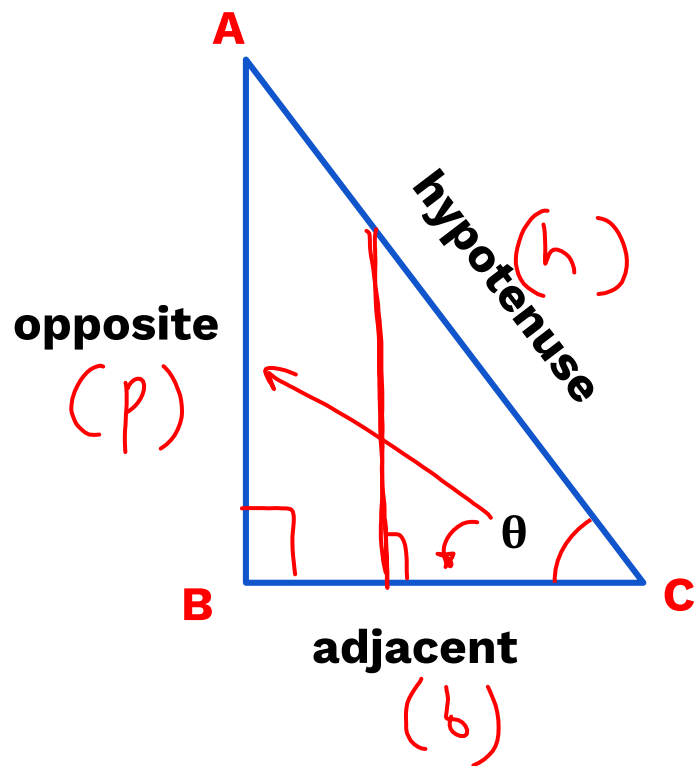
$$\triangle ABC \sim \triangle PQC$$

$$\frac{AB}{l} = \frac{x}{n}$$

$$AB = \frac{l \cdot x}{n}$$



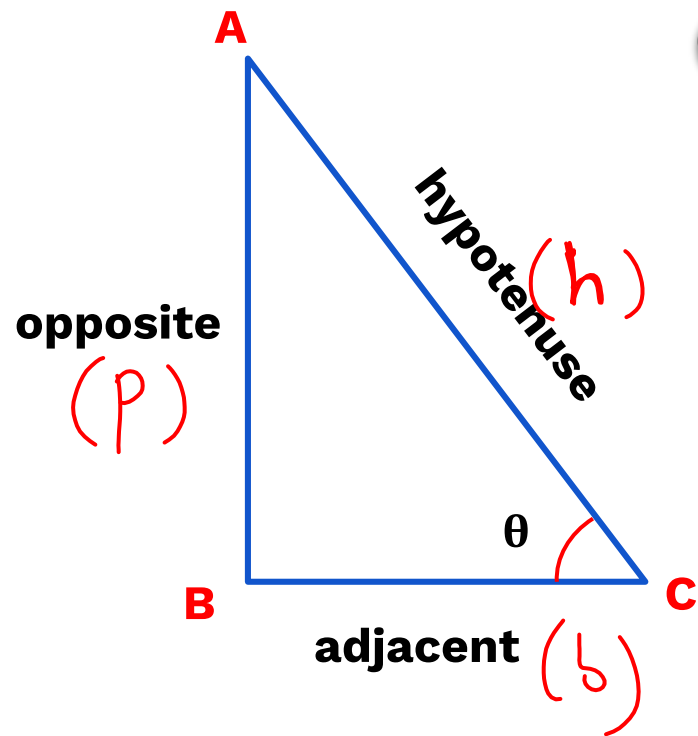
Observation



$$\begin{aligned} \textcircled{1} \sin \theta &= \frac{p}{h} & \csc \theta &= \frac{h}{p} \\ \textcircled{2} \cos \theta &= \frac{b}{h} & \sec \theta &= \frac{h}{b} \\ \textcircled{3} \tan \theta &= \frac{p}{b} & \cot \theta &= \frac{b}{p} \end{aligned}$$



Fundamental Identities



1

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$p^2 + b^2 = h^2$$

$$\left(\frac{p}{h}\right)^2 + \left(\frac{b}{h}\right)^2 = 1$$

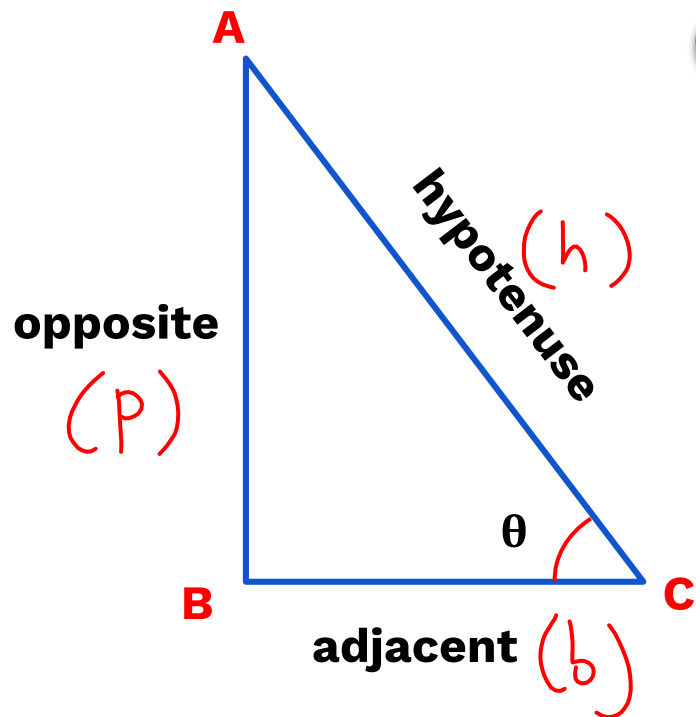
$$\boxed{\sin^2 \theta + \cos^2 \theta = 1}$$



Fundamental Identities

2

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



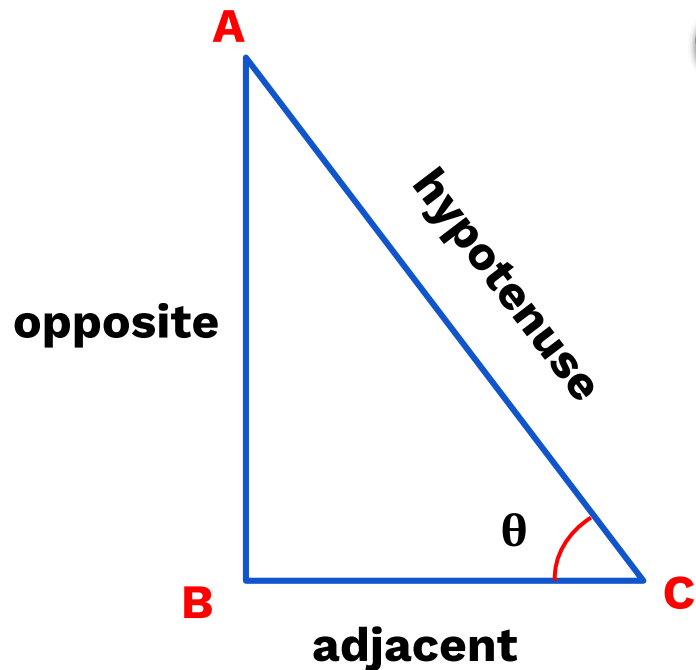
$$p^2 + b^2 = h^2$$

$$\left(\frac{p}{b}\right)^2 + 1 = \left(\frac{h}{b}\right)^2$$

$$\boxed{\tan^2 \theta + 1 = \sec^2 \theta}$$



Fundamental Identities



3

$$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$$

$$p^2 + b^2 = h^2$$

$$1 + \left(\frac{b}{p}\right)^2 = \left(\frac{h}{p}\right)^2$$

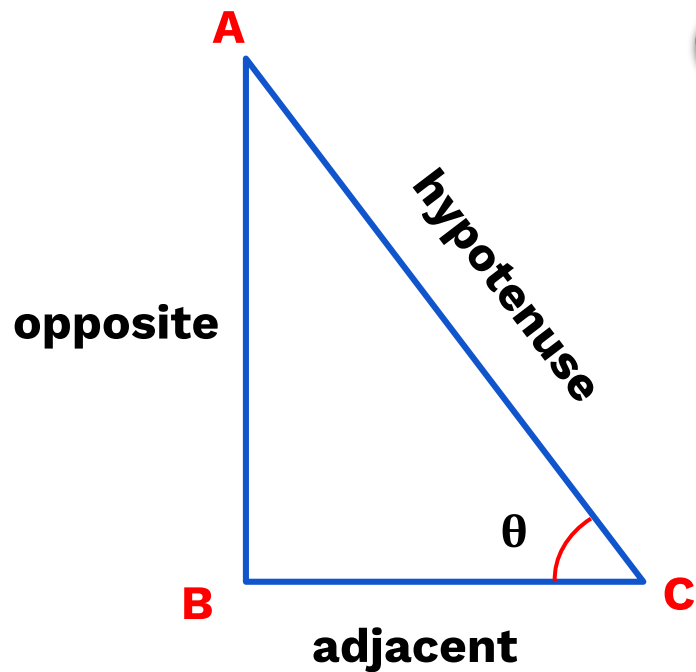
$$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$$



Fundamental Identities

3

$$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$$





Important Observations



Reciprocal Identities

1

$$\cot(\theta) = \frac{1}{\tan \theta}$$

2

$$\operatorname{cosec}(\theta) = \frac{1}{\sin \theta}$$

3

$$\sec(\theta) = \frac{1}{\cos \theta}$$



Important Observations



Quotient Identities

1

$$\tan(\theta) = \frac{\sin \theta}{\cos \theta}$$

2

$$\cot(\theta) = \frac{\cos \theta}{\sin \theta}$$

$$\begin{aligned} \sin \theta &= \frac{p}{h} \\ \cos \theta &= \frac{b}{h} \\ \tan \theta &= \frac{p}{b} \end{aligned} \quad \left\{ \begin{array}{l} \rightarrow \frac{\sin \theta}{\cos \theta} = \frac{p/h}{b/h} \\ = \frac{p}{b} \end{array} \right.$$

Simplify: $\frac{\sin \theta}{1 + \cos \theta} + \frac{1 + \cos \theta}{\sin \theta}$

A. $2 \operatorname{cosec} \theta$

B. $2 \sec \theta$

C. $-2 \sec \theta$

D. None

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

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

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

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

$$= \boxed{2 \sec \theta}$$

Simplify: $\frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A}$

A. $\cos A - \sin A$

B. $\sin A - \cos A$

C. $\cos^2 A - \sin^2 A$

☒ D. $\sin A + \cos A$

$$= \frac{\cos A}{\left(1 - \frac{\sin A}{\cos A}\right)} + \frac{\sin A}{\left(1 - \frac{\cos A}{\sin A}\right)}$$

$$= \frac{\cos^2 A}{\cos A - \sin A} + \frac{\sin^2 A}{\sin A - \cos A}$$

$$= \frac{\cos^2 A - \sin^2 A}{(\cos A - \sin A)}$$

$$= \boxed{\cos A + \sin A}$$

The expression $\frac{\tan A}{1 - \cot A} + \frac{\cot A}{1 - \tan A}$ can be written as :

A. $\sin A \cos A + 1$

☒ B. $\sec A \operatorname{cosec} A + 1$

JEE M 2013

C. $\tan A + \cot A$

D. $\sec A + \operatorname{cosec} A$

$$\begin{aligned} & \frac{\tan A}{\left(1 - \frac{1}{\tan A}\right)} + \frac{\left(\frac{1}{\tan A}\right)}{(1 - \tan A)} \\ &= \frac{\tan^2 A}{(\tan A - 1)} - \frac{1}{(\tan A - 1)\tan A} \end{aligned} \quad \left| \quad \frac{(\tan^3 A - 1)}{(\tan A - 1)\tan A} \right.$$

$$\frac{(\cancel{\tan A - 1})(\tan^2 A + \tan A + 1)}{(\cancel{\tan A - 1})\tan A}$$

$$\frac{\sec^2 A + \tan A}{\tan A}$$

$$\frac{\sec^2 A}{\tan A} + 1$$

$$\sec A \csc A + 1$$

Find the value of $(5 \sin \theta - 3 \cos \theta)$ if $3 \sin \theta + 5 \cos \theta = 5$

A. 2

✓ B. 3

C. -2

✓ D. -3

$$\begin{cases} (3 \sin \theta + 5 \cos \theta)^2 = (5)^2 \\ (5 \sin \theta - 3 \cos \theta)^2 = (m)^2 \end{cases}$$

$$\begin{cases} 9 \sin^2 \theta + 25 \cos^2 \theta + 30 \sin \theta \cos \theta = 25 \\ 25 \sin^2 \theta + 9 \cos^2 \theta - 30 \sin \theta \cos \theta = m^2 \end{cases}$$

$$9 + \cancel{25} = \cancel{25} + m^2$$

$$m^2 = 9$$

$$\boxed{m = \pm 3}$$

Simplify: $\frac{\tan A + \sec A - 1}{\tan A - \sec A + 1}$

✓ A. $\frac{\cos A}{1 - \sin A}$

B. $\frac{1 - \sin A}{\cos A}$

C. $\frac{\cos A}{1 + \sin A}$

✓ D. $\frac{1 + \sin A}{\cos A}$

$$\frac{(\tan A + \sec A) - (\sec^2 A - \tan^2 A)}{(\tan A - \sec A + 1)}$$

$$\frac{(\tan A + \sec A) - (\sec A + \tan A)(\sec A - \tan A)}{(\tan A - \sec A + 1)}$$

$$\frac{(\tan A + \sec A) [1 - (\sec A - \tan A)]}{(\tan A - \sec A + 1)}$$

$$= \frac{\sin A}{\cos A} + \frac{1}{\cos A} \rightarrow \left(\frac{1 + \sin A}{\cos A} \right) \times \left(\frac{1 - \sin A}{1 - \sin A} \right) \rightarrow \frac{\cos A}{1 - \sin A}$$

Let $f_k(x) = \frac{1}{k} (\sin^k x + \cos^k x)$ where $x \in \mathbb{R}$ and $k \geq 1$. Then

$f_4(x) - f_6(x)$ equals

A. $\frac{1}{4}$

☒ B. $\frac{1}{12}$

C. $\frac{1}{6}$

D. $\frac{1}{3}$

JEE M 2014

$$\left\{ \begin{aligned} f_k(x) &= \frac{1}{k} (\sin^k x + \cos^k x) \\ f_4(x) - f_6(x) &= \frac{1}{4} (\sin^4 x + \cos^4 x) - \frac{1}{6} (\sin^6 x + \cos^6 x) \\ f_4(0) - f_6(0) &= \frac{1}{4} - \frac{1}{6} = \frac{1}{12} \end{aligned} \right.$$

$$= \frac{1}{4} \left(\underline{(\sin^2 x + \cos^2 x)^2} - 2 \sin^2 x \cos^2 x \right)$$

$$- \frac{1}{6} \left((\sin^2 x + \cos^2 x)^3 - 3 \sin^2 x \cos^2 x (\sin^2 x + \cos^2 x) \right)$$

$$= \frac{1}{4} \left(1 - 2 \sin^2 x \cos^2 x \right) - \frac{1}{6} \left(1 - 3 \sin^2 x \cos^2 x \right)$$

$$= \frac{1}{4} - \frac{1}{6} = \left(\frac{1}{12} \right)$$

If $\tan \theta + \sec \theta = 1.5$, find $\sin \theta$.

A. $\frac{12}{13}$

✓ B. $\frac{5}{13}$

C. $\frac{5}{12}$

D. None

$$\tan \theta + \sec \theta = \frac{3}{2} \quad \text{--- (1)}$$

$$\sec^2 \theta - \tan^2 \theta = 1$$

$$\rightarrow (\sec \theta + \tan \theta)(\sec \theta - \tan \theta) = 1$$

$$\Rightarrow \sec \theta - \tan \theta = \frac{2}{3} \quad \text{--- (2)}$$

$$\underline{Eq^{\text{n}} (1) + Eq^{\text{n}} (2) :}$$

$$2 \sec \theta = \frac{3}{2} + \frac{2}{3}$$

$$2 \sec \theta = \frac{13}{6}$$

$$\cos \theta = \frac{12}{13}$$

$$\sin \theta = ?$$

If $\sin^2 x + \sin x = 1 \Rightarrow \sin x = 1 - \sin^2 x \rightarrow \sin x = \cos^2 x$

Then find the value of $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x$

✓ A.

1

B. 2

C. 3

D. None of these

$$\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x$$

$$(\cos^2 x)^6 + 3(\cos^2 x)^5 + 3(\cos^2 x)^4 + (\cos^2 x)^3$$

$$\sin^6 x + 3\sin^5 x + 3\sin^4 x + \sin^3 x$$

$$(\sin^2 x)^3 + 3(\sin^2 x)^2(\sin x) + 3(\sin^2 x)(\sin x)^2 + (\sin x)^3$$

(a)
(b)

$$\begin{cases} a^3 + 3a^2b + 3ab^2 + b^3 \\ (a+b)^3 \end{cases}$$

$$\underline{\underline{(\sin^2 x + \sin x)^3}} = (1)^3 = \textcircled{1}$$

If $\sin^2\theta + \sin\theta = 1$, Then, find the value of $\tan^4\theta - \tan^2\theta$

A. $2\sin\theta - 1$

B. $\sin^2\theta - \cos^2\theta$

C. $\sin\theta - 1$

D. None of these

$\left\{ \begin{array}{l} \text{if: } \sin^2\theta + \sin\theta = 1 \\ \text{then: } \tan^4\theta - \tan^2\theta \end{array} \right.$

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

$$\sin\theta = \cos^2\theta$$

$$\tan\theta = \cos\theta$$

Now,

$$\tan^4 \theta - \tan^2 \theta$$

$$\cos^4 \theta - \cos^2 \theta$$



$$\sin^2 \theta - \cos^2 \theta$$

$$\boxed{\cos^2 \theta - \sin^2 \theta}$$

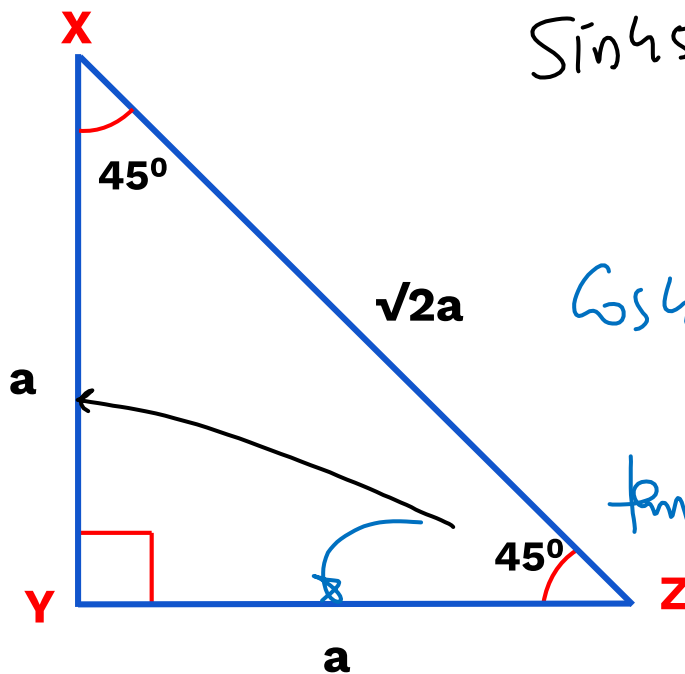
T-Ratios of Standard Angles





T-Ratios of standard angles:

1 45°



$$\sin 45^\circ = \frac{a}{\sqrt{2}a} = \left(\frac{1}{\sqrt{2}} \right)$$

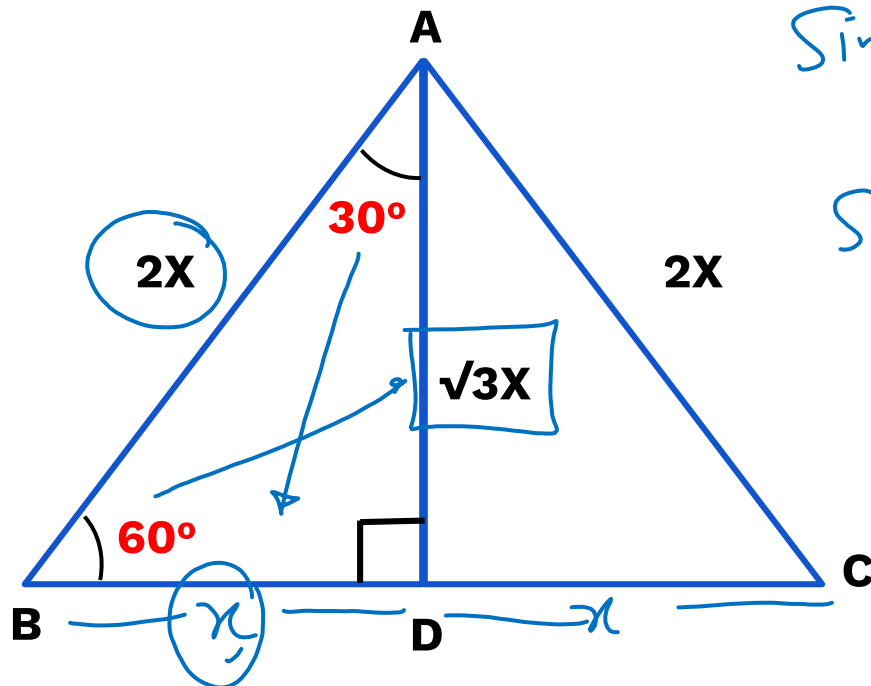
$$\cos 45^\circ = \frac{a}{\sqrt{2}a} = \left(\frac{1}{\sqrt{2}} \right)$$

$$\tan 45^\circ = 1$$



T-Ratios of standard angles:

2 30° and 60°



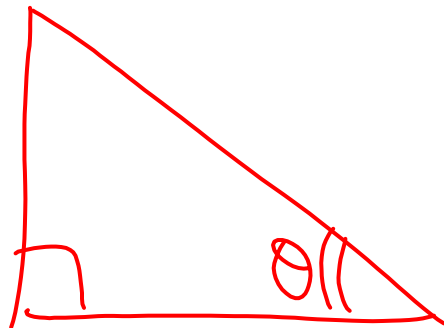
$$\sin 30^\circ = \frac{x}{2x} = \frac{1}{2}$$

$$\sin 60^\circ = \frac{\sqrt{3}x}{2x} = \frac{\sqrt{3}}{2}$$



T-Ratios of standard angles:

3

 0° and 90° 



T-Ratios of standard angles: Summary

	0°	30°	45°	60°	90°
$\sin \theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos \theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan \theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
$\operatorname{cosec} \theta$	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
$\sec \theta$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
$\cot \theta$	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0



Need for extending understanding of Trigonometry



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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

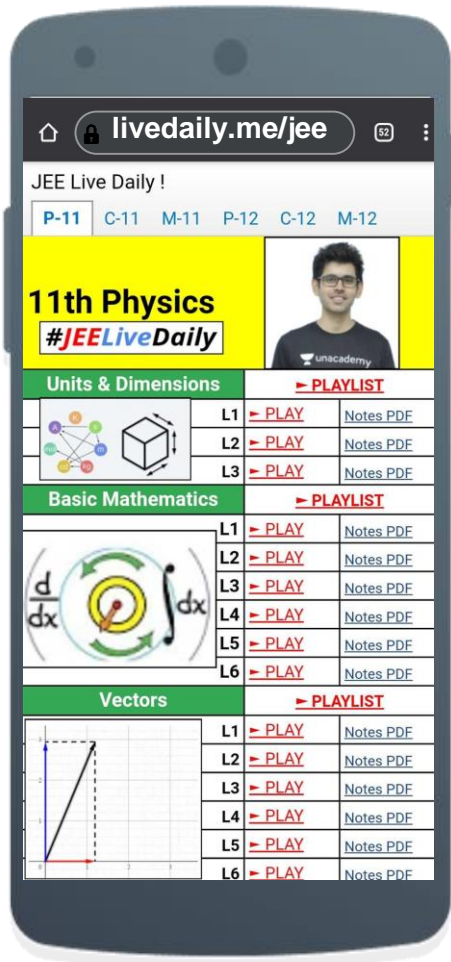
3:00 - 4:30 PM



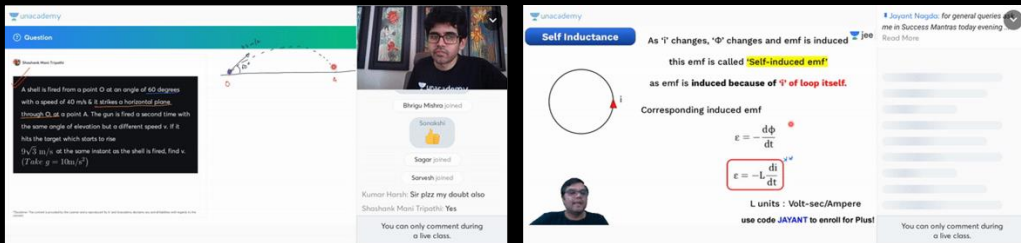
Nishant Sir | Maths

4:30 - 6:00 PM

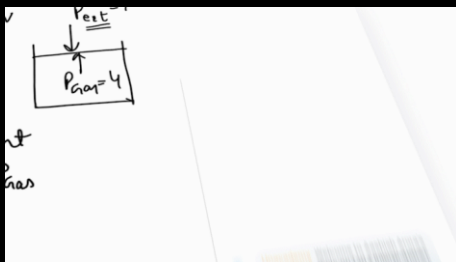
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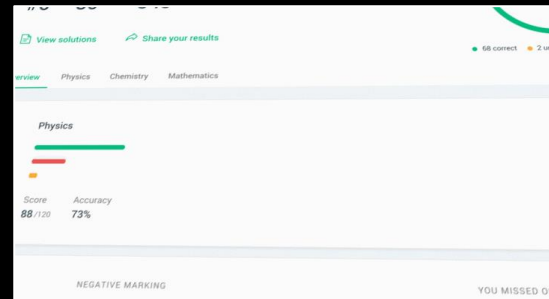
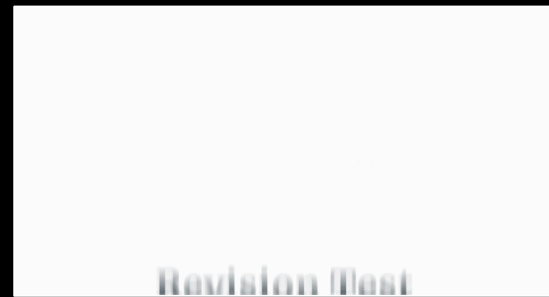


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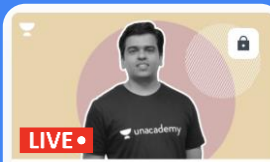


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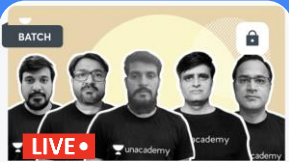
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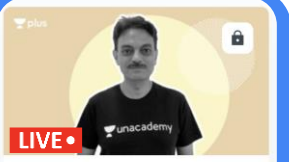
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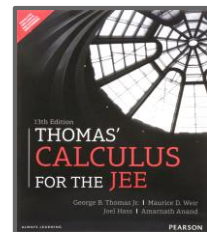
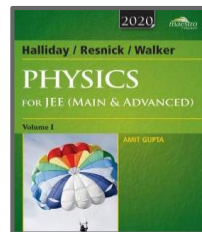
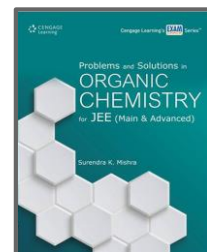
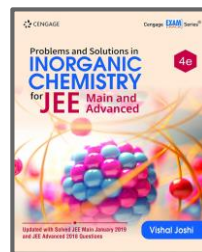
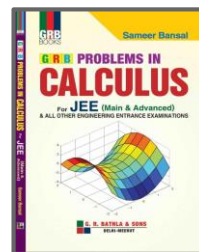
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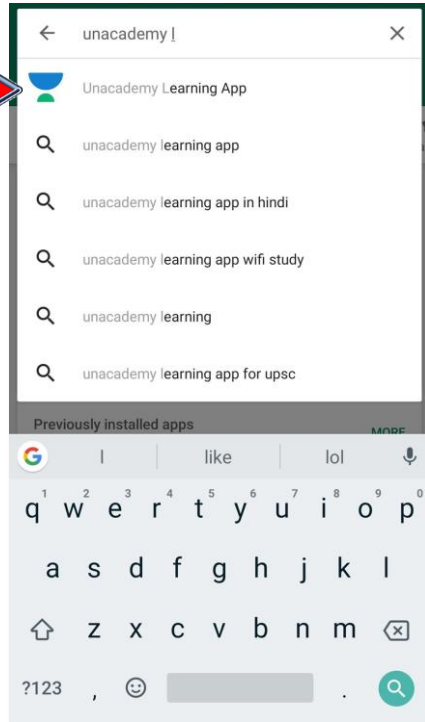


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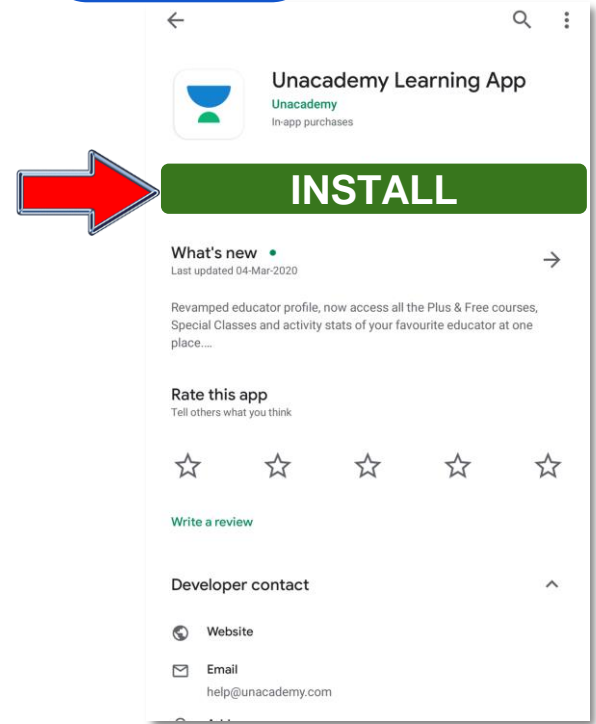


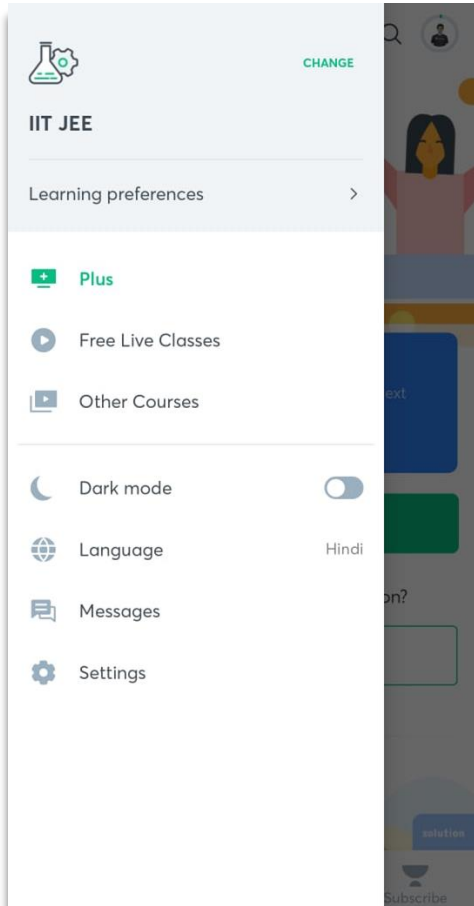
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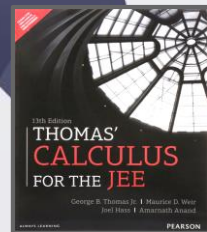
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