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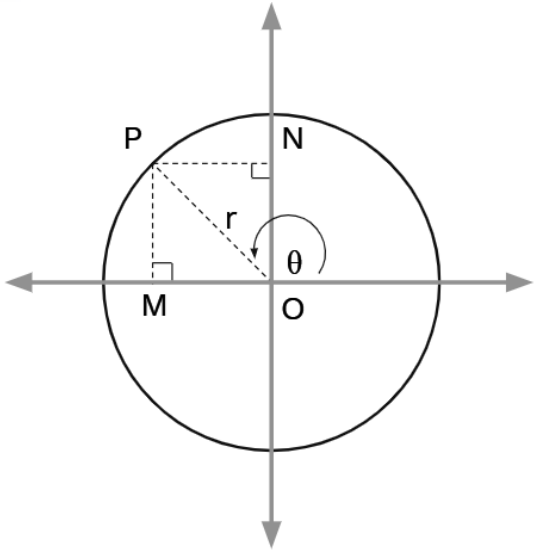
Allied Angles

Trigonometry 4



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Sameer Chincholikar

B.Tech, M.Tech - IIT-Roorkee

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

sameer_iitr

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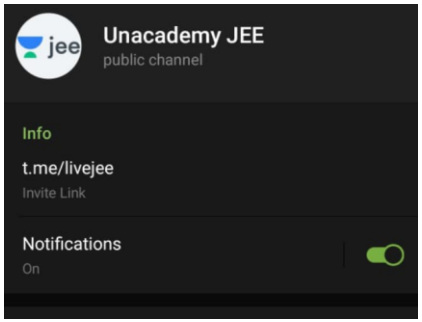

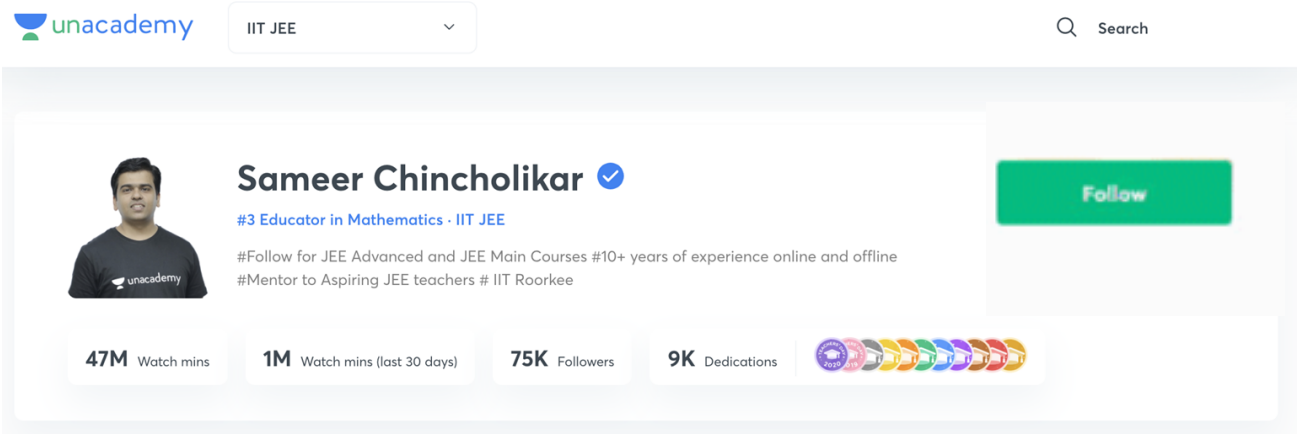

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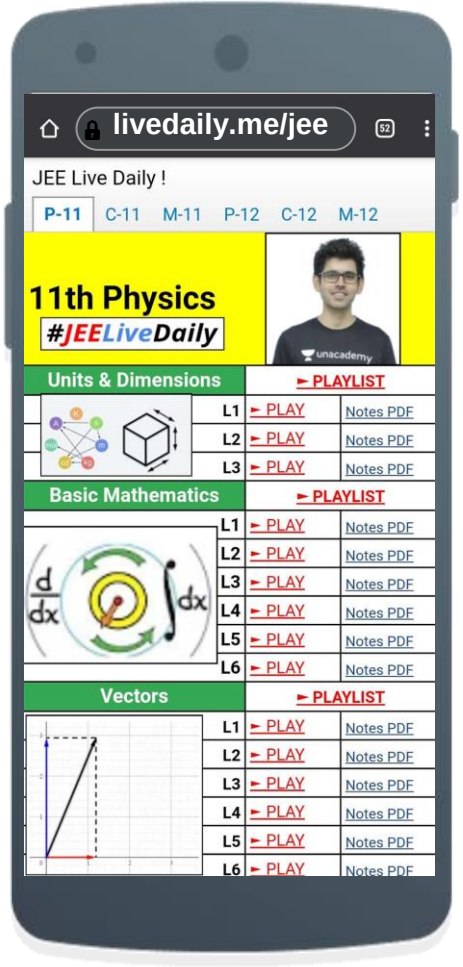

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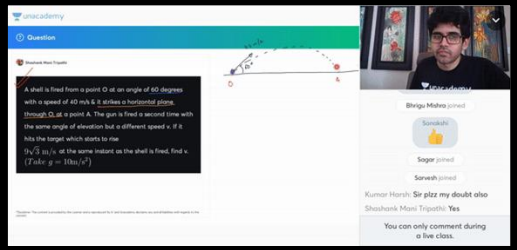

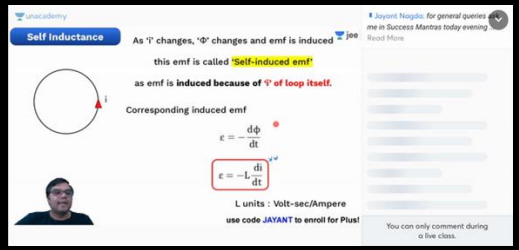

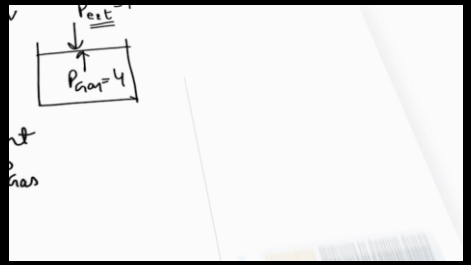

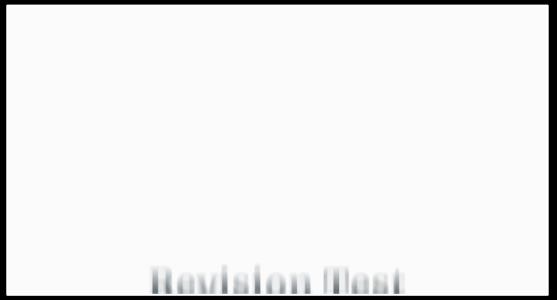

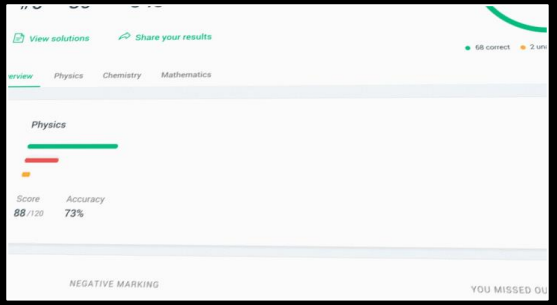

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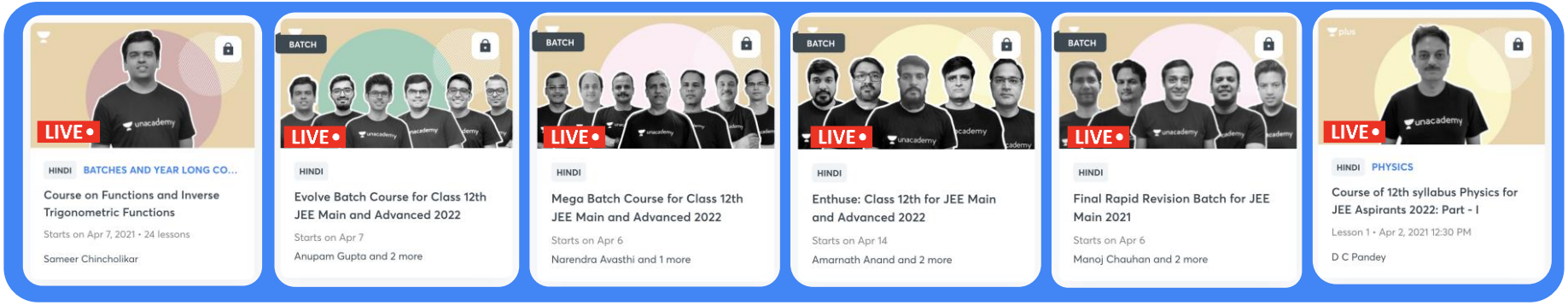

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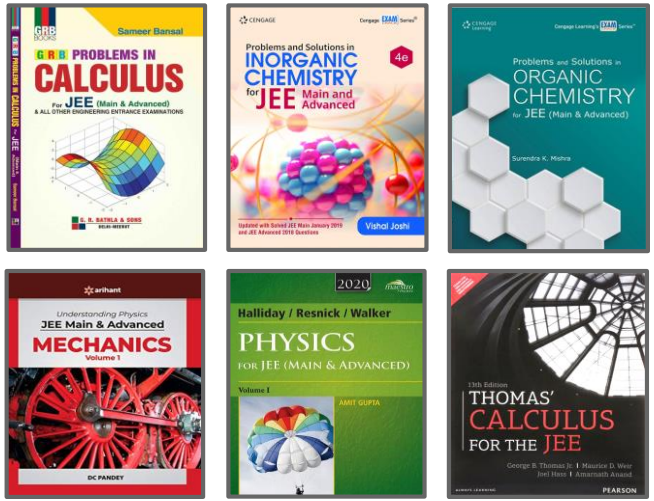

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Top Results

Bratin Mondal

100 %ile

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99.95

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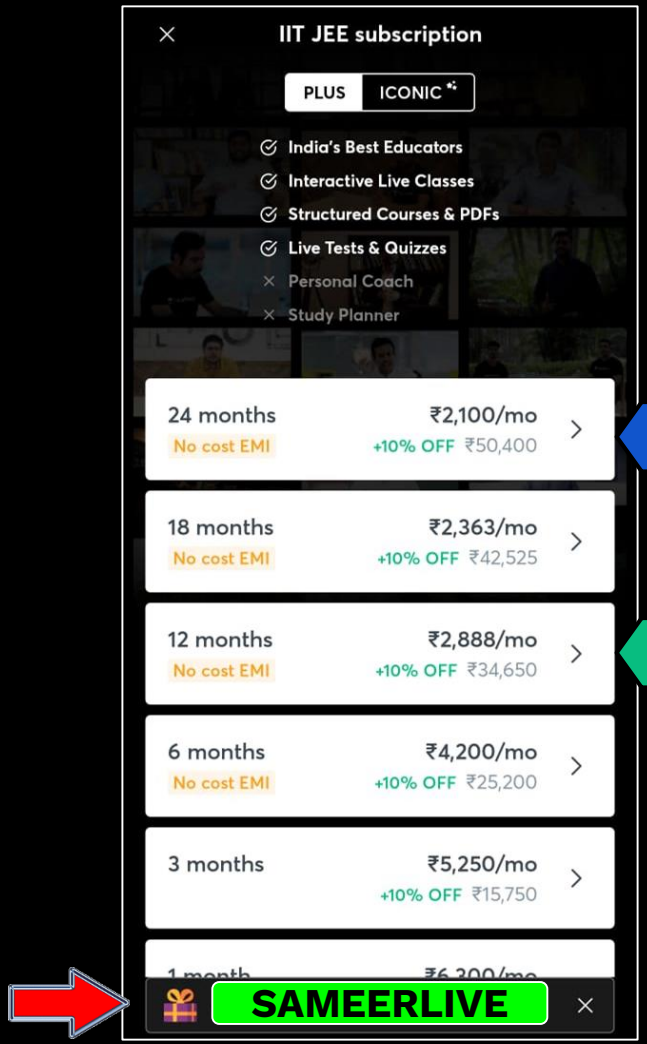

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11th / 9, 10

12th / Drop

LET'S BEGIN!!

Allied Angles

What are allied angles?

- If two angles are such that their sum or difference is zero or multiple of 90° , then they are called allied angles.

$(60^\circ, 30^\circ) \xrightarrow{\text{sum}} 90^\circ$

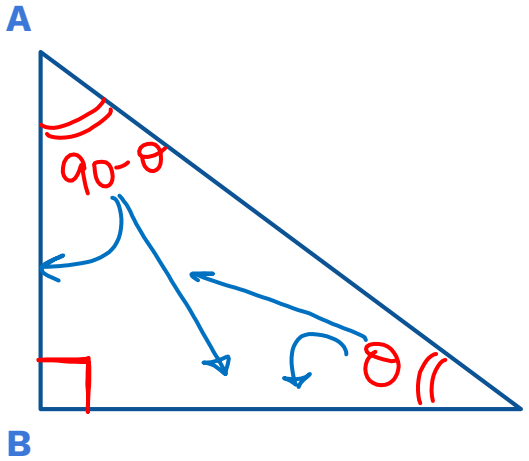
$(120^\circ, 60^\circ) \xrightarrow{\text{sum}} 180^\circ$

$(120^\circ, 30^\circ) \xrightarrow{\text{Diff}} 90^\circ$

$(\theta, 90+\theta)$

$(\theta, 90-\theta)$

Relation between: $(90^0 - \theta)$ and θ



① $\sin(90-\theta) = \frac{BC}{AC} = \cos\theta$

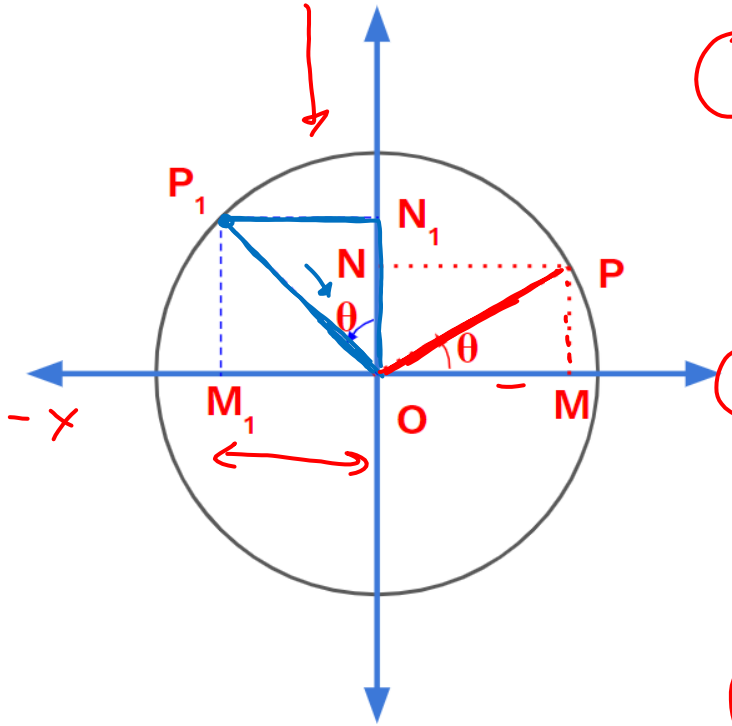
② $\cos(90-\theta) = \frac{AB}{AC} = \sin\theta$

③ $\tan(90-\theta) = \cot\theta$

vbv

Relation between: $(90^0 + \theta)$ and θ

2nd



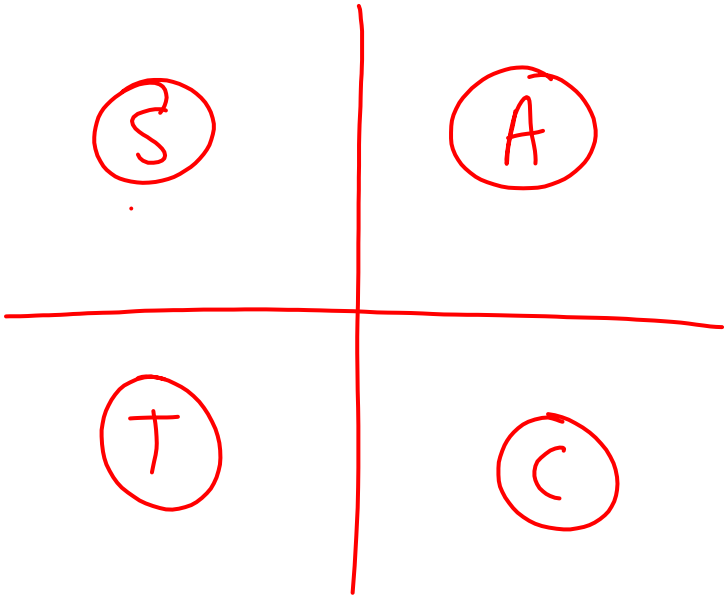
① $\sin(90+\theta) = \frac{ON_1}{OP_1} = \frac{OM}{OP}$

$= \cos\theta$

② $\cos(90+\theta) = -\frac{(OM_1)}{OP_1}$

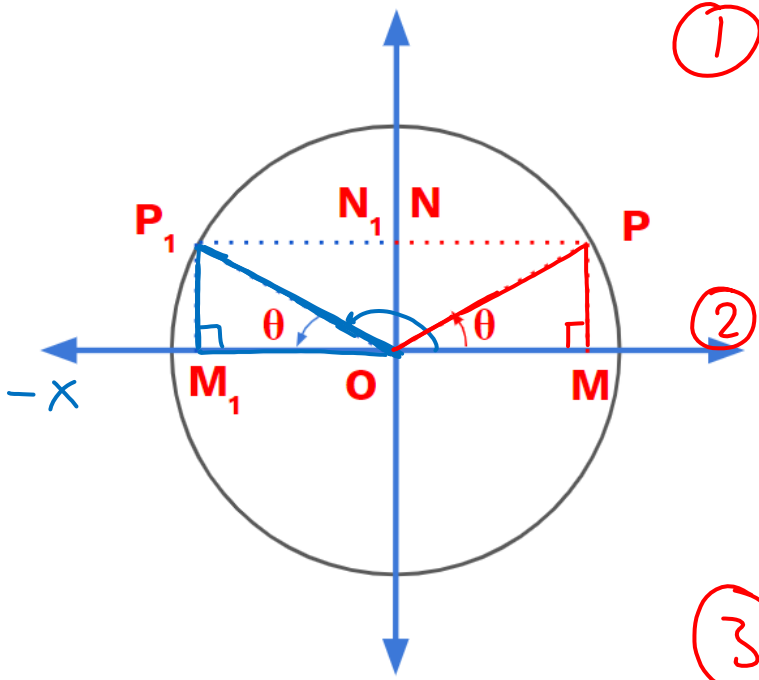
$= -\frac{(P_1N_1)}{OP_1} = -\left(\frac{PM}{OP}\right) = -\sin\theta$

③ $\tan(90+\theta) = -\cot\theta$


S
A
T
C

Relation between: $(180^0 - \theta)$ and θ

2nd



① $\sin(180-\theta) = \frac{ON_1}{OP_1} = \frac{P_1M_1}{OP_1}$

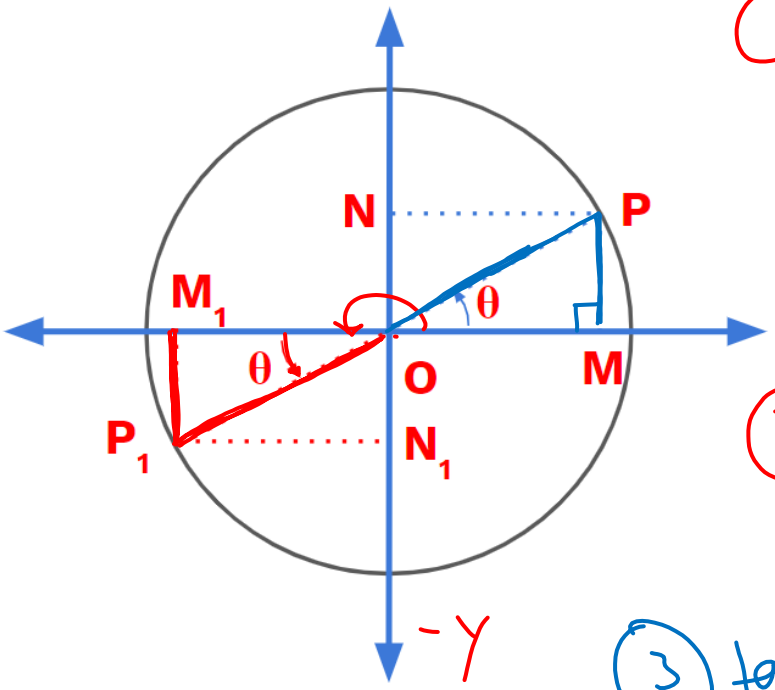
$= \frac{PM}{OP} = \sin\theta$

② $\cos(180-\theta)$

$= -\frac{(OM_1)}{OP_1} = -\left(\frac{OM}{OP}\right) = -\cos\theta$

③ $\tan(180-\theta) = -\tan\theta$

Relation between: $(180^0 + \theta)$ and θ



(1) $\sin(180+\theta) = \frac{-ON_1}{OP_1}$

$= -\left(\frac{P_1M_1}{OP_1}\right) = -\left(\frac{PM}{OP}\right)$

$= -\sin\theta$

(2) $\cos(180+\theta) = \frac{-OM_1}{OP_1} = \frac{-OM}{OP}$

$= -\cos\theta$

(3) $\tan(180+\theta) = \tan\theta$

How to use in Questions?

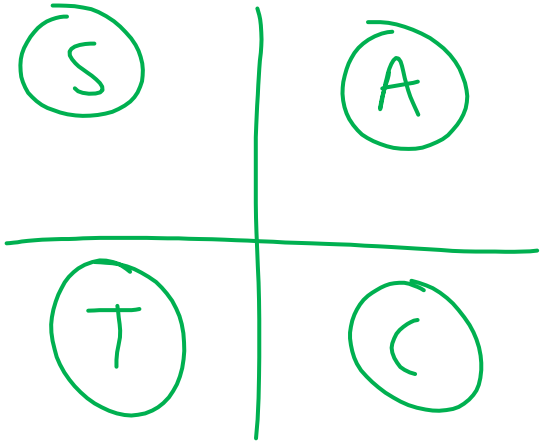
1. Check how allied angle is created?
For **[(odd multiples of 90) ± θ]** change the ratio

Sin ↔ Cos ; Tan ↔Cot ; Sec ↔Cosec

& for **[(even multiples of 90 ± θ]** keep ratio as it is.

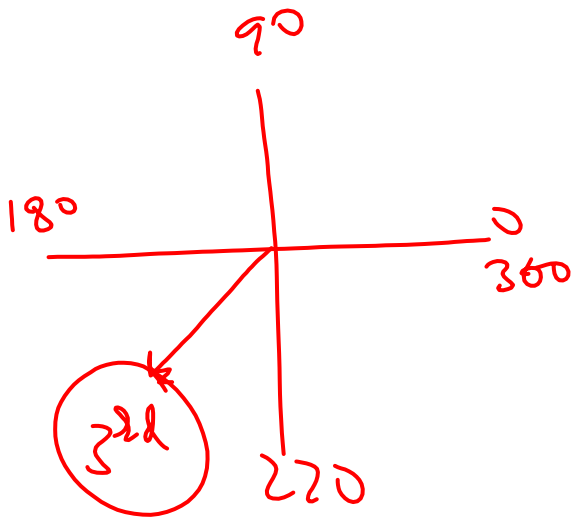
How to use in Questions?

2. Check in which quadrant the angle lies & what sign the T-ratio has in that quadrant?



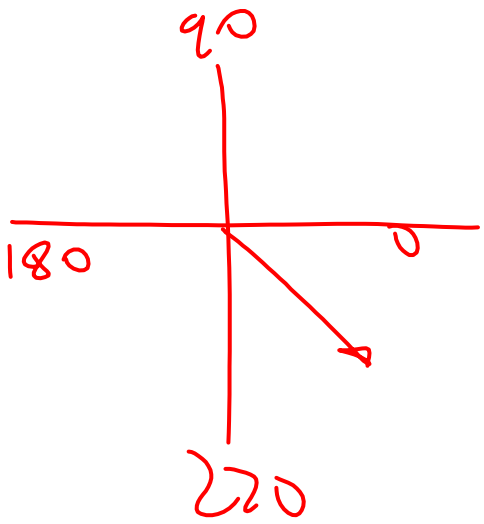
Relation between (270 - θ) & θ

1. $\sin(270^\circ - \theta) = -\cos\theta$
2. $\cos(270^\circ - \theta) = -\sin\theta$
3. $\tan(270^\circ - \theta) = +\cot\theta$



Relation between (270 + θ) & θ

1. $\sin(270^\circ + \theta) = -\cos\theta$
2. $\cos(270^\circ + \theta) = +\sin\theta$
3. $\tan(270^\circ + \theta) = -\cot\theta$

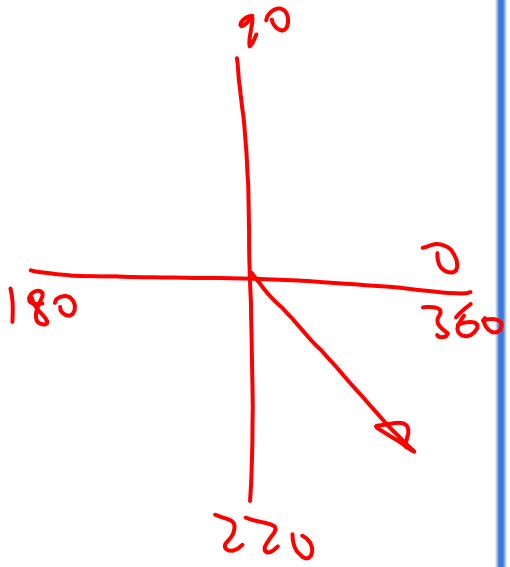


Relation between (360 - θ) & θ

1. $\sin(360^\circ - \theta) = -\sin\theta$

2. $\cos(360^\circ - \theta) = +\cos\theta$

3. $\tan(360^\circ - \theta) = -\tan\theta$

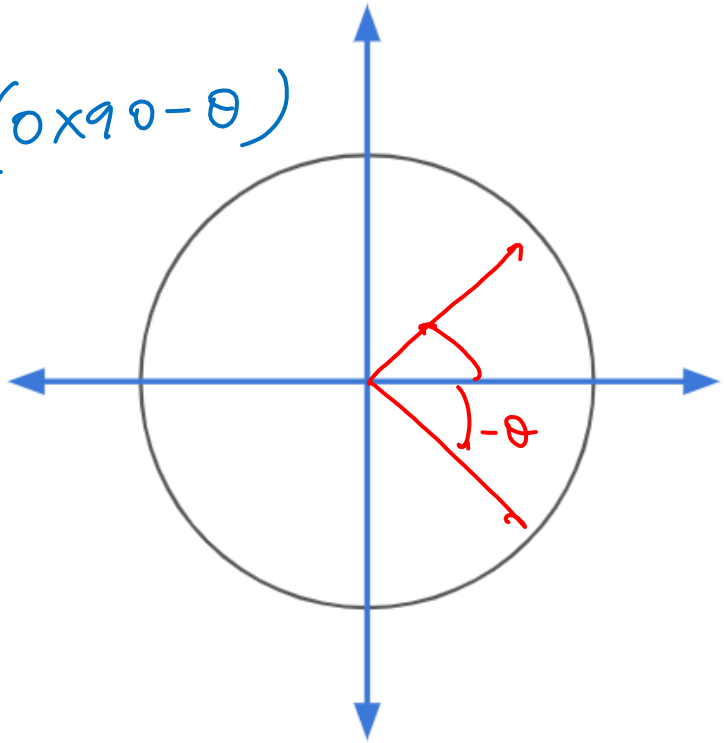


Important Results

1. $\sin(-\theta) = -\sin\theta$
2. $\cos(-\theta) = \cos\theta$
3. $\tan(-\theta) = -\tan\theta$

$(-\theta, \theta)$

$\sin(0 \times 90 - \theta)$

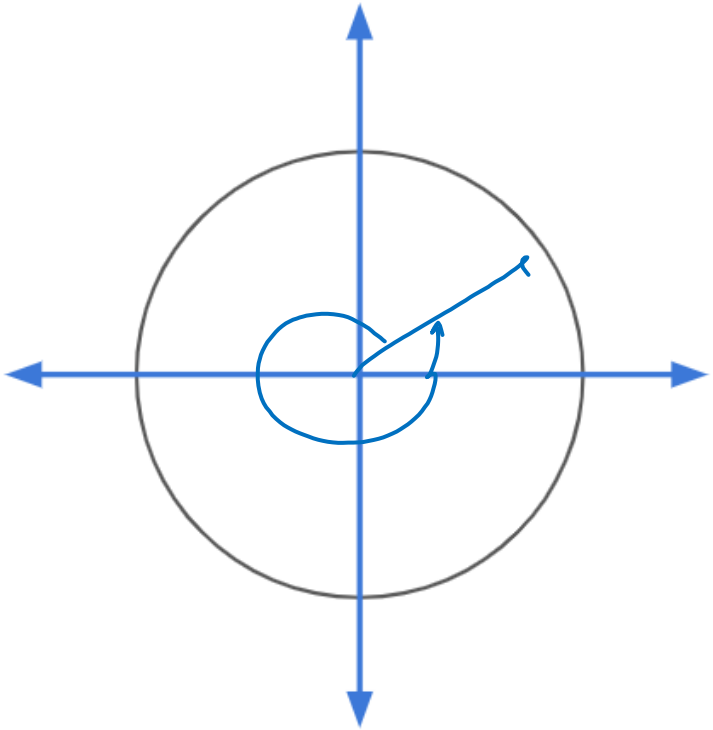


Important Results

4. $\sin(360 + \theta) = \sin\theta$

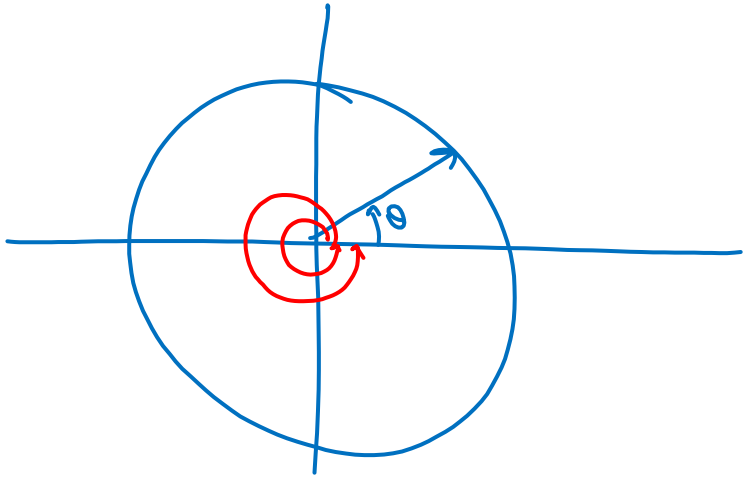
5. $\cos(360 + \theta) = \cos\theta$

6. $\tan(360 + \theta) = \tan\theta$



Important Results

- Adding or subtracting multiples of 360^{o} (or $2\pi^{c}$) does not change the value of trigonometric ratio.



$\sin(720 + \theta)$

$\downarrow$

$360 \times 2 + \theta$

Find the value of :

1. sin (225°) $= \sin(180+45^\circ) = -\sin 45^\circ = -\frac{1}{\sqrt{2}}$

2. cos (330°) $= \cos(360-30^\circ) = +\cos 30^\circ = \frac{\sqrt{3}}{2}$

3. tan (150°) $= \tan(180-30^\circ) = -\tan 30^\circ = -\frac{1}{\sqrt{3}}$

Find the value of :

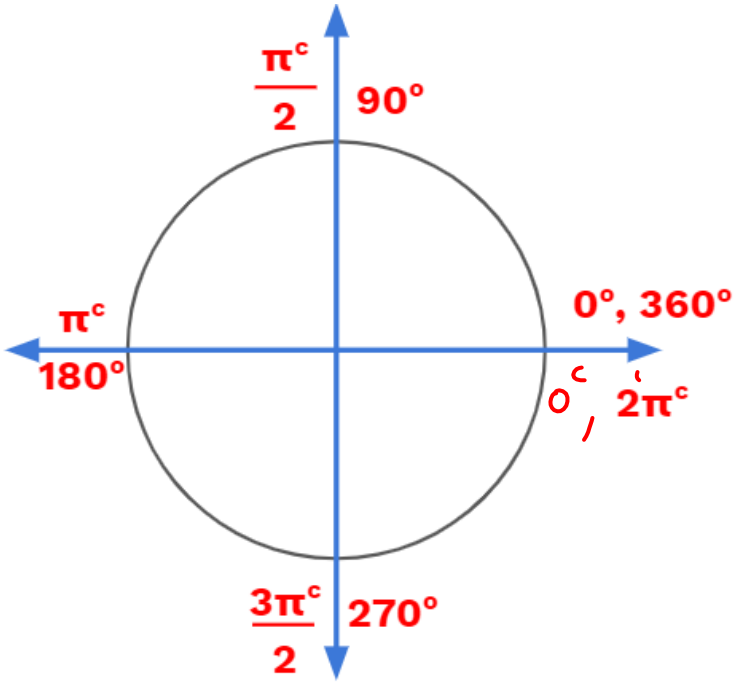
4. sin (765°) $= \sin(720 + 45^\circ) = \sin 45^\circ = \frac{1}{\sqrt{2}}$

5. cosec (-1410°) $= \operatorname{cosec}(-1410 + 4 \times 360^\circ) = \operatorname{cosec} 30^\circ = 2$

6. cos (-1710°) $= \cos(-1710 + 5 \times 360^\circ)$

$= \cos 90^\circ = 0$

Learn to read angles in Radians:



Find the value of:

$\sec(270^0 - A)\sec(90^0 - A) - \tan(270^0 - A)\tan(90^0 + A)$

A. 1 **B.** -1 **C.** 0 **D.** None

$(-\operatorname{cosec} A)(\operatorname{cosec} A) - (\cot A)(-\cot A)$

$-\operatorname{cosec}^2 A + \cot^2 A$

$= -(\operatorname{cosec}^2 A - \cot^2 A) = -1$

Find the value of: $\tan 225^0 \cot 405^0 + \tan 765^0 \cot 675^0$

A. 1 **B.** -1 **C.** 0 **D.** None

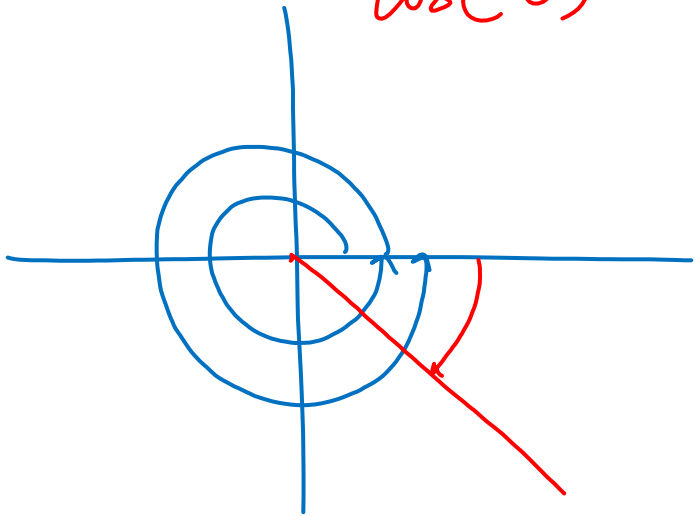
$\tan(180+45^\circ)\cot(360+45^\circ)$

$+ \tan(720+45^\circ)\cdot\cot(720-45^\circ)$

$(\tan 45^\circ)\cdot(\cot 45^\circ) + (\tan 45^\circ)(-\cot 45^\circ)$

$(1)(1) + (1)(-1) = 0$

$$\frac{1}{\cos(-\theta)}$$



$$\operatorname{cosec}(-\theta) = -\operatorname{cosec}\theta$$

$$\sec(-\theta) = \sec\theta$$

$$\cot(-\theta) = -\cot\theta$$

Find the **value of:** $\sin\frac{3\pi}{5} + \sin\frac{4\pi}{5} + \sin\frac{6\pi}{5} + \sin\frac{7\pi}{5}$

$\frac{3\pi}{5} + \frac{7\pi}{5} = \frac{10\pi}{5} = 2\pi$ → $4\left(\frac{\pi}{2}\right)$

$\frac{4\pi}{5} + \frac{6\pi}{5} = \frac{10\pi}{5} = 2\pi$

$\sin\left(\frac{8\pi}{5}\right) + \sin\left(\frac{4\pi}{5}\right) + \sin\left(2\pi - \frac{4\pi}{5}\right) + \sin\left(2\pi - \frac{3\pi}{5}\right)$

$$\sin\left(\frac{3\pi}{5}\right) + \sin\left(\frac{4\pi}{5}\right) + \left(-\sin\frac{4\pi}{5}\right)$$

$$+ \left(-\sin\frac{3\pi}{5}\right)$$

$$= 0$$

If $\tan\theta = \frac{3}{4}$ and θ is not in the 1st Quadrant, then the find the value of

$$\frac{\sin(90^0 + \theta) - \cot(180^0 - \theta)}{\tan(270^0 - \theta) - \cos(270^0 + \theta)}$$

HW

#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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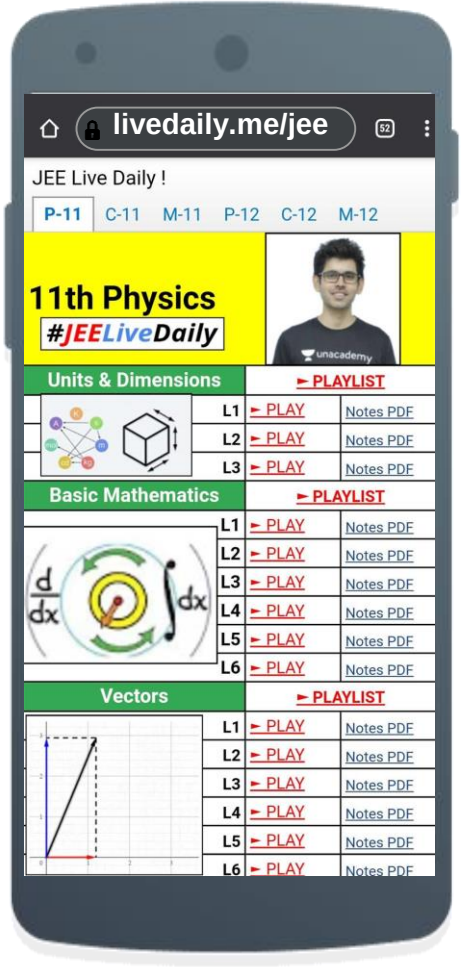

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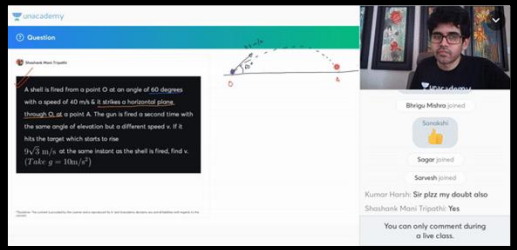

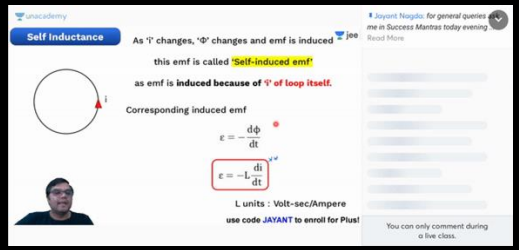

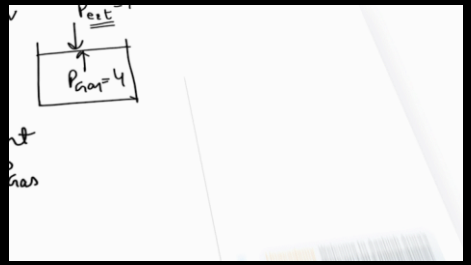

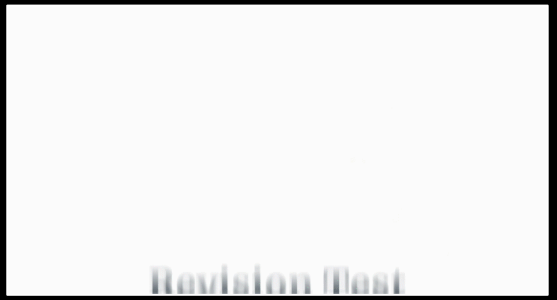

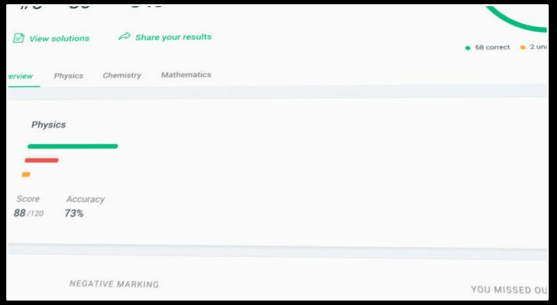

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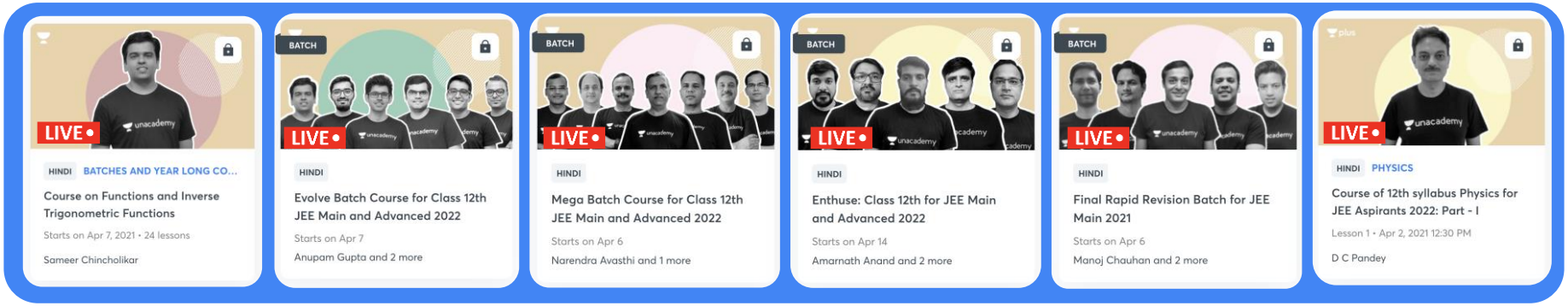

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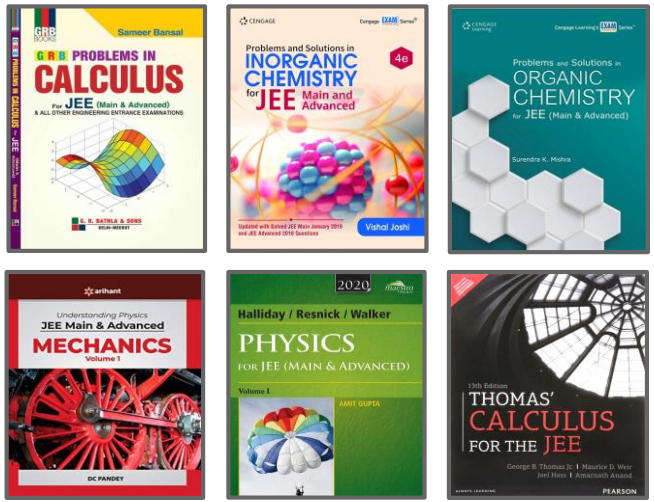

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98.16

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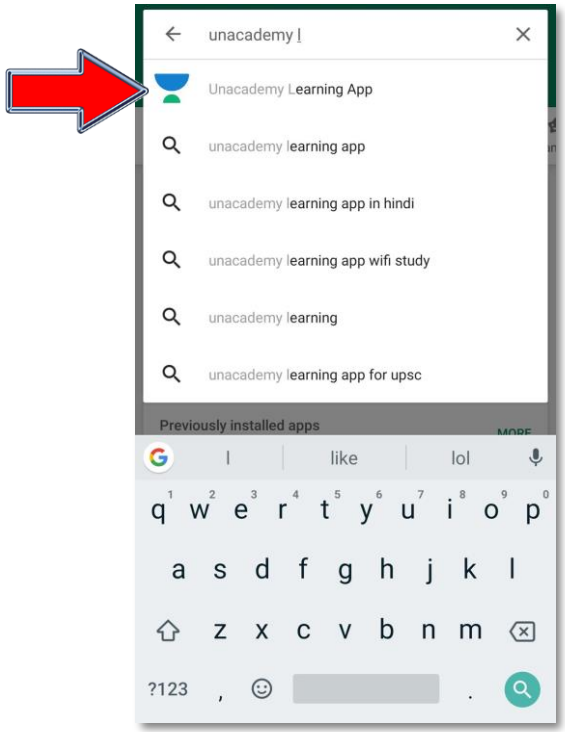
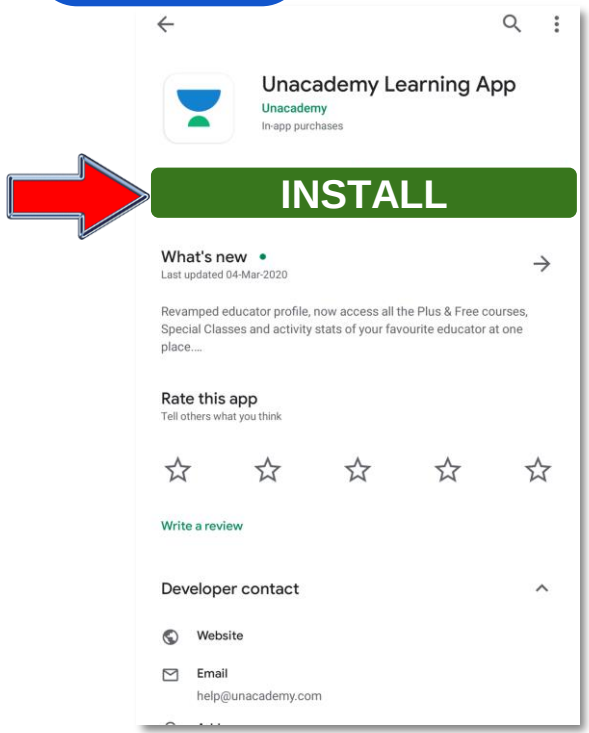
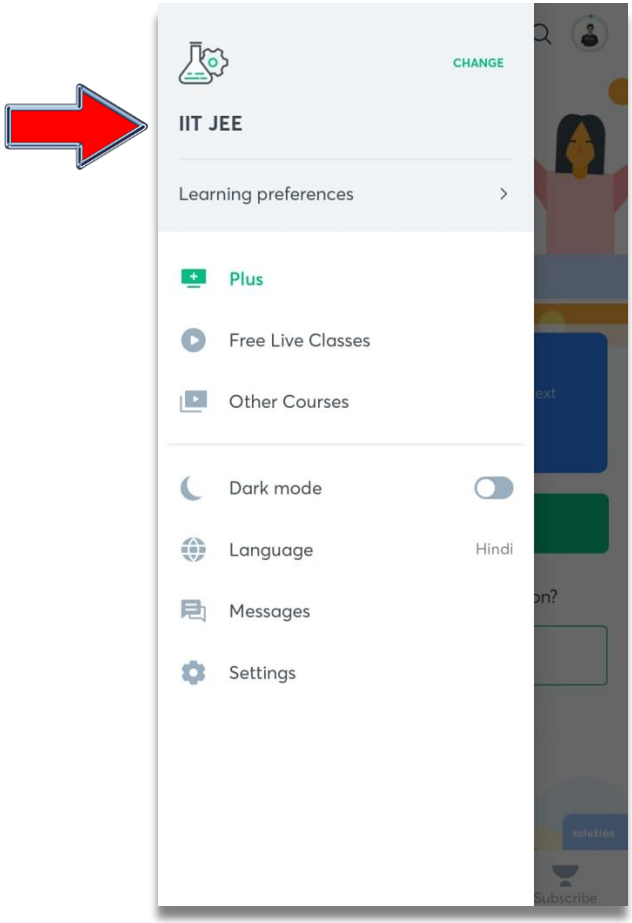
Step 1



Step 2

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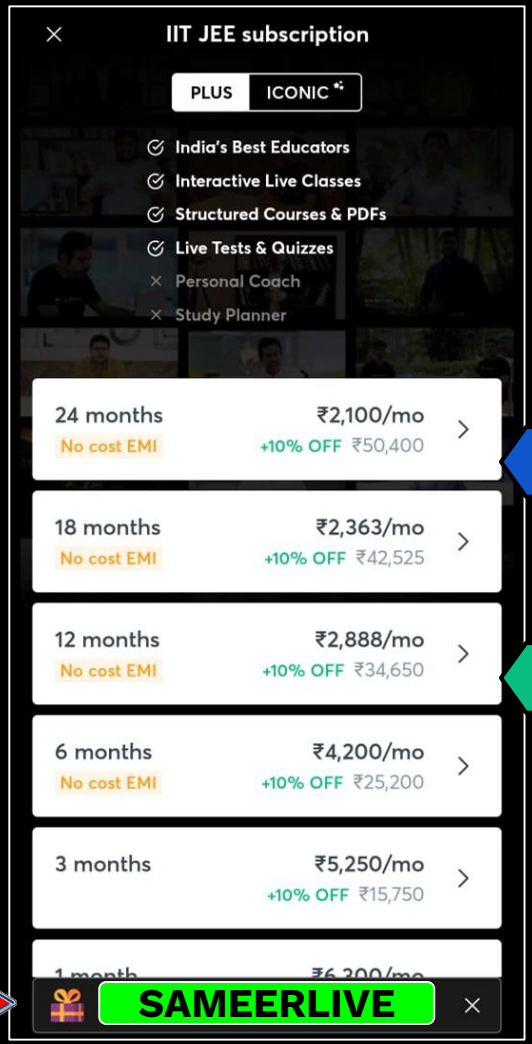

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