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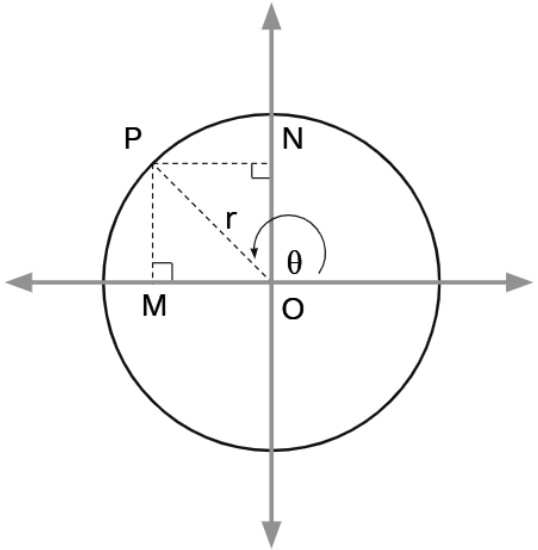
Trigonometry in Circular System

Trigonometry 3



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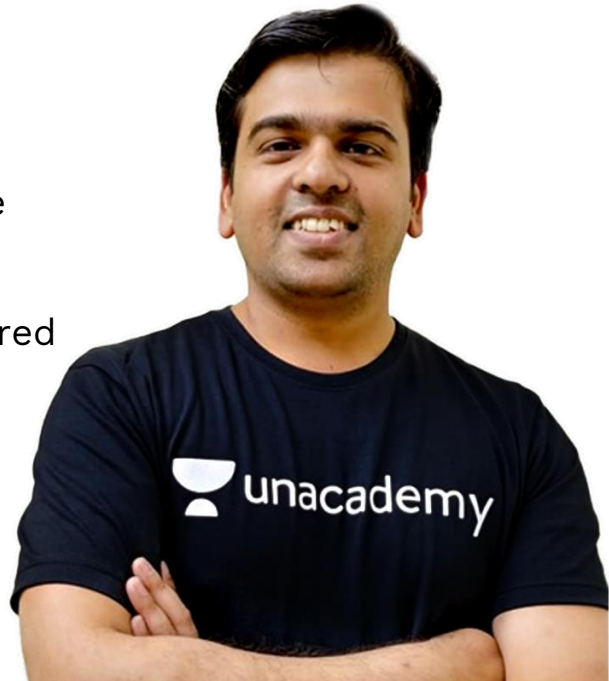
B.Tech, M.Tech - IIT-Roorkee

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



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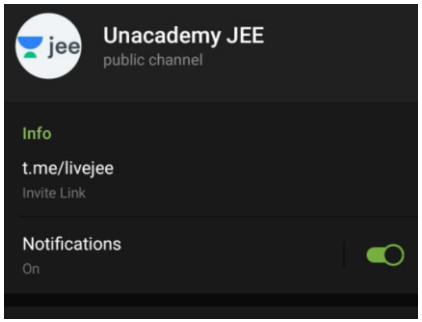

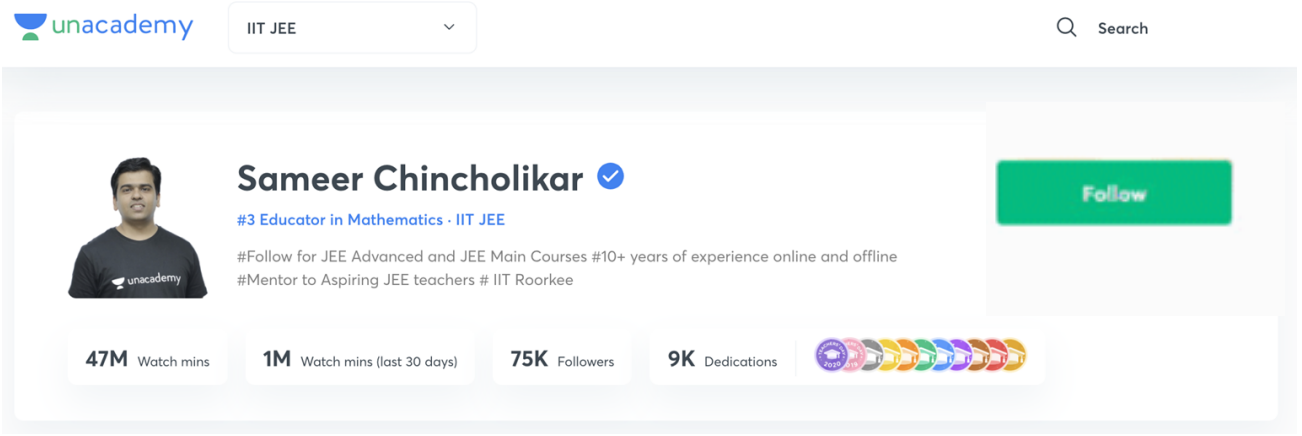

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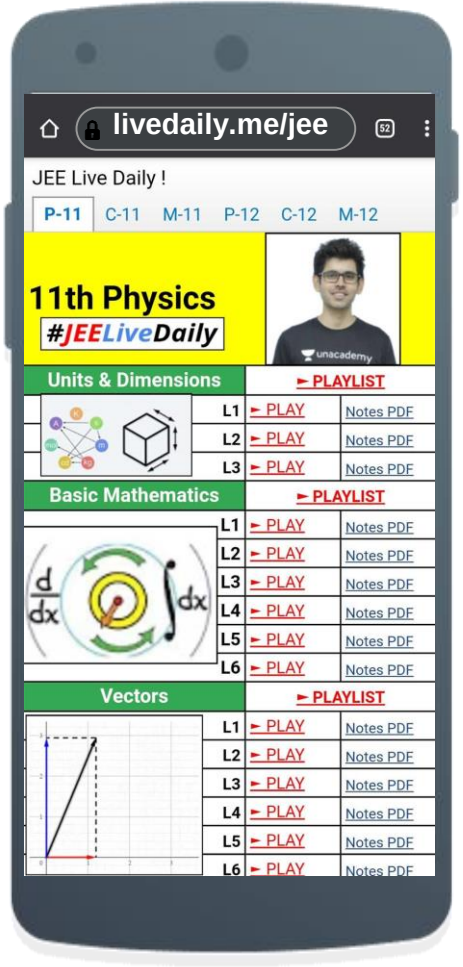

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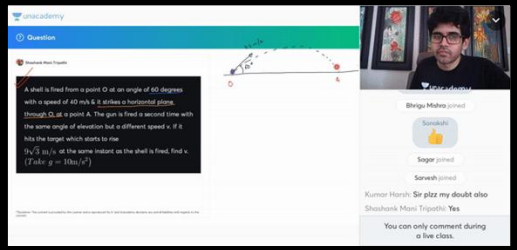

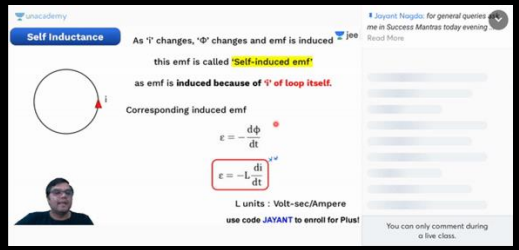

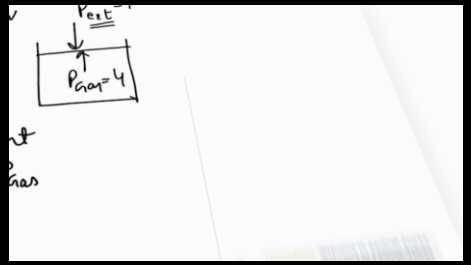

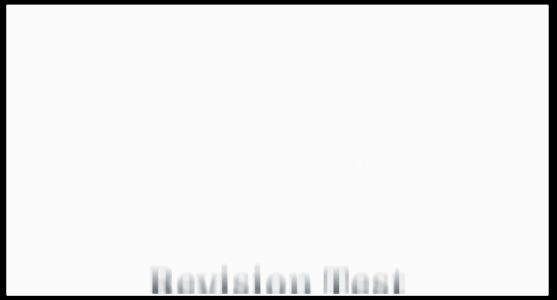

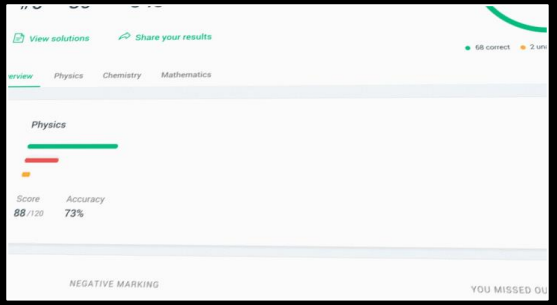

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India's **BEST** Educators

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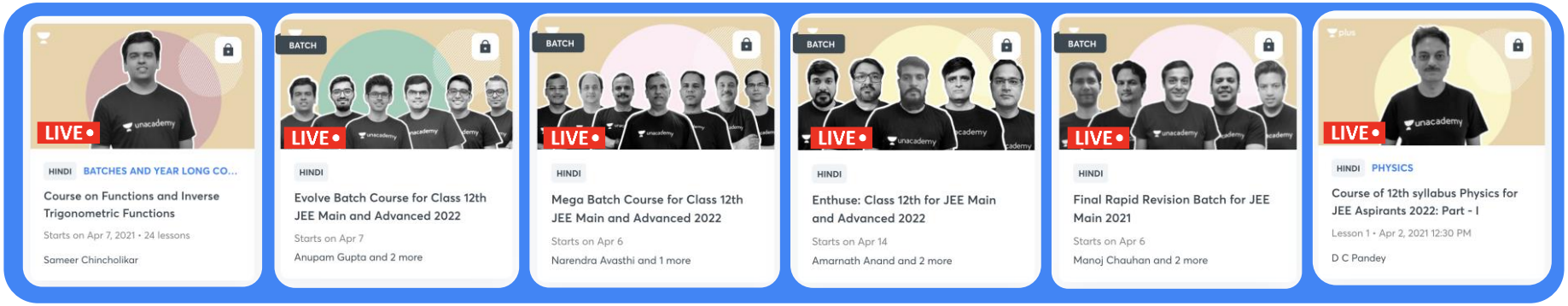

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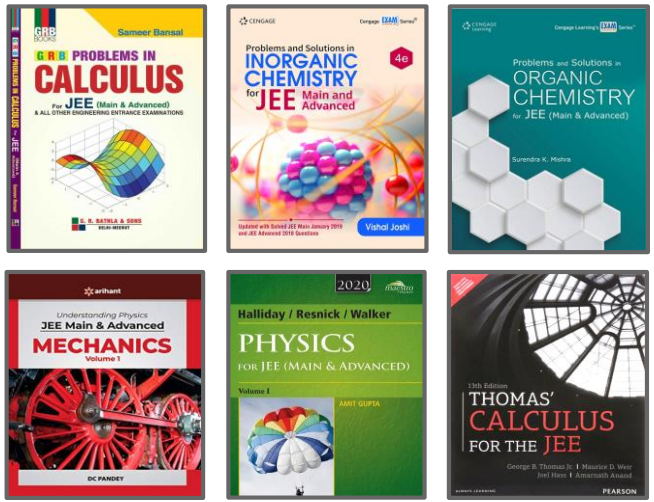

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100 %ile

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MIHIR PRAJAPATI
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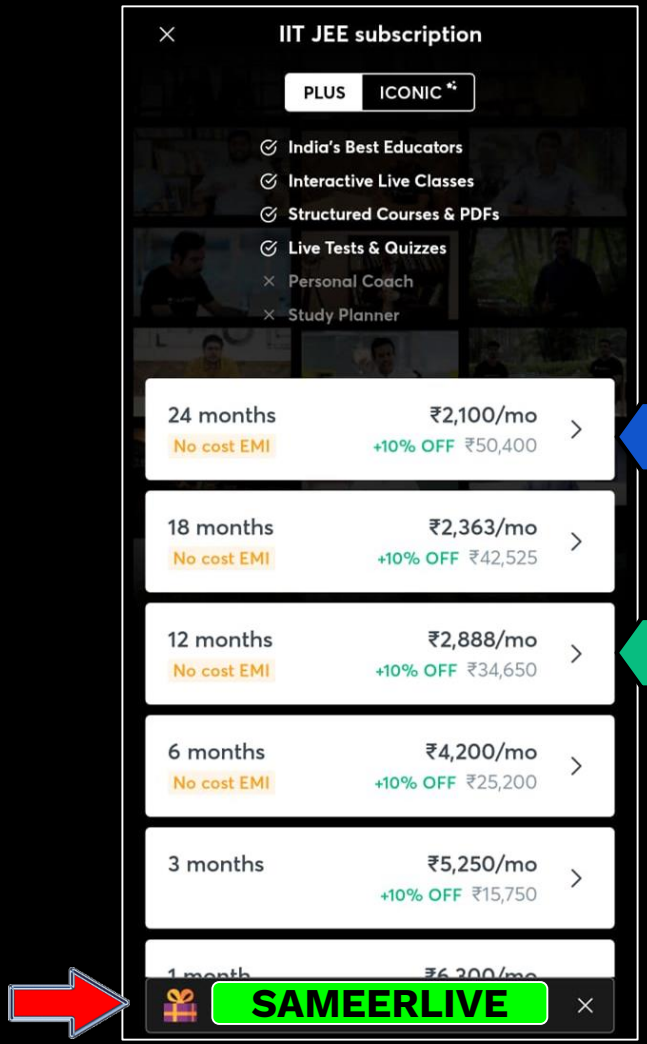

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12th / Drop

LET'S BEGIN!!

The angle of a quadrilateral are in **A.P.** and the greatest angle is **120,** the angles in radian are

A. $\frac{\pi}{3}, \frac{4\pi}{9}, \frac{5\pi}{9}, \frac{2\pi}{3}$

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

C. $\frac{5\pi}{18}, \frac{8\pi}{18}, \frac{11\pi}{18}, \frac{12\pi}{18}$

D. None of these

$120, 120-d, 120-2d, 120-3d$

$\Rightarrow (4 \times 120) - 6d = 360^\circ \; 60^\circ$

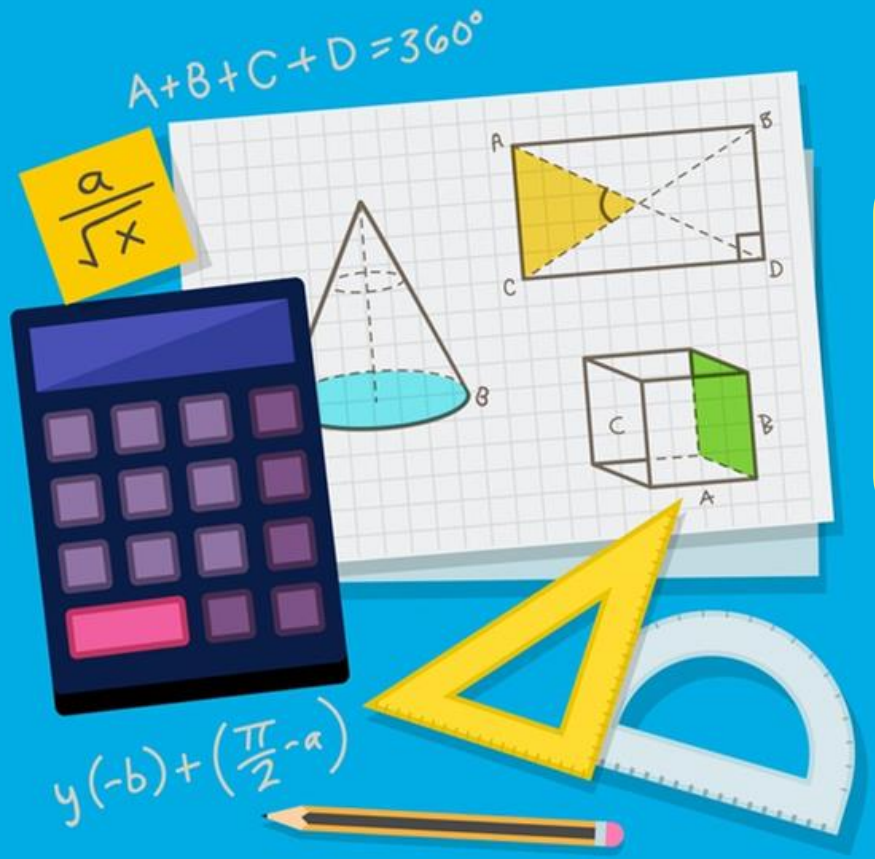
$d = 20^\circ$

$$120^\circ \times \frac{\pi}{180} = \frac{2\pi}{3}$$

$$100^\circ \times \frac{\pi}{180} = \frac{5\pi}{9}$$

$$80^\circ \times \frac{\pi}{180} = \frac{4\pi}{9}$$

$$60^\circ \times \frac{\pi}{180} = \frac{\pi}{3}$$

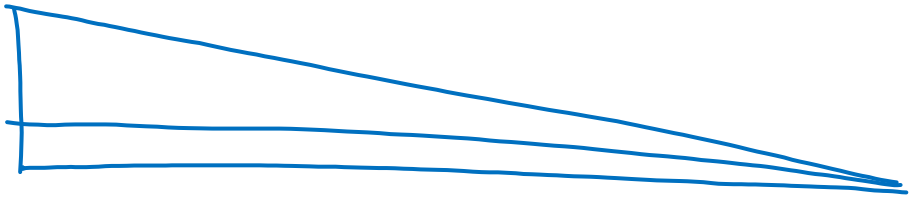


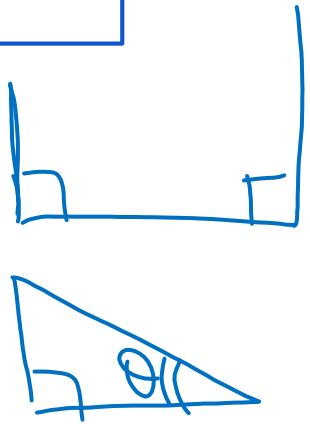
TRIGONOMETRY in Circular System

Limitations of Trigonometry in Right Angled Triangle

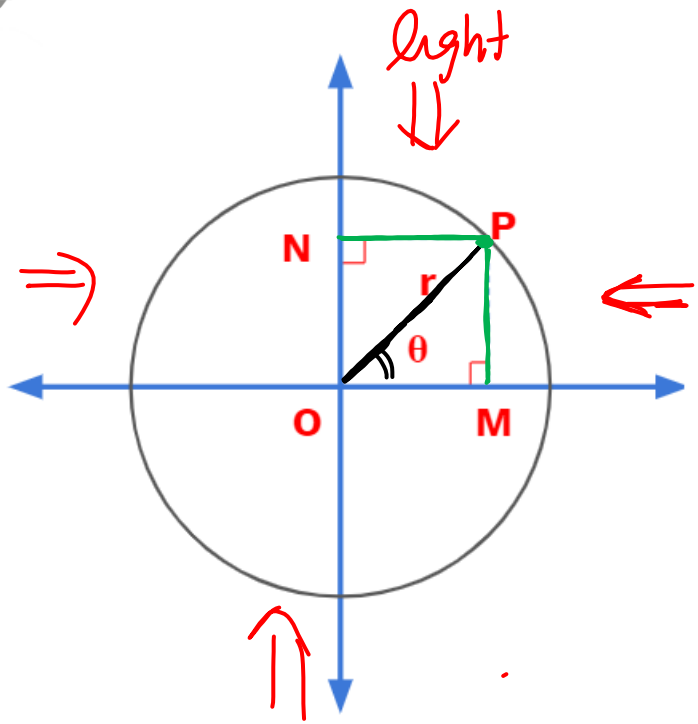
- Explanation for values of 0 degrees and 90 degrees

- Values of T - ratios for angles other than acute angles **eg:** $\sin 120^0$





New Definitions of T-Ratios



In Δ OPM

$$\sin\theta = \frac{PM}{OP} = \frac{ON}{OP} = \frac{\text{Proj. of OP on Y-axis}}{\text{(length of radius)}}$$

$$\cos\theta = \frac{OM}{OP}$$

$$\tan\theta = \frac{PM}{OM} = \frac{ON}{OM}$$

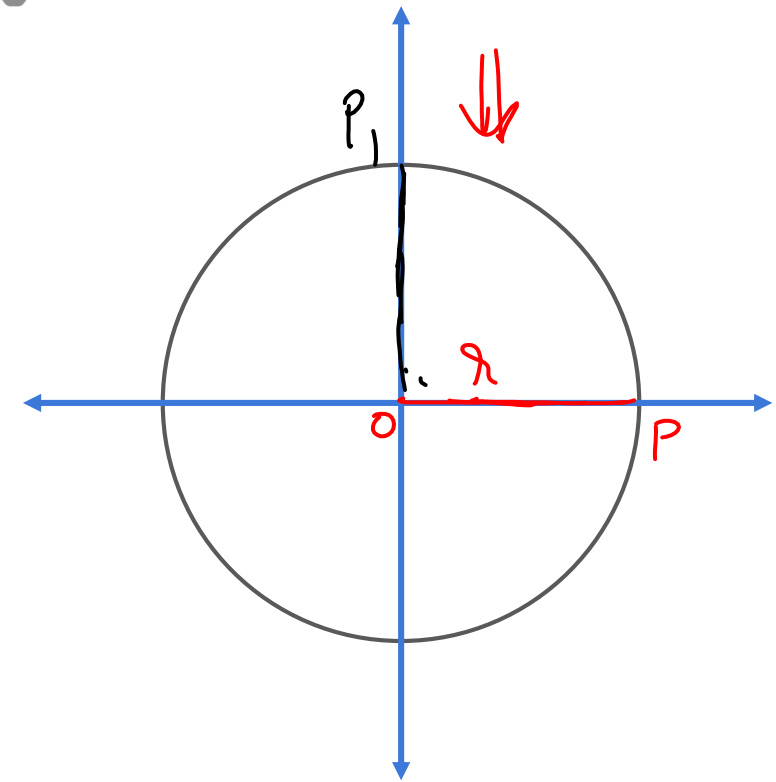
New Definitions of T-Ratios

1. $\sin\theta = \dfrac{\text{Projection of radius on Y - axis}}{\text{Length of radius}}$

2. $\cos\theta = \dfrac{\text{Projection of radius on X - axis}}{\text{Length of radius}}$

3. $\tan\theta = \dfrac{\text{Projection of radius on Y - axis}}{\text{Projection of radius on X - axis}}$

Can we now explain T-Ratios for 0^0 and 90^0 ?



$$\sin 0 = \frac{0}{r} = 0$$

$$\cos 0 = \frac{r}{r} = 1$$

$\rightarrow \tan 0 = 0$

$$\sin 90^\circ = \frac{r}{r} = 1$$

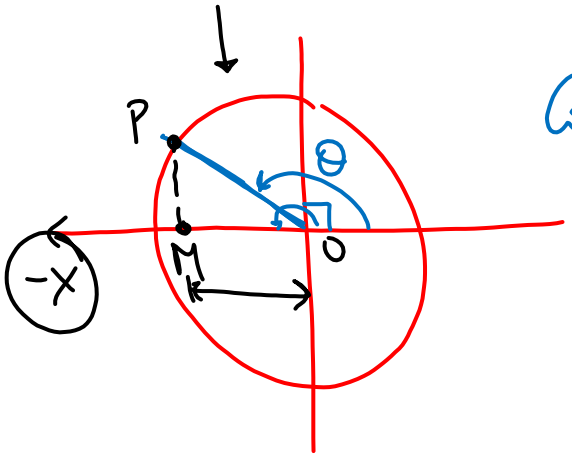
$$\cos 90^\circ = \frac{0}{r} = 0$$

$\rightarrow \tan 90^\circ$ Not defined

Limitations of Trigonometry in Right Angled Triangle

- Projection on positive x-axis and positive y-axis is considered with a **positive sign**

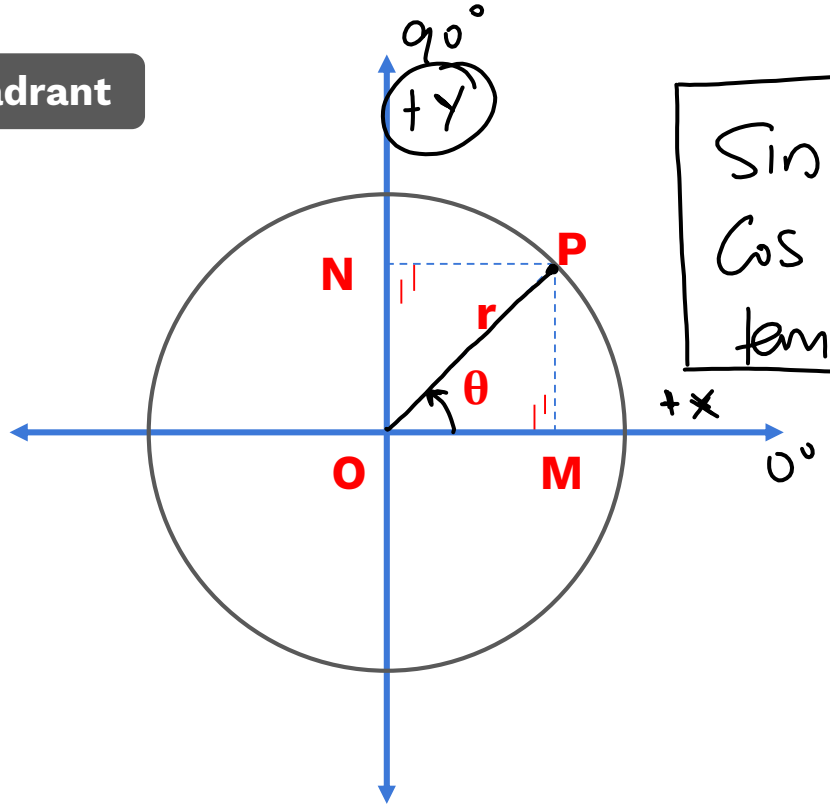
- Projection on negative x-axis and negative y-axis is considered with a **negative sign**



$$\cos\theta = -\frac{(OM)}{OP}$$

Signs of T-Ratios in 4 Quadrants

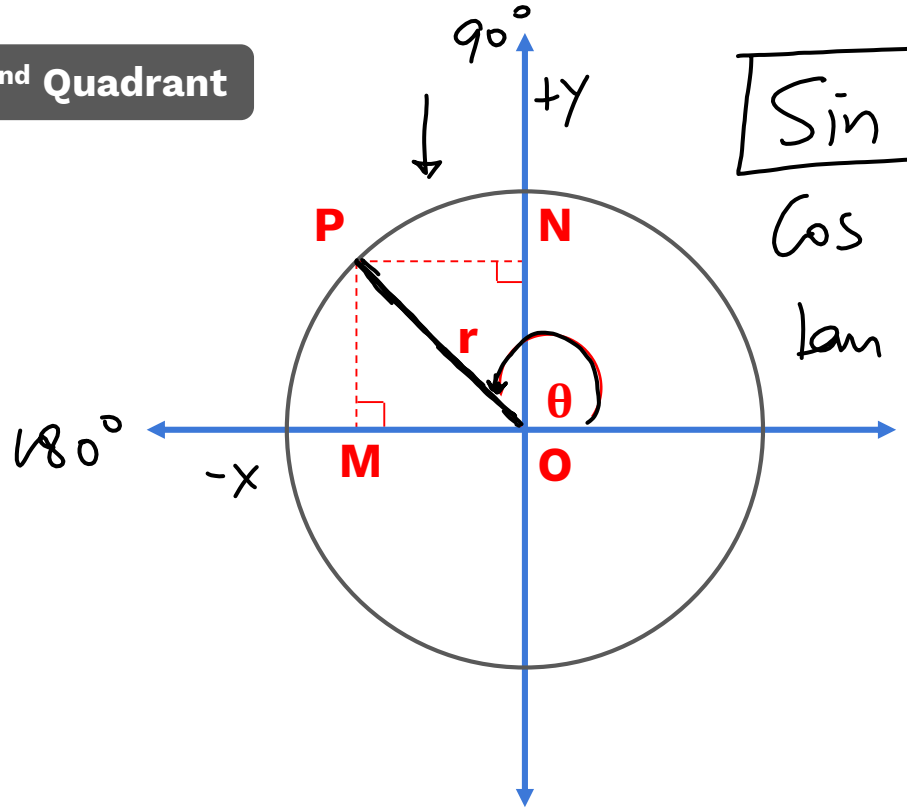
1st Quadrant



Sin : +ve
Cos : +ve
tan : +ve

Signs of T-Ratios in 4 Quadrants

2nd Quadrant



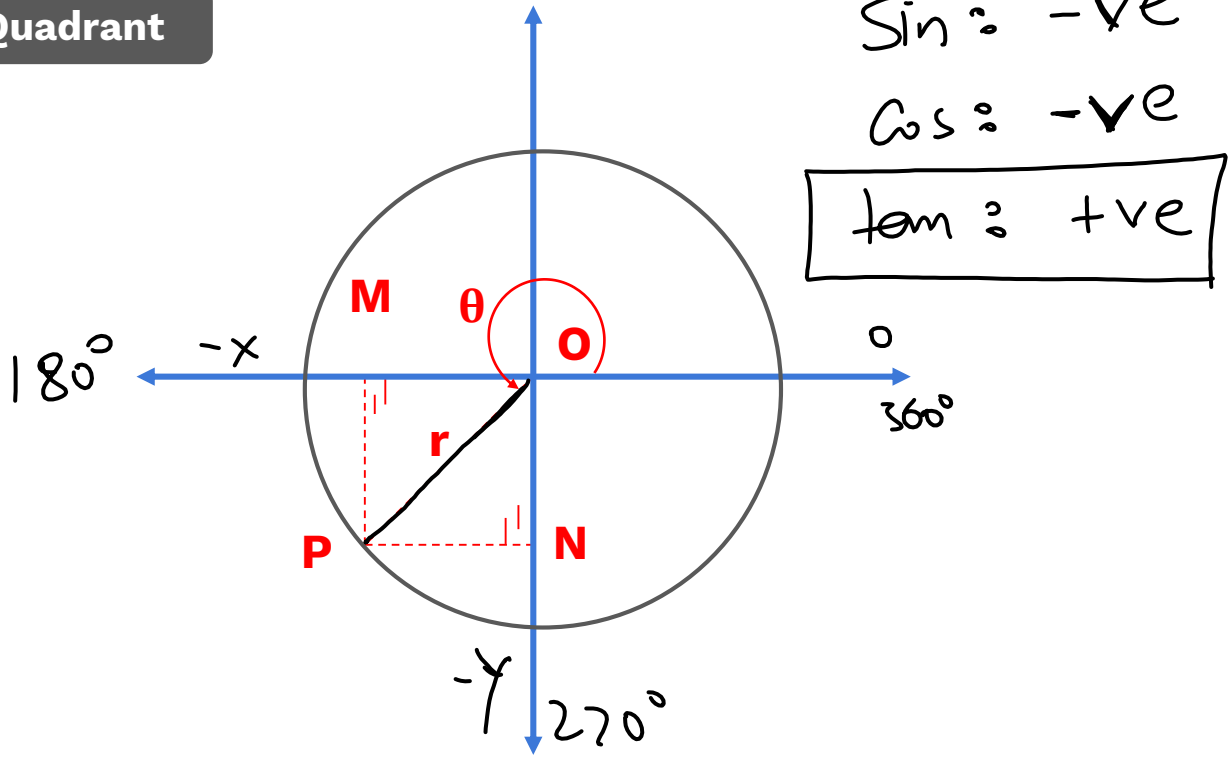
Sin : +ve

Cos : -ve

tan : -ve

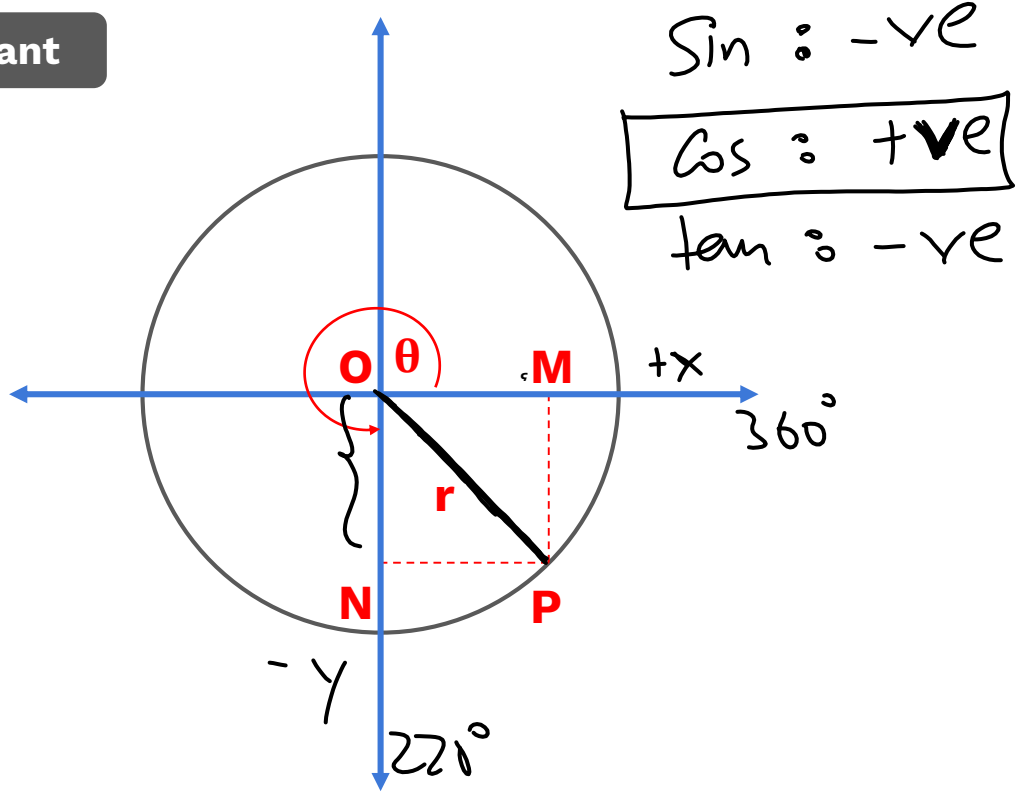
Signs of T-Ratios in 4 Quadrants

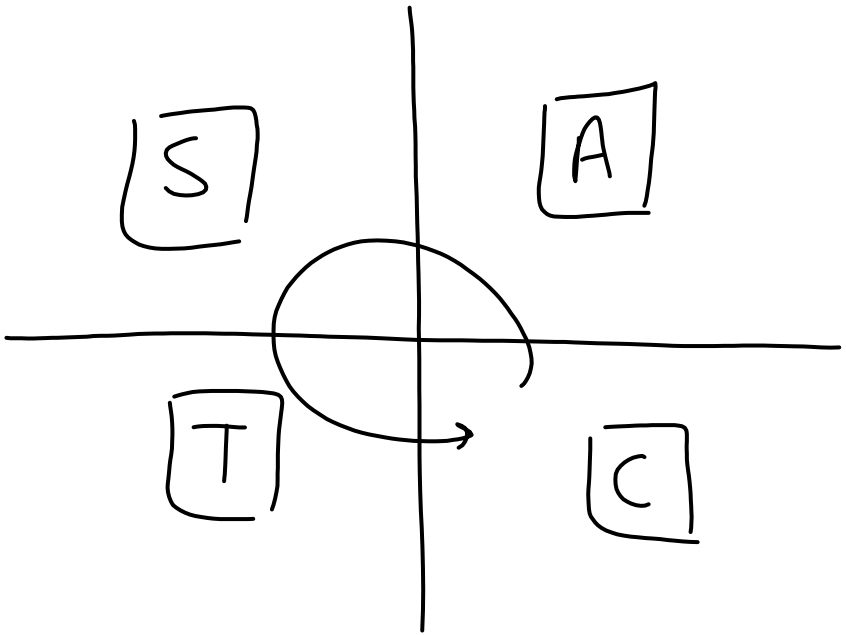
3rd Quadrant



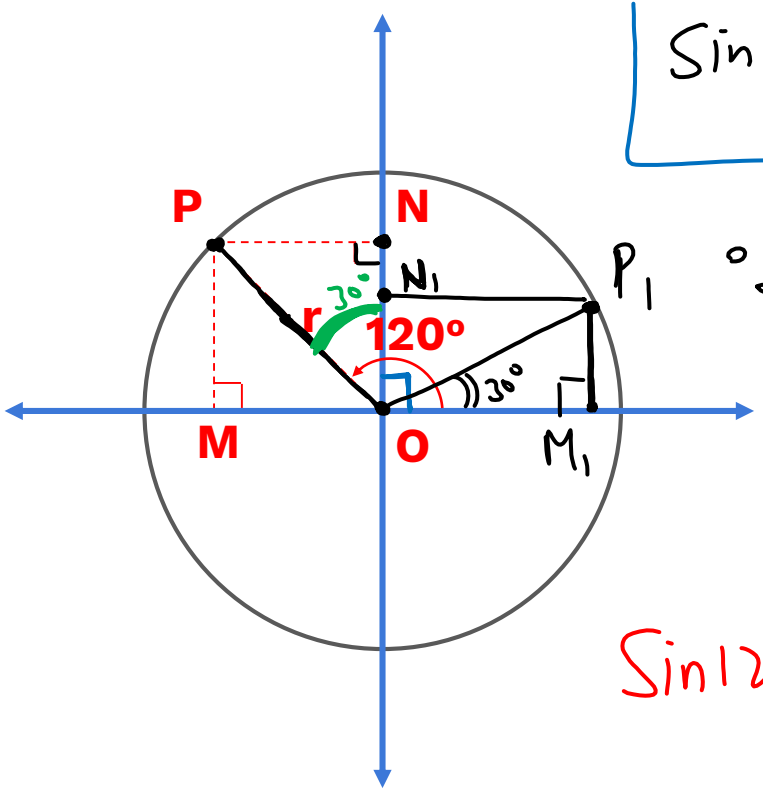
Signs of T-Ratios in 4 Quadrants

4th Quadrant




S
A
T
C

How much is sin 120° ?



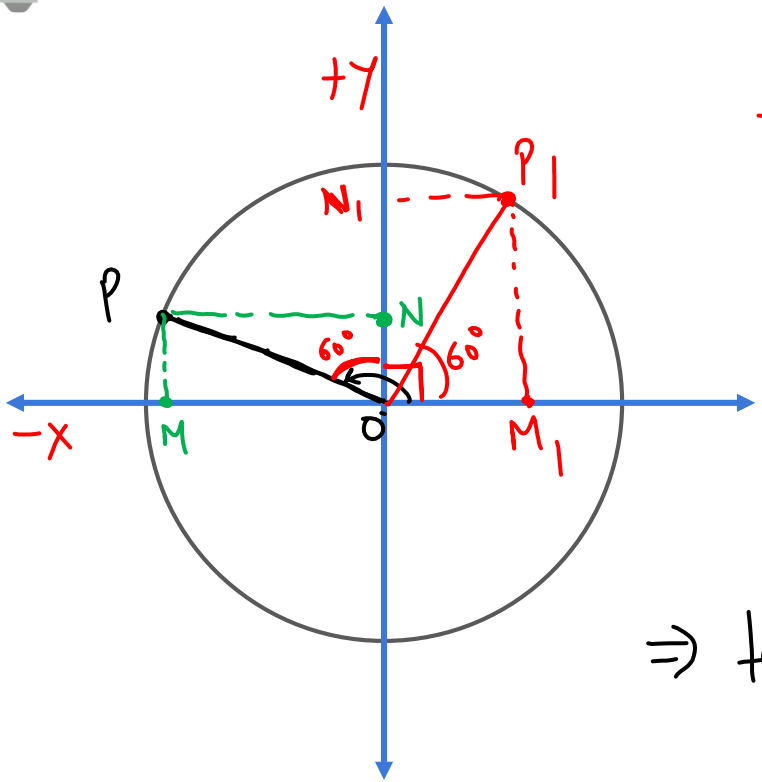
$$\sin 120^\circ = \frac{ON}{OP} \quad (1)$$

$P_1 \because \triangle ONP \cong \triangle OM_1P_1$

$$\frac{ON}{OP} = \frac{OM_1}{OP_1} \quad (2)$$

$$\sin 120^\circ = \frac{OM_1}{OP_1} = \cos 30^\circ = \frac{\sqrt{3}}{2}$$

How much is tan 150° ?



$$\tan 150^\circ = \frac{ON}{-(OM)} = -\left(\frac{ON}{OM}\right)$$

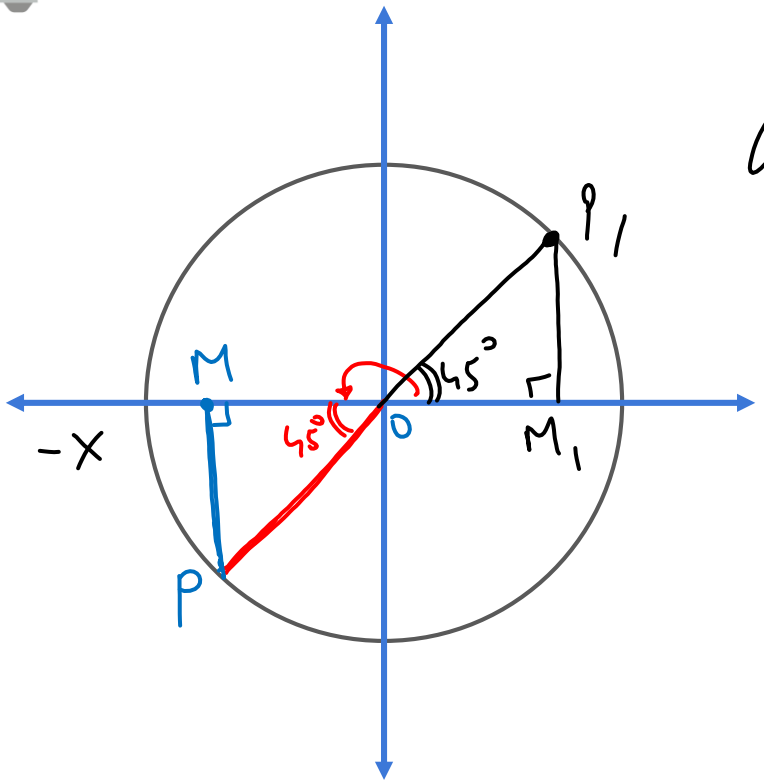
$$\begin{cases} \Delta ONP \cong \Delta OM_1P_1 \\ \frac{ON}{NP} = \frac{OM_1}{PM_1} \end{cases}$$

$$= -\left(\frac{ON}{NP}\right)$$

$$\Rightarrow \tan 150^\circ = -\left(\frac{OM_1}{PM_1}\right) = -\cot 60^\circ = \boxed{\frac{-1}{\sqrt{3}}}$$

How much is cos 225⁰ ?

$180 + 45$



$$\cos 225^\circ = \frac{-(OM)}{OP}$$

$$= -\left(\frac{OM_1}{OP_1}\right)$$

$$= -(\cos 45^\circ)$$

$$= -\frac{1}{\sqrt{2}}$$

#JEELiveDaily Schedule

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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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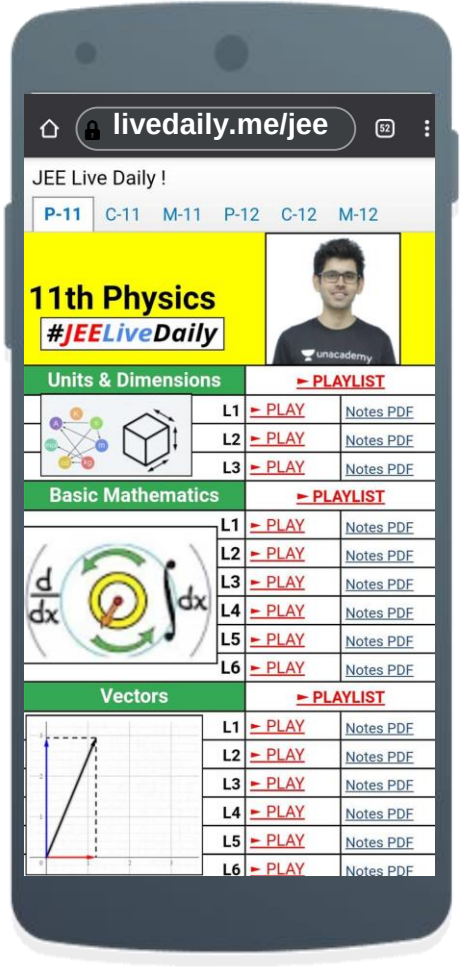

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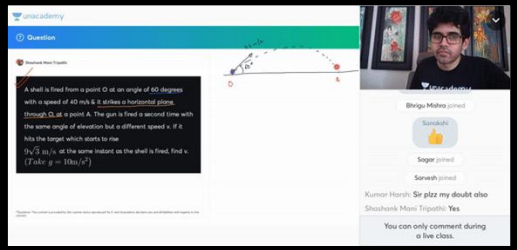

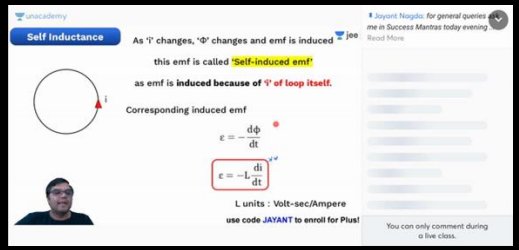

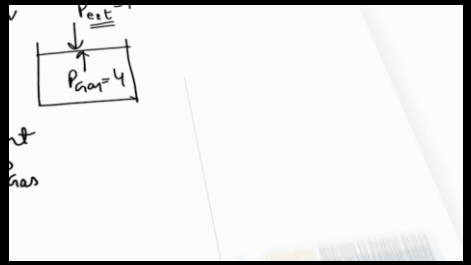

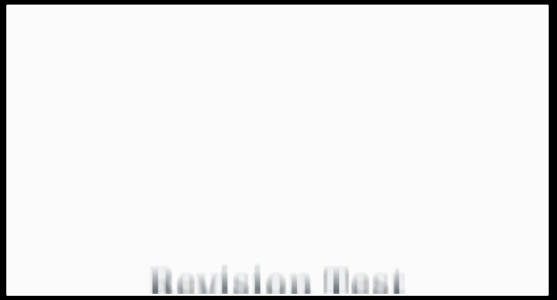

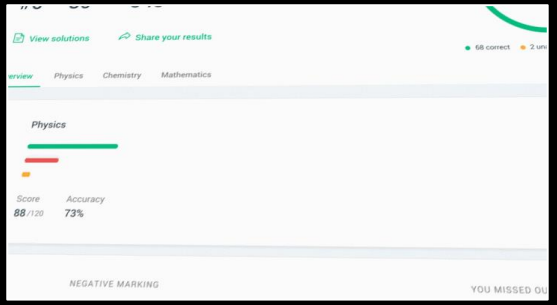

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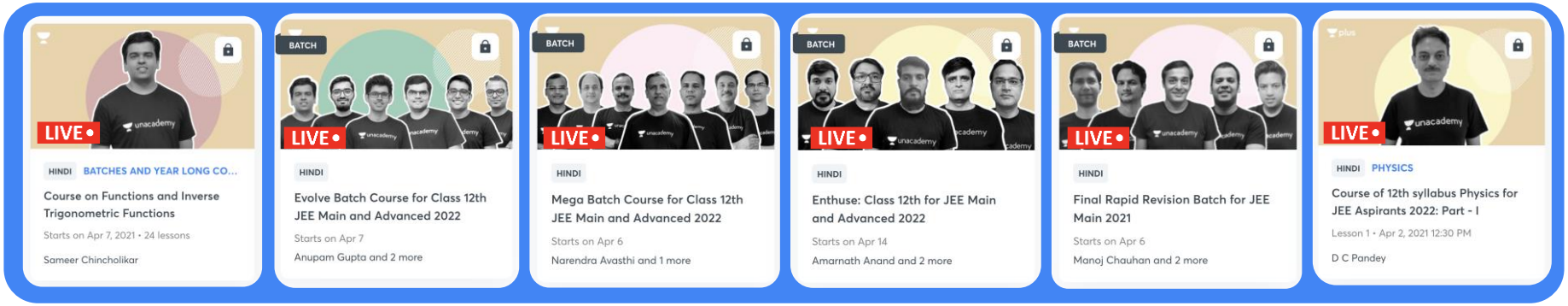

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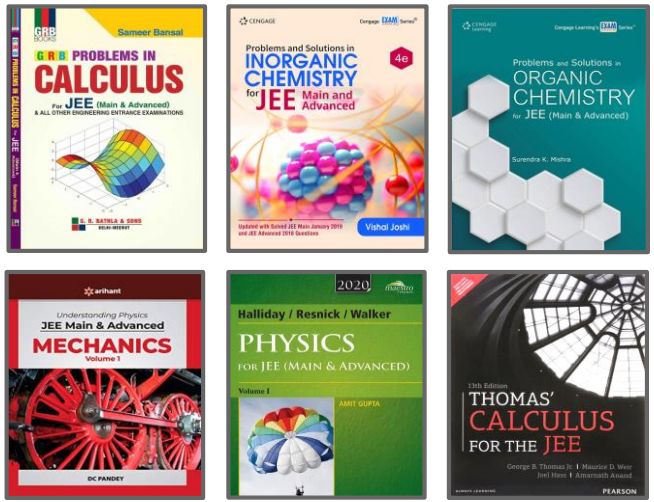

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Naman Goyal
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MIHIR PRAJAPATI
98.16

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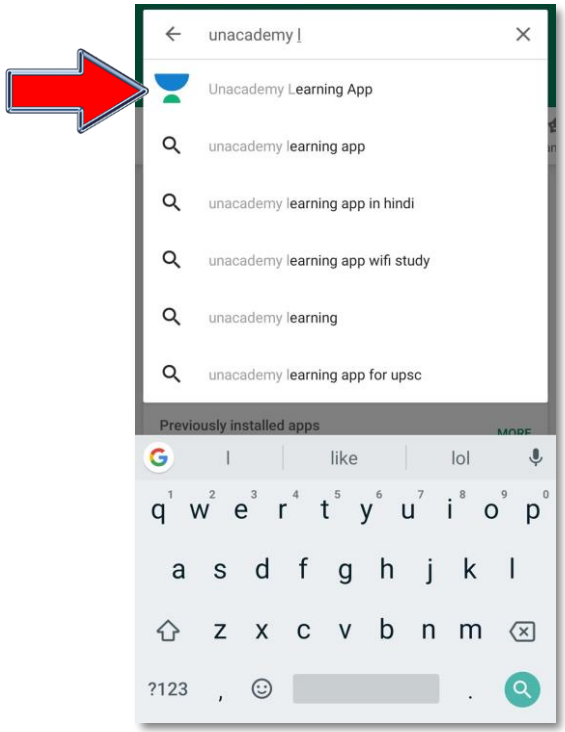
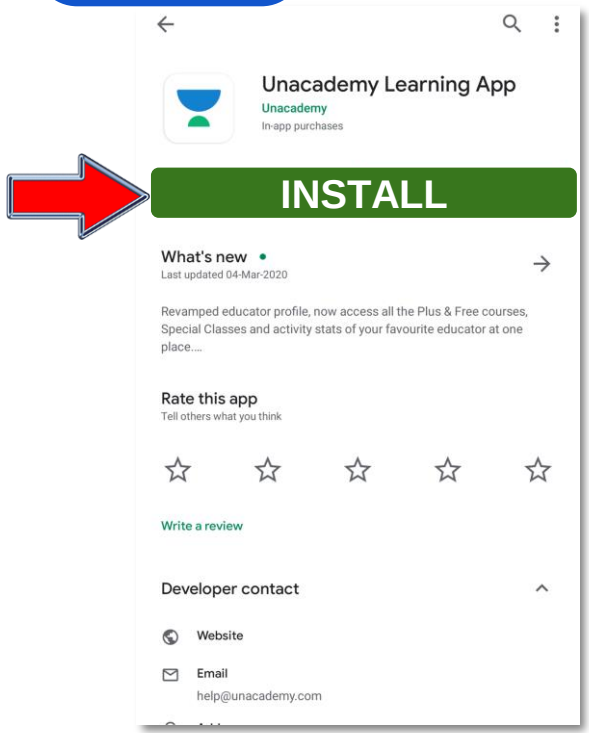
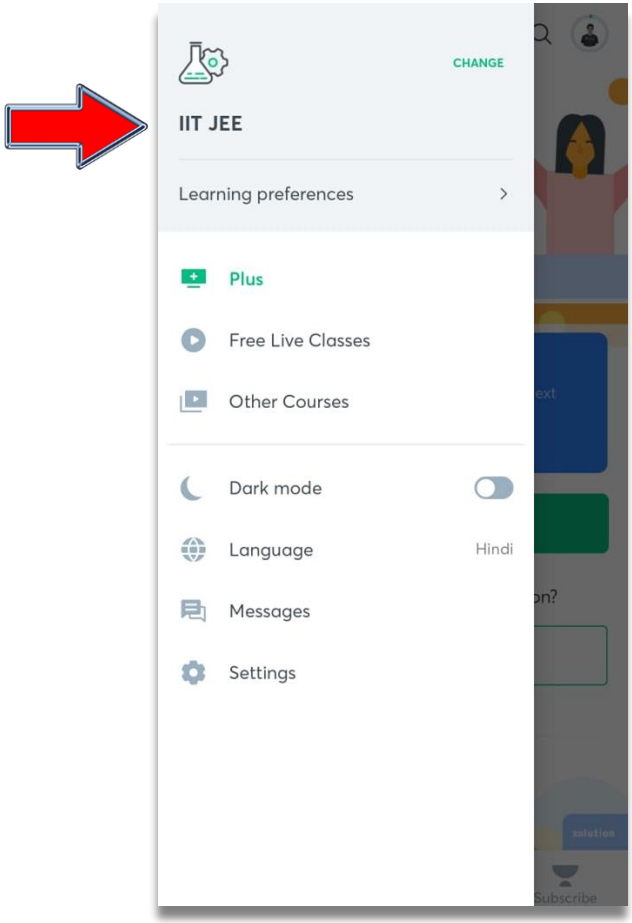
Step 1



Step 2

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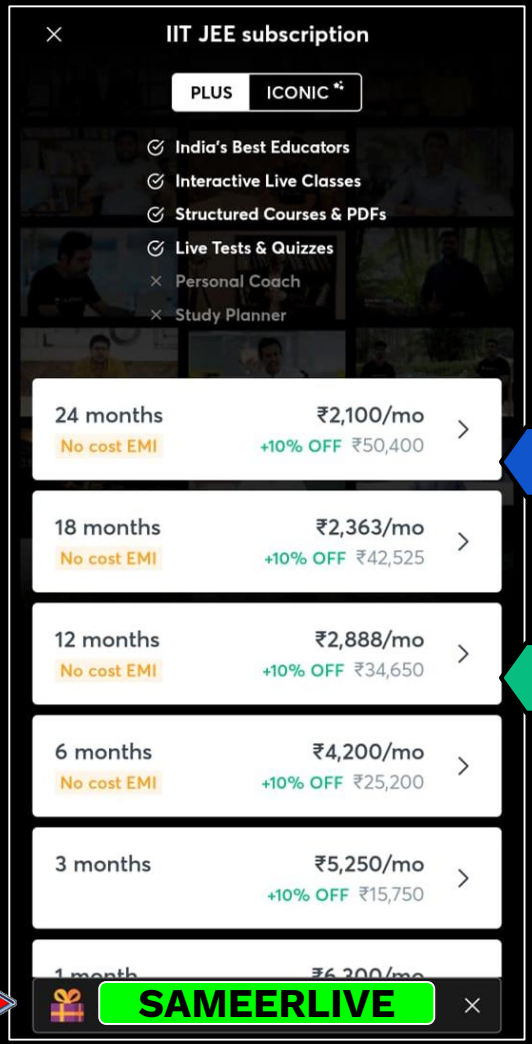

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