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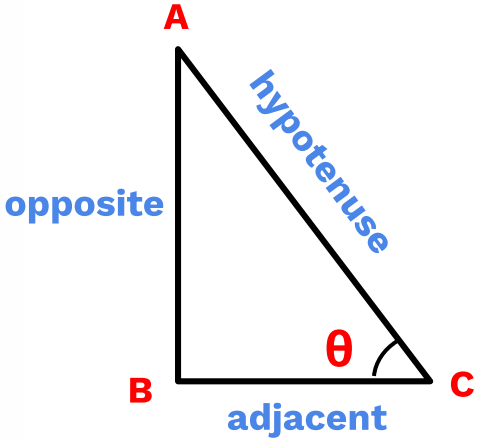
Trigonometry in Right angled Triangle

Trigonometry 1



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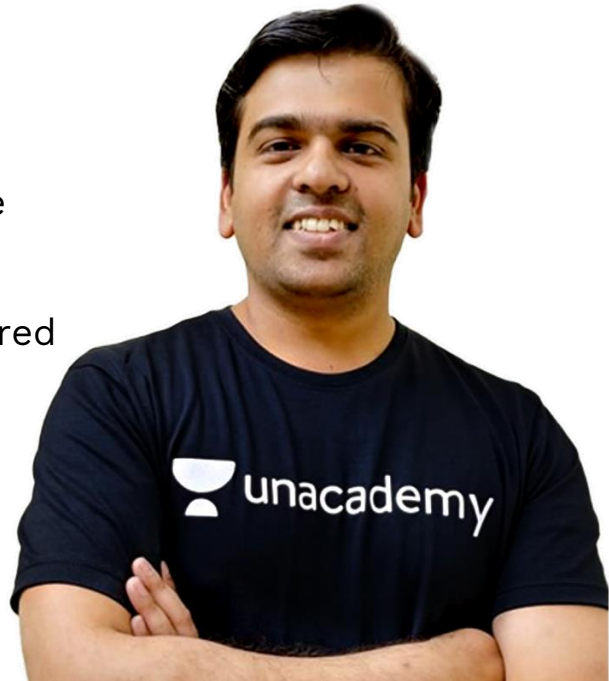
Sameer Chincholikar

B.Tech, M.Tech - IIT-Roorkee

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



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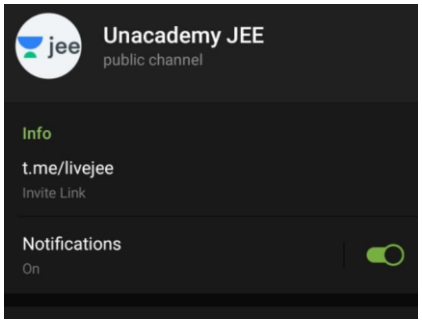

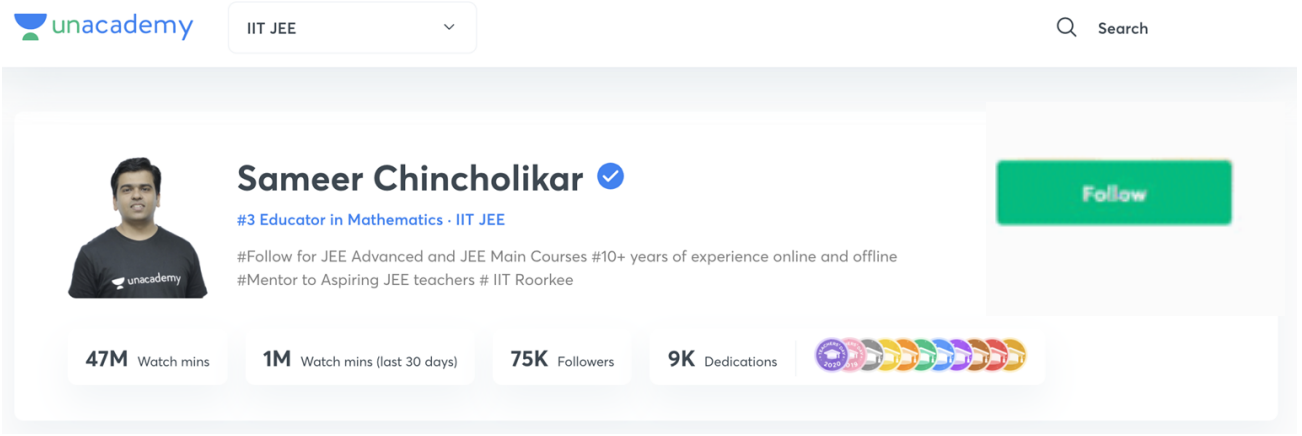

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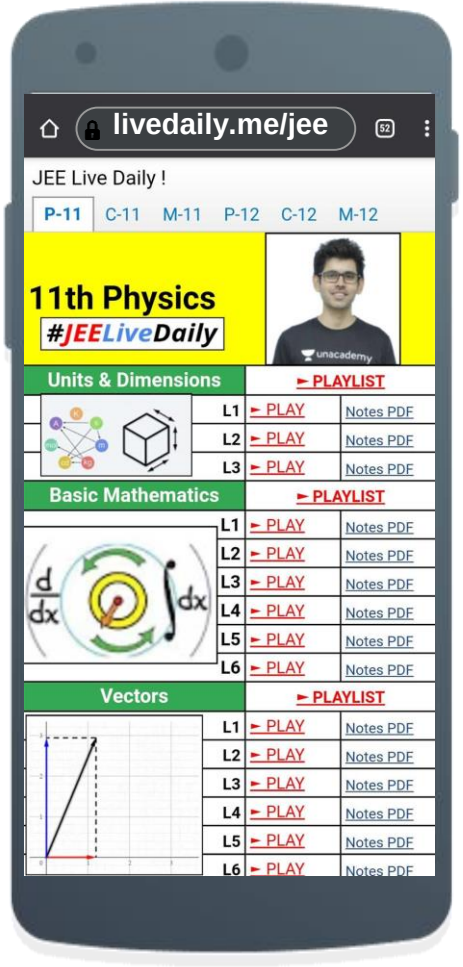

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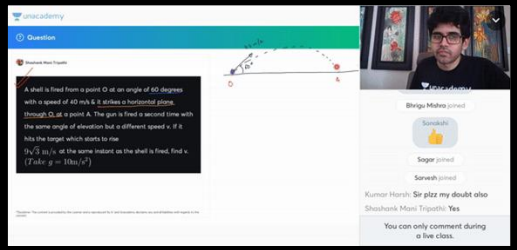

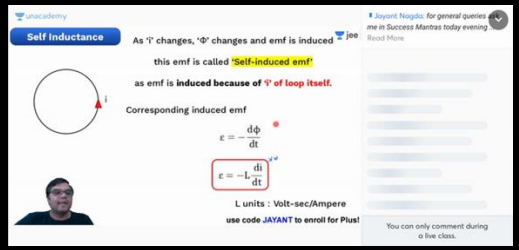

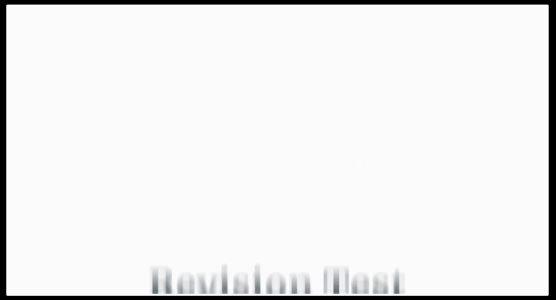

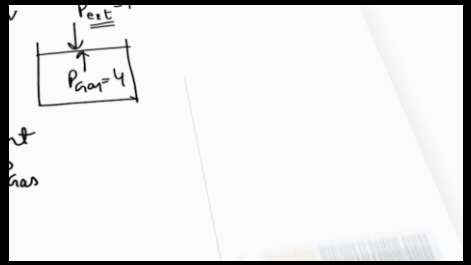

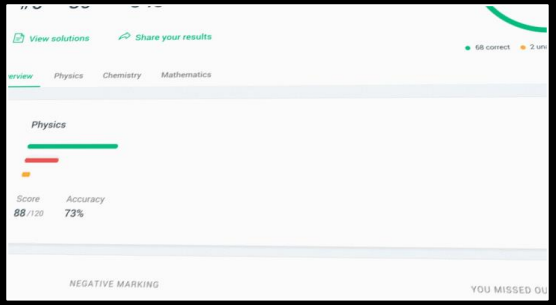

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- **Weekly Test Series**
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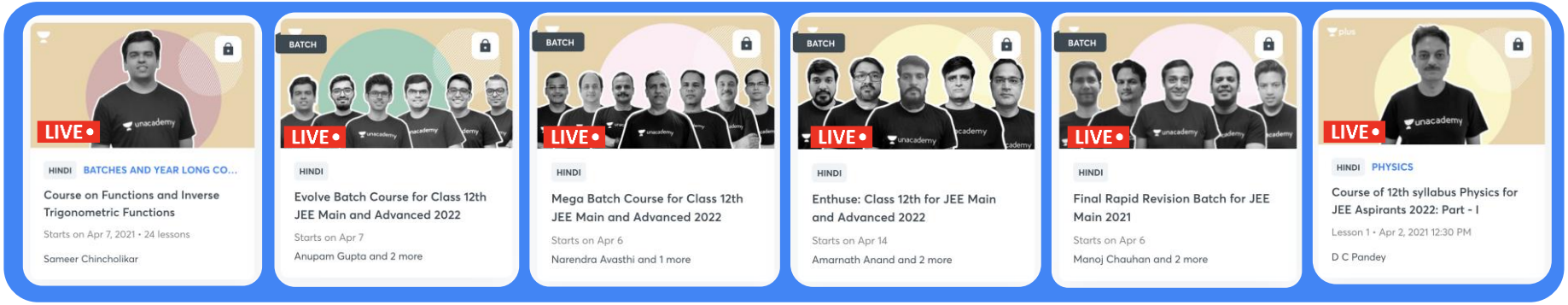

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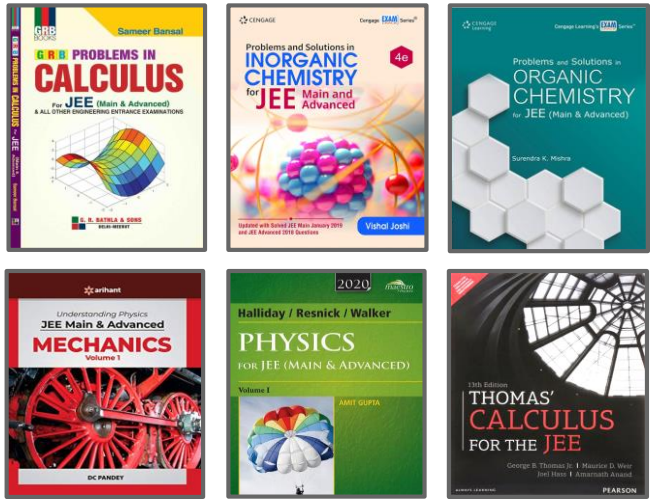

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Top Results

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

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

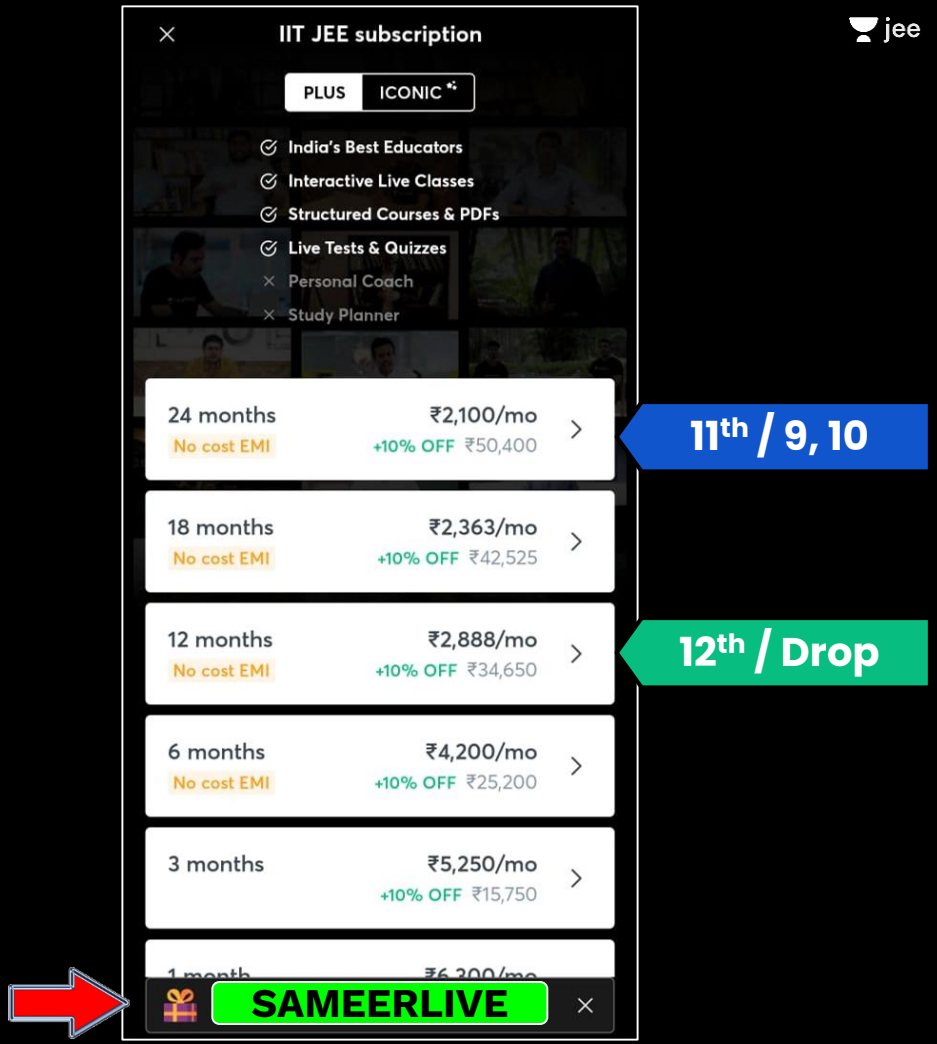
Ayush Kale
98.85

Ayush Gupta
98.67

Megh Gupta
98.59

Naman Goyal
98.48

MIHIR PRAJAPATI
98.16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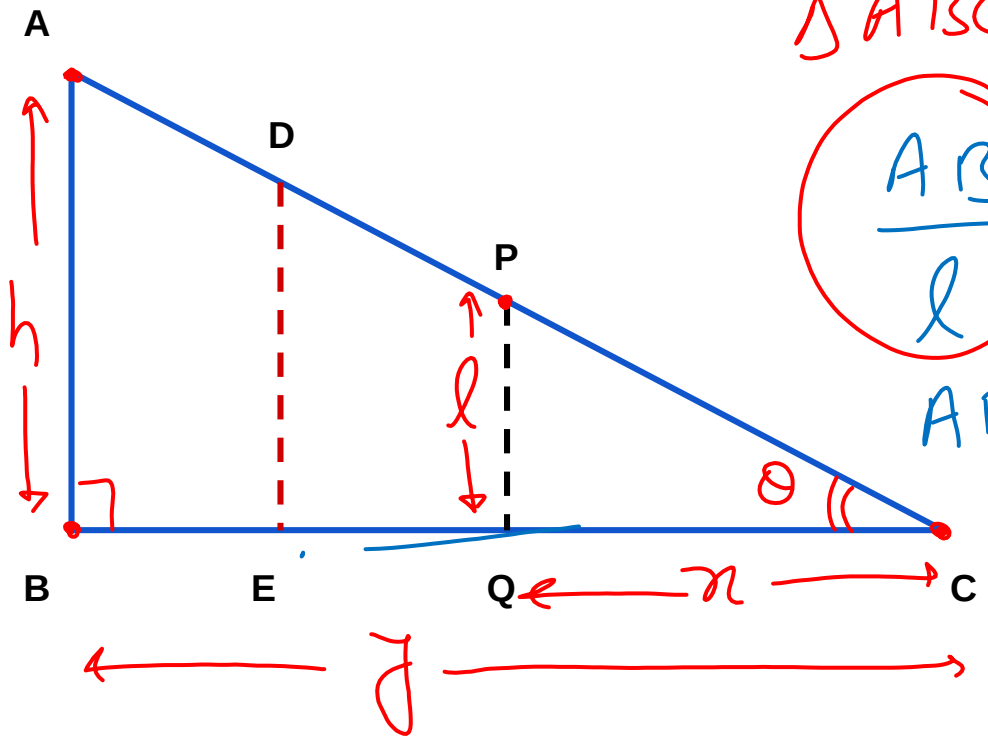
+10% OFF ₹50,400
18 months
No cost EMI
₹2,363/mo
+10% OFF ₹42,525
12 months
No cost EMI
₹2,888/mo
+10% OFF ₹34,650
6 months
No cost EMI
₹4,200/mo
+10% OFF ₹25,200
3 months
₹5,250/mo
+10% OFF ₹15,750
SAMEERLIVE
jee
11th / 9, 10
12th / Drop

LET'S BEGIN!!

Observation

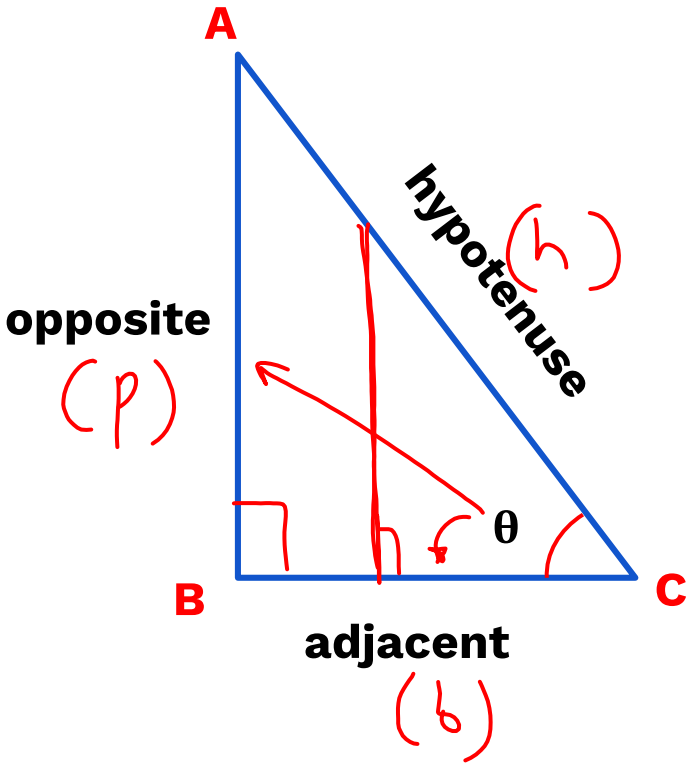


$\triangle ABC \sim \triangle PQC$

$$\frac{AB}{\ell} = \frac{y}{x}$$

$$AB = \frac{\ell y}{x}$$

Observation

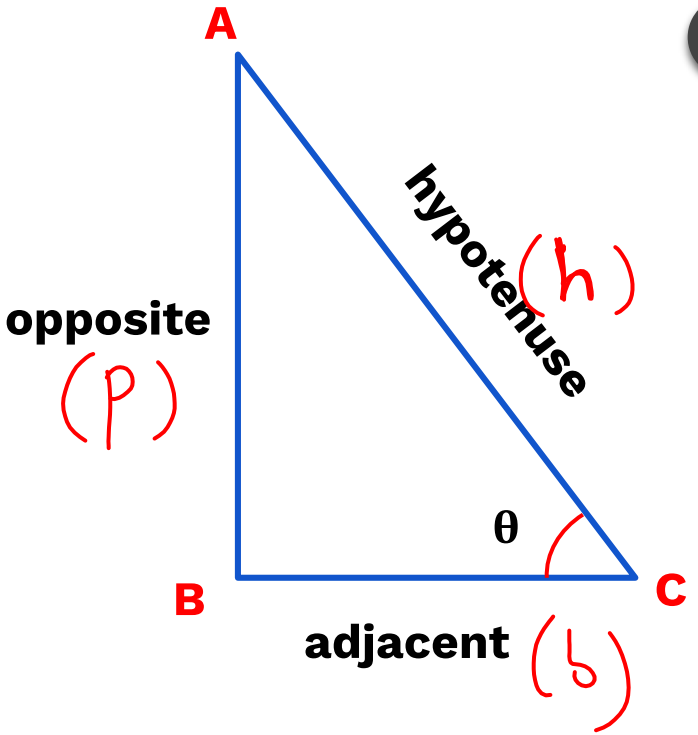


1. $\sin\theta = \frac{p}{h}$ $\quad \operatorname{cosec}\theta = \frac{h}{p}$

2. $\cos\theta = \frac{b}{h}$ $\quad \sec\theta = \frac{h}{b}$

3. $\tan\theta = \frac{p}{b}$ $\quad \cot\theta = \frac{b}{p}$

Fundamental Identities



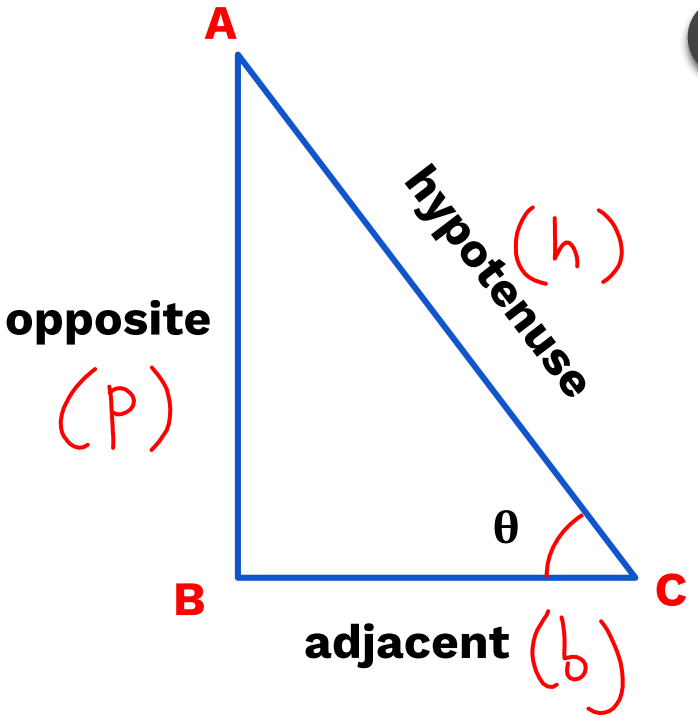
1 $\sin^2\theta + \cos^2\theta = 1$

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

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

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

Fundamental Identities



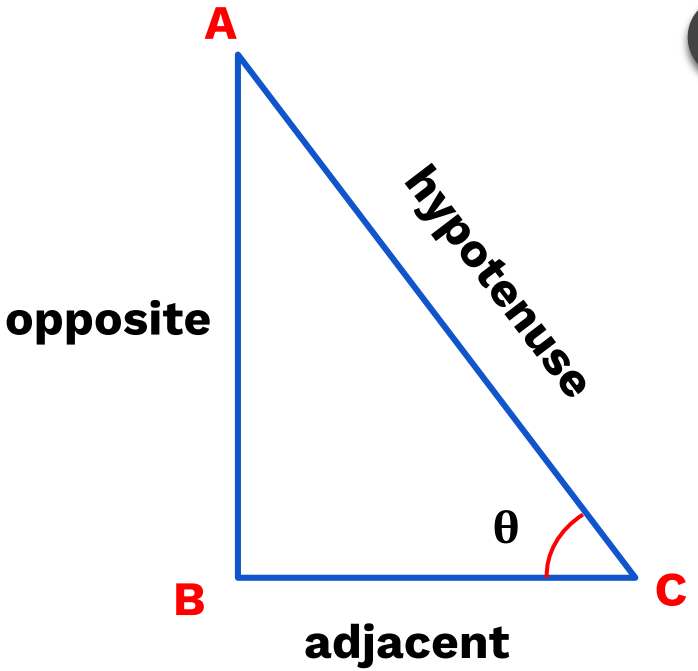
2 $\tan^2\theta + 1 = \sec^2\theta$

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

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

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

Fundamental Identities



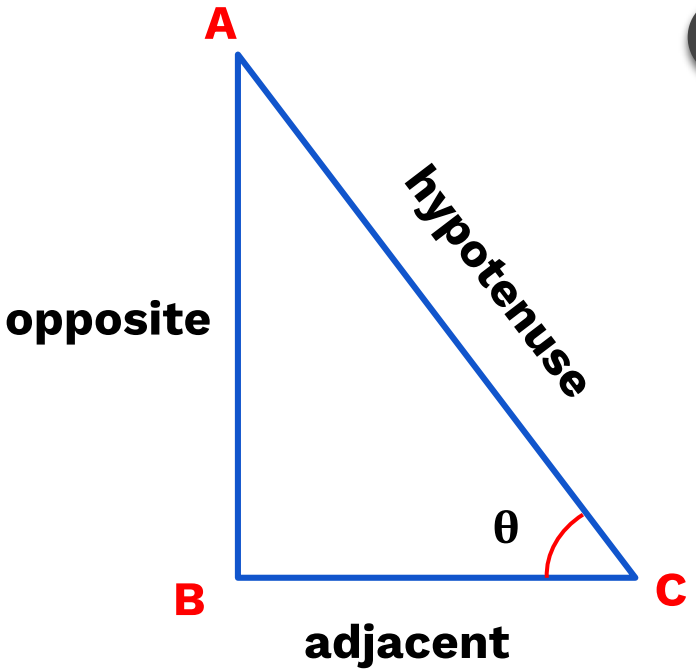
3 $1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$

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

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

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

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. $\tan(\theta) = \dfrac{\sin\theta}{\cos\theta}$

2. $\cot(\theta) = \dfrac{\cos\theta}{\sin\theta}$

$\sin\theta = \frac{P}{h}$

$\cos\theta = \frac{b}{h}$

$\tan\theta = \frac{P}{b}$

$\frac{\sin\theta}{\cos\theta} = \frac{P/h}{b/h} = \frac{P}{b}$

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

A. 2 cosec θ B. 2 sec θ C. -2 sec θ D. None

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

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

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

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

$$= \boxed{2\operatorname{cosec}\theta}$$

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 ✓

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

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

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

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

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

A. sinA cos A + 1

B. secA cosecA + 1

C. tanA + cotA

D. secA + cosecA

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$$\frac{\tan A}{\left(1-\frac{1}{\tan A}\right)}+\frac{\left(1/\tan A\right)}{\left(1-\tan A\right)}$$

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

$$\frac{(\tan^3 A-1)}{(\tan A-1)\tan A}$$

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

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

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

$$\sec A \operatorname{cosec} A + 1$$

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

A. 2

B. 3

C. -2

D. -3

$$(3\sin\theta + 5\cos\theta)^2 = (5)^2$$

$$(5\sin\theta - 3\cos\theta)^2 = (m)^2$$

$$9\sin^2\theta + 25\cos^2\theta + 30\sin\theta\cos\theta = 25$$

$$25\sin^2\theta + 9\cos^2\theta - 30\sin\theta\cos\theta = m^2$$

$$9 + 25 = 25 + m^2$$

$$m^2 = 9$$

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

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

A. $\dfrac{\cos A}{1 - \sin A}$

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

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

D. $\dfrac{1 + \sin A}{\cos A}$

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

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

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

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

Let $f_k(x) = \frac{1}{k}(\sin^k x + \cos^k x)$ where $x \in R$ and $k \geq 1$. Then $F_4(x) - f_6(x)$ equals

JEE M 2014

A. $\frac{1}{4}$ B. $\frac{1}{12}$ C. $\frac{1}{6}$ D. $\frac{1}{3}$

$$f_k(x) = \frac{1}{k}(\sin^k x + \cos^k x)$$

$$f_4(x) - f_6(x) = \frac{1}{4}(\sin^4 x + \cos^4 x) - \frac{1}{6}(\sin^6 x + \cos^6 x)$$

$$f_4(0) - f_6(0) = \frac{1}{4} - \frac{1}{6} = \frac{1}{12}$$

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

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

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

$$= \frac{1}{4} - \frac{1}{6} = \frac{1}{12}$$

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

A. $\frac{12}{13}$ B. $\frac{5}{13}$ C. $\frac{5}{12}$ D. None

$\tan\theta + \sec\theta = \frac{3}{2}$ — (1)

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

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

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

Eq^n (1) + Eq^n (2):

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

$2\sec\theta = 13/6$

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

$$\sin\theta = ?$$

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

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

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

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

$(\sin^2 x)^3 + 3(\sin^2 x)^2(\sin x) + 3(\sin^2 x)^1(\sin x)^2$

$+ (\sin x)^3$

(a) (b)

$a^3 + 3a^2b + 3ab^2 + b^3$

$(a+b)^3$

$(\sin^2 x + \sin x)^3 = (1)^3 = 1$

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

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

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

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

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

$\tan\theta = \cos\theta$

Now,

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

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

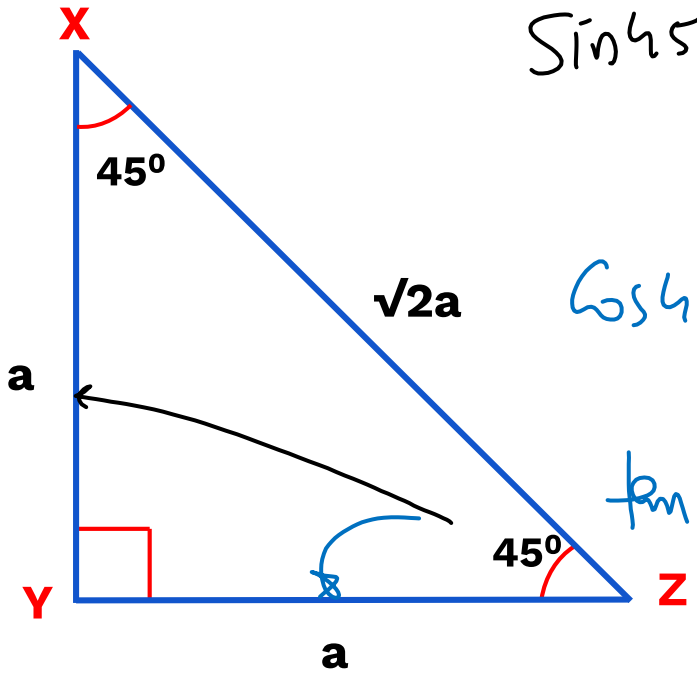
$$\sin^2\theta - \cos^2\theta$$

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

T-Ratios of Standard Angles

T-Ratios of standard angles:

1 45^0



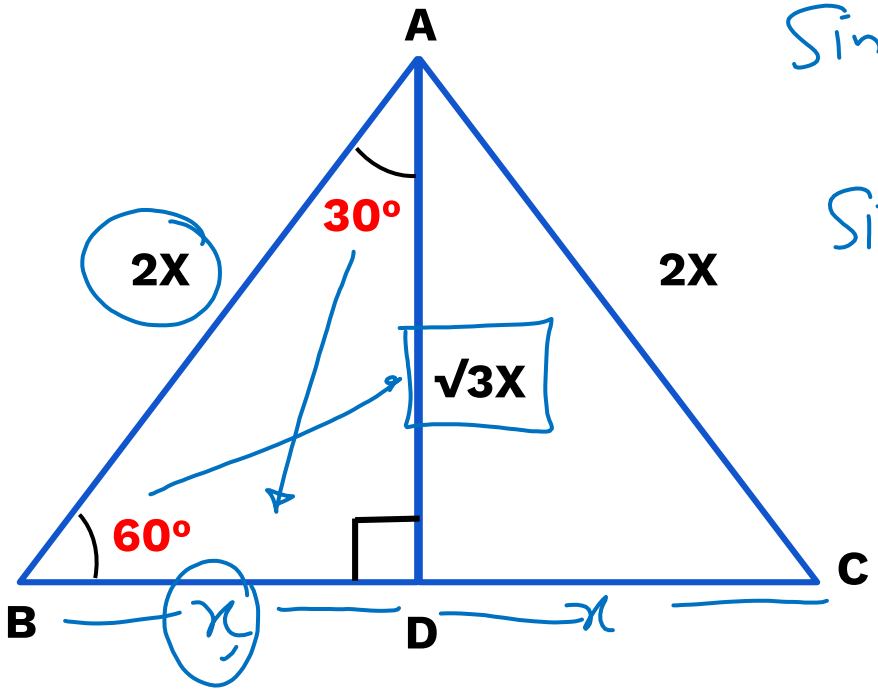
$$\sin 45^\circ = \frac{a}{\sqrt{2}a} = \frac{1}{\sqrt{2}}$$

$$\cos 45^\circ = \frac{a}{\sqrt{2}a} = \frac{1}{\sqrt{2}}$$

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

T-Ratios of standard angles:

2 30^0 and 60^0

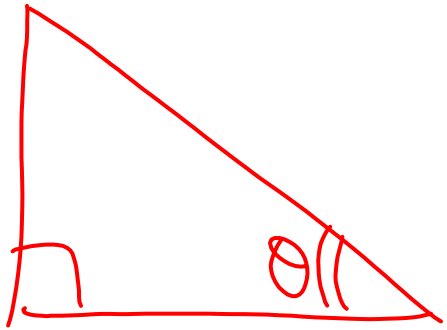


$$\sin 30^\circ = \frac{x}{2x} = \frac{1}{2}$$

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

T-Ratios of standard angles:

3 0^0 and 90^0



T-Ratios of standard angles: Summary

	0^0	30^0	45^0	60^0	90^0
$\sin\theta$	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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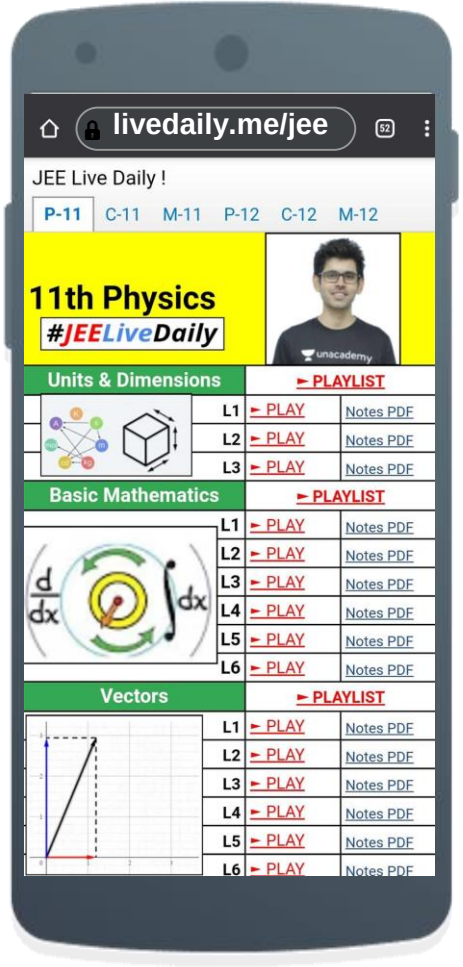

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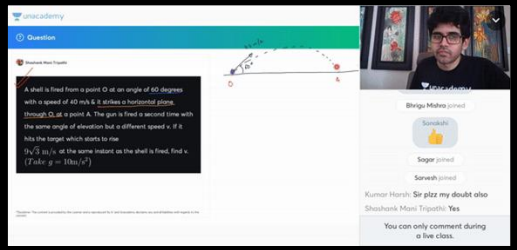

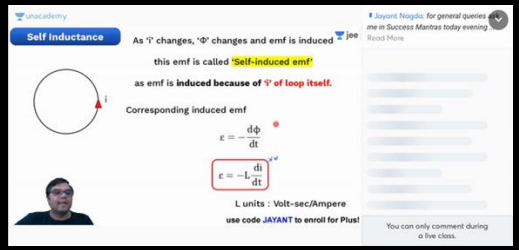

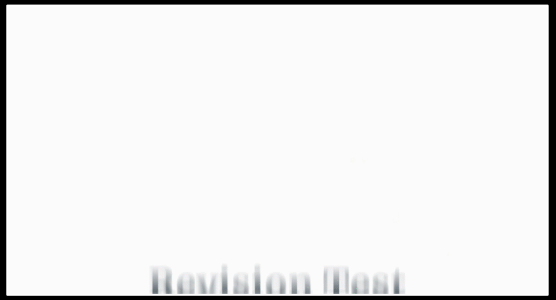

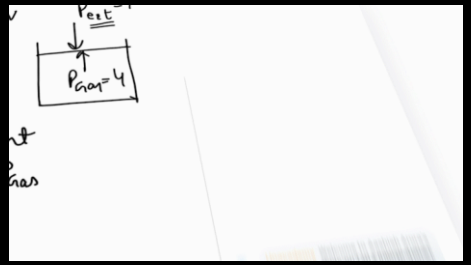

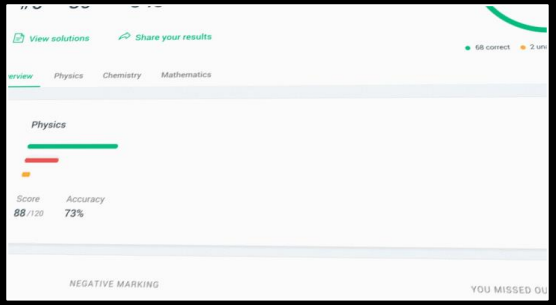

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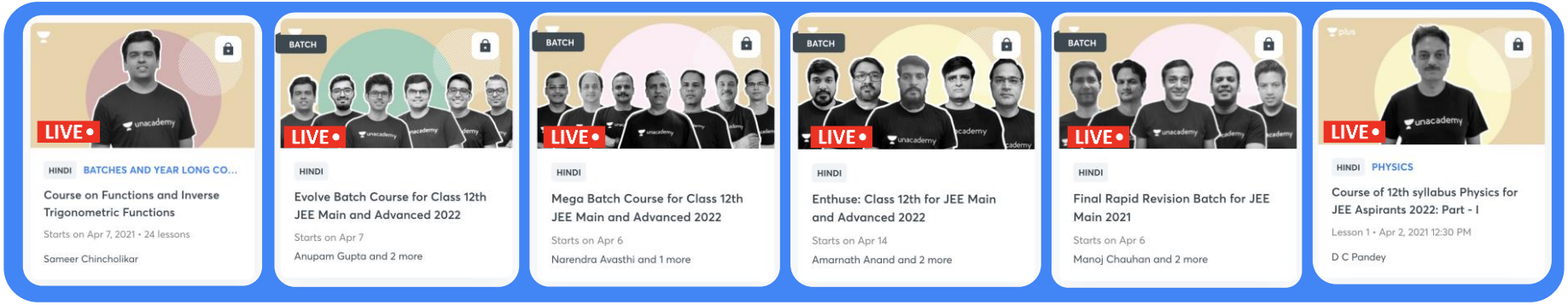

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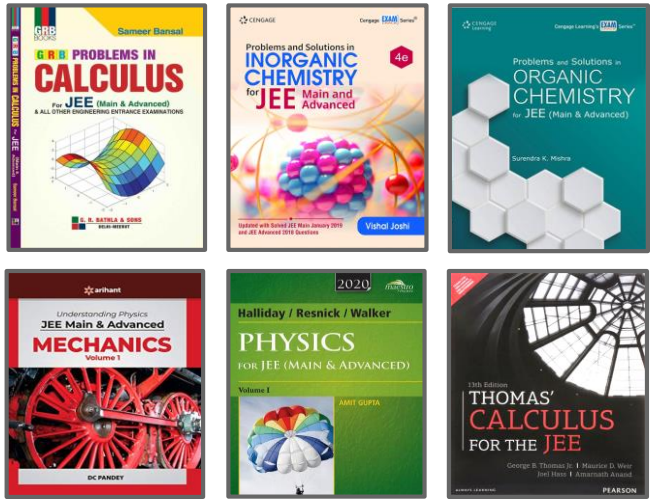

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Top Results

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Amaiya Singhal
99.97

Adnan
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Ashwin Prasanth
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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

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

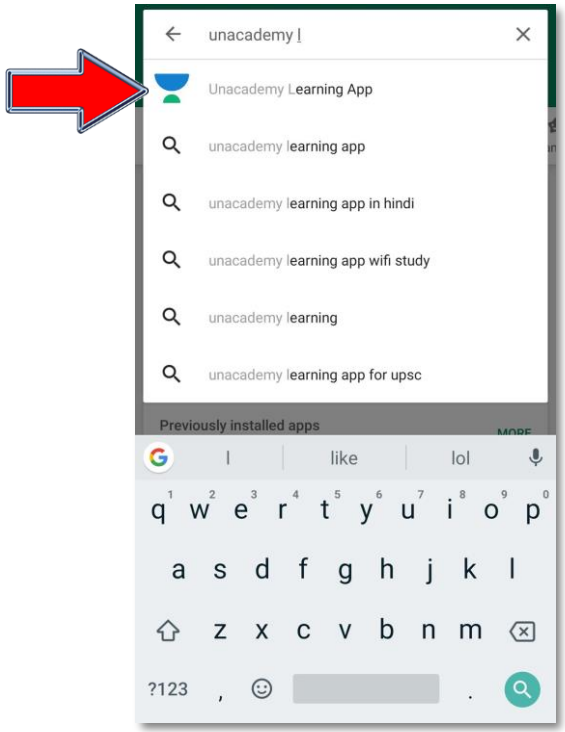
Ayush Gupta
98.67

Megh Gupta
98.59

Naman Goyal
98.48

MIHIR PRAJAPATI
98.16

Step 1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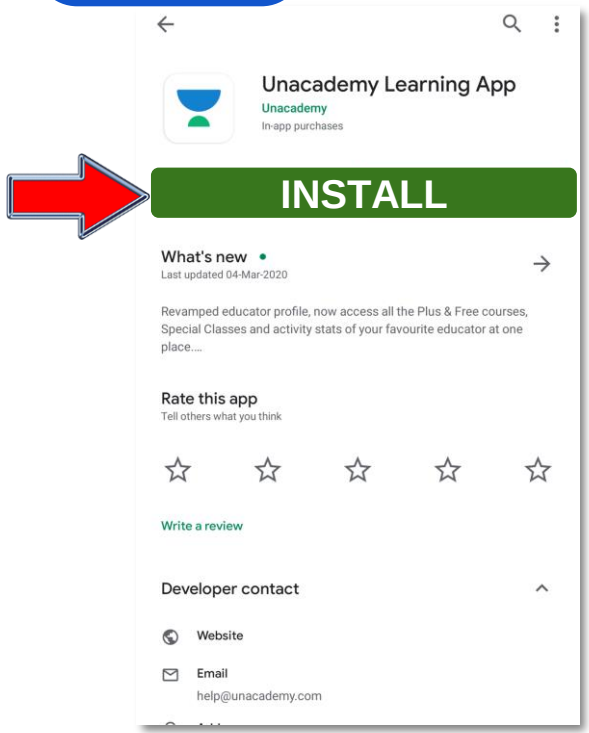
Step 2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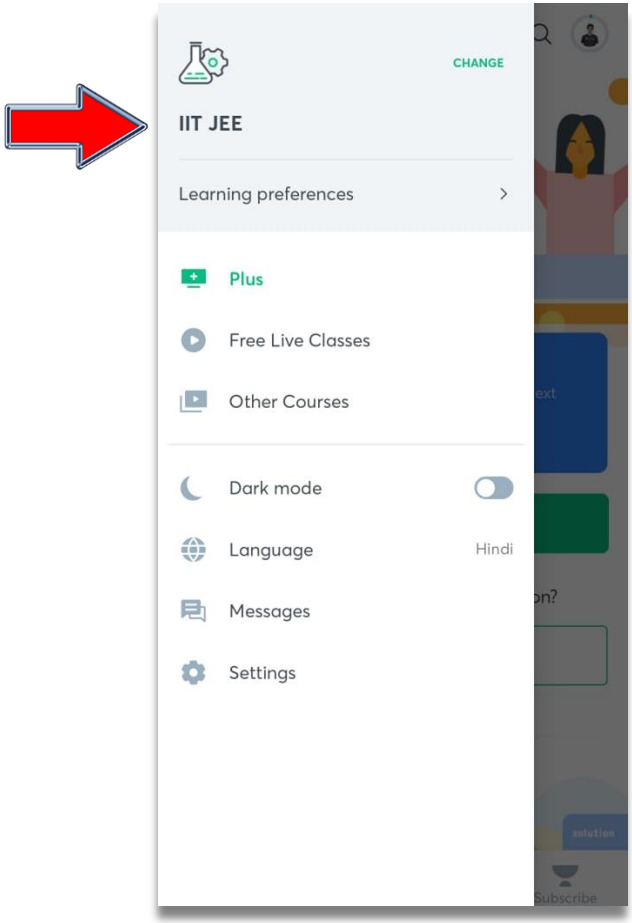
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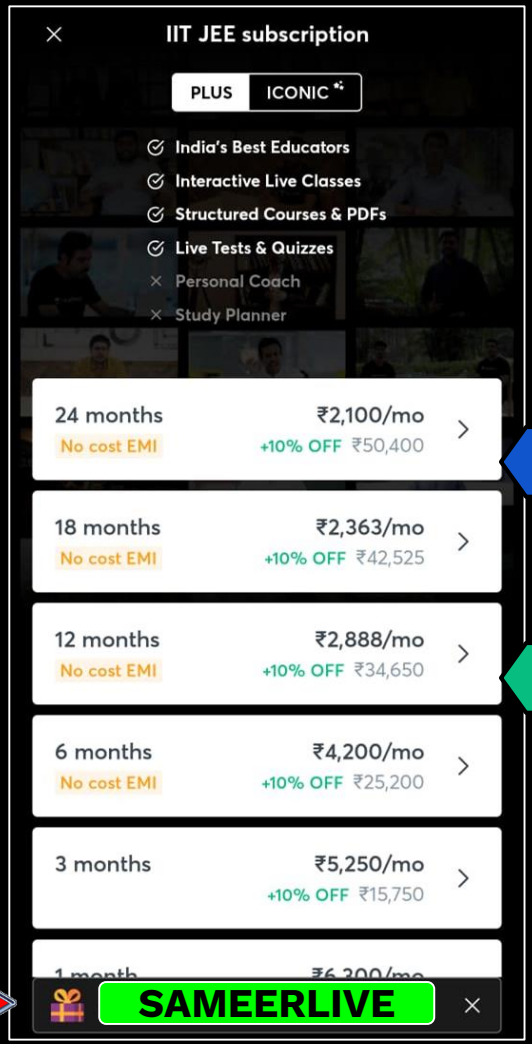

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