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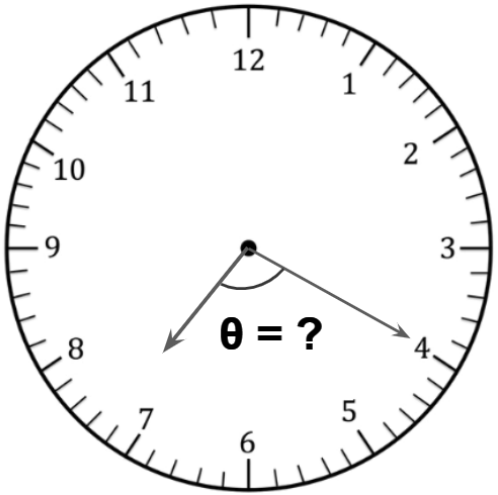
Angle Measurement

Trigonometry 2



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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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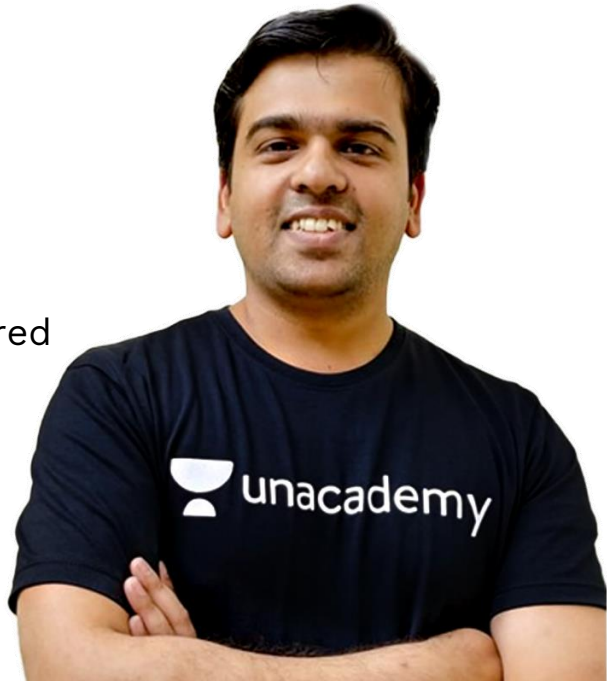
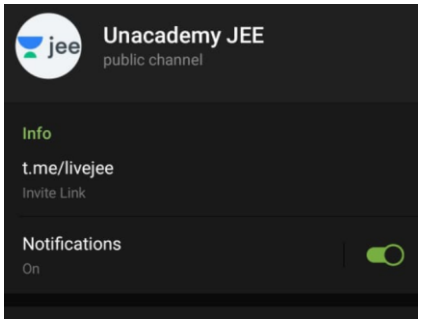
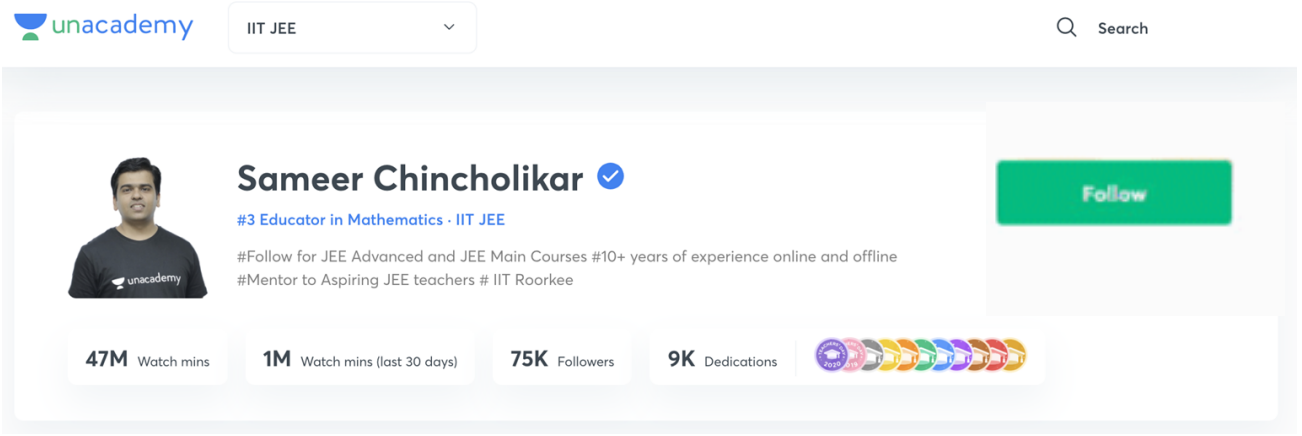


Telegram Channel





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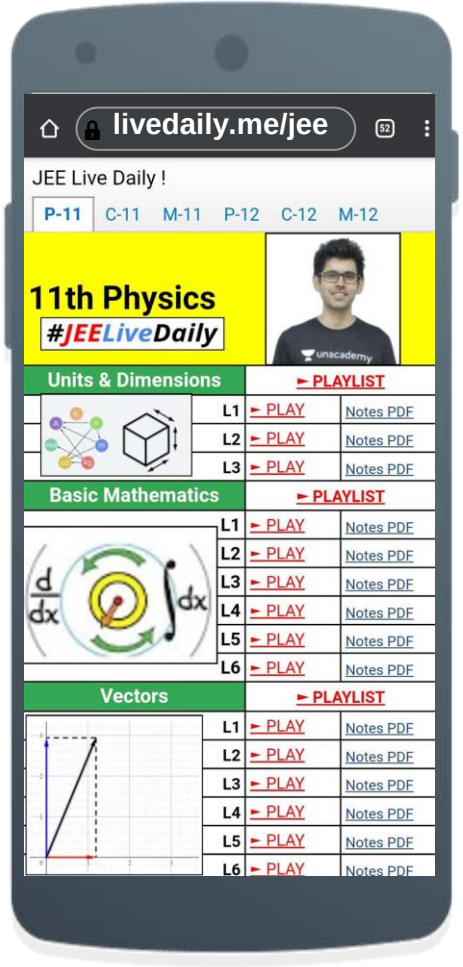

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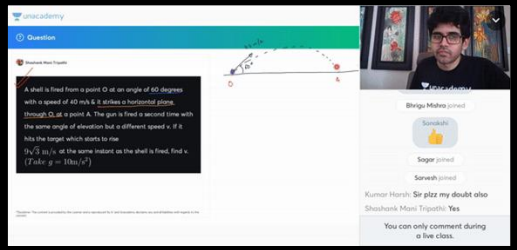

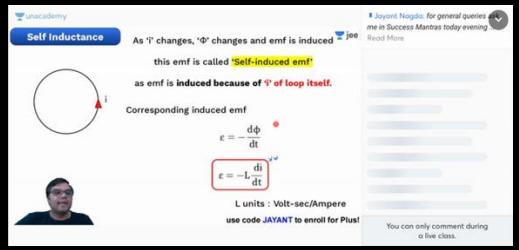

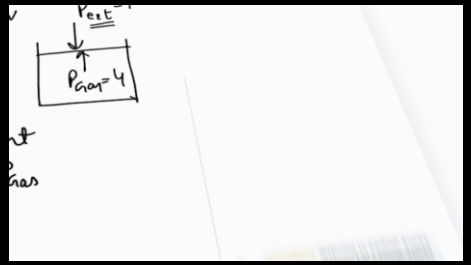

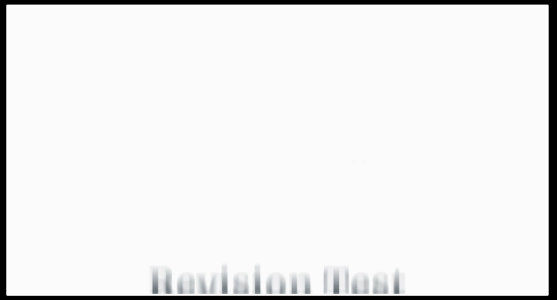

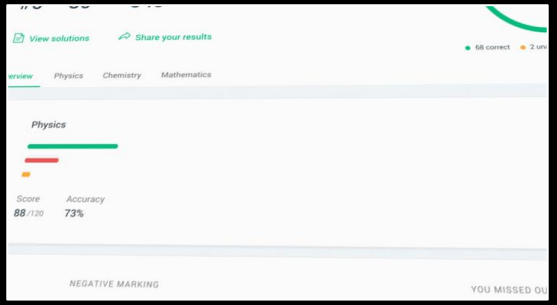

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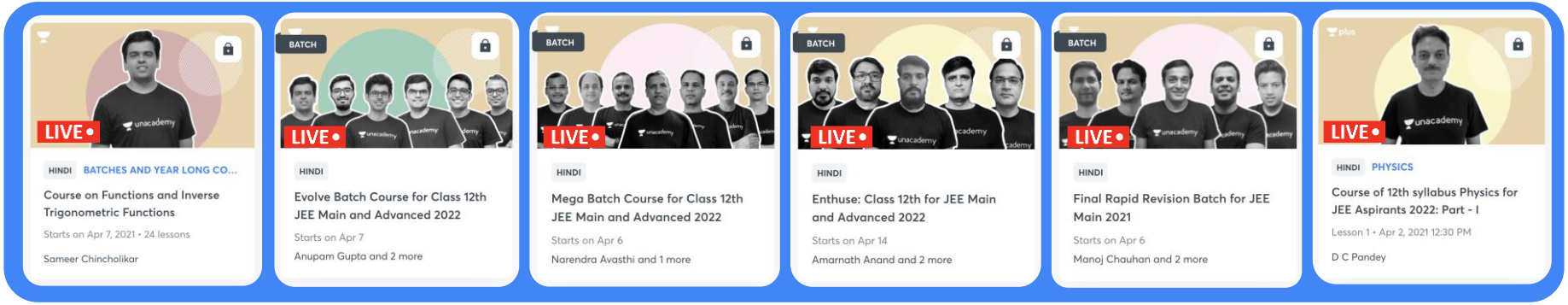

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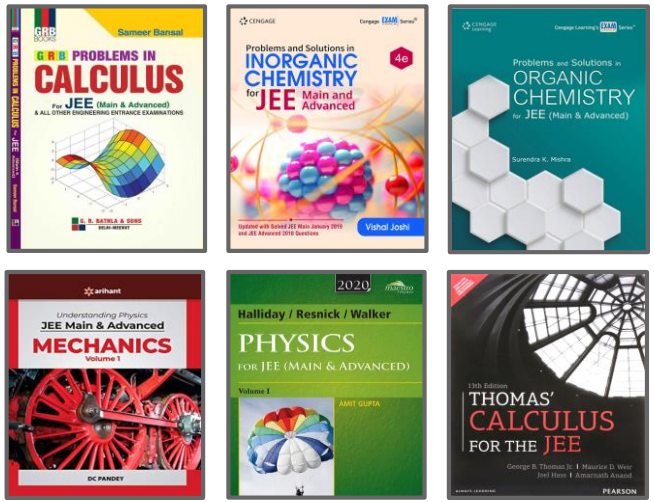

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Amaiya Singhal
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Adnan
99.95

Ashwin Prasanth
99.94

Tanmay Jain
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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

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99.10

Subhash Patel
99.02

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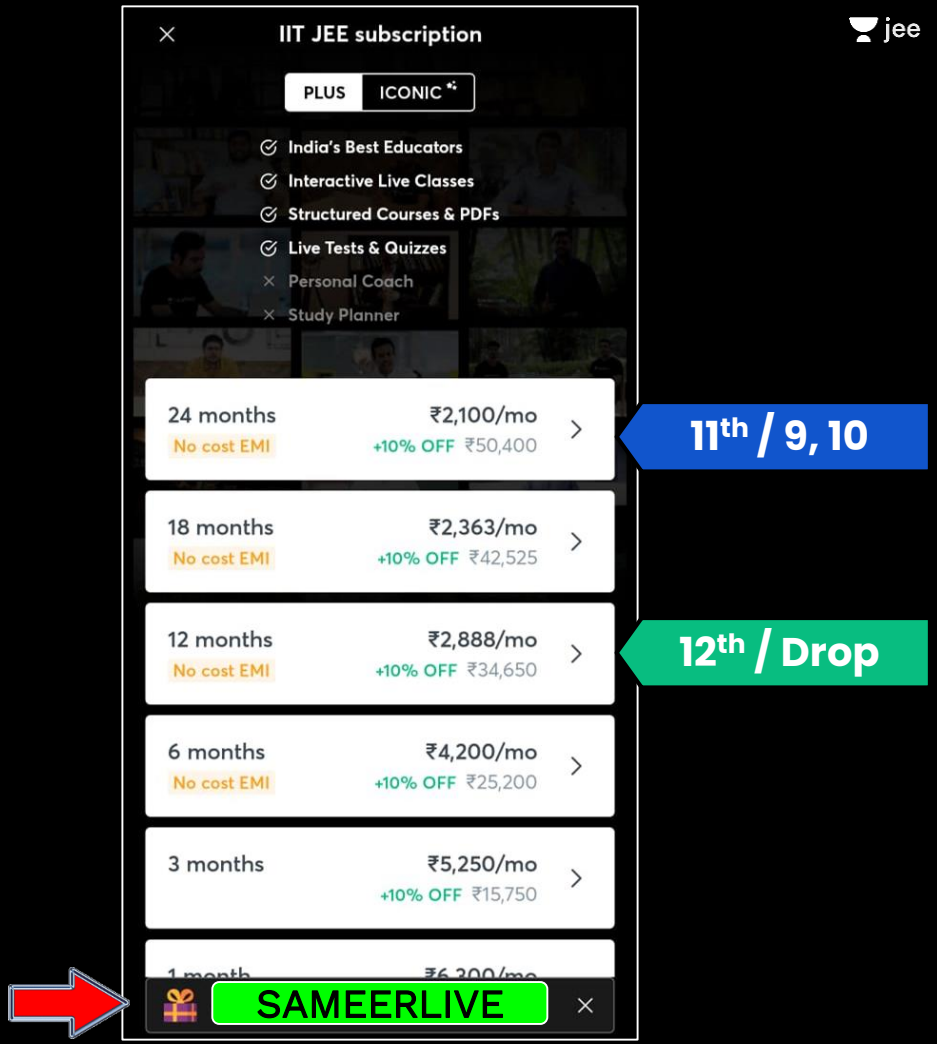
Ayush Gupta
98.67

Megh Gupta
98.59

Naman Goyal
98.48

MIHIR PRAJAPATI
98.16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+10% OFF ₹34,650
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No cost EMI
₹4,200/mo
+10% OFF ₹25,200
3 months
₹5,250/mo
+10% OFF ₹15,750
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12th / Drop
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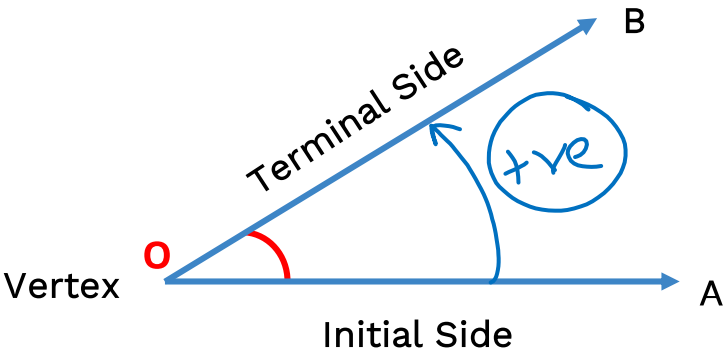
LET'S BEGIN!!

Angles

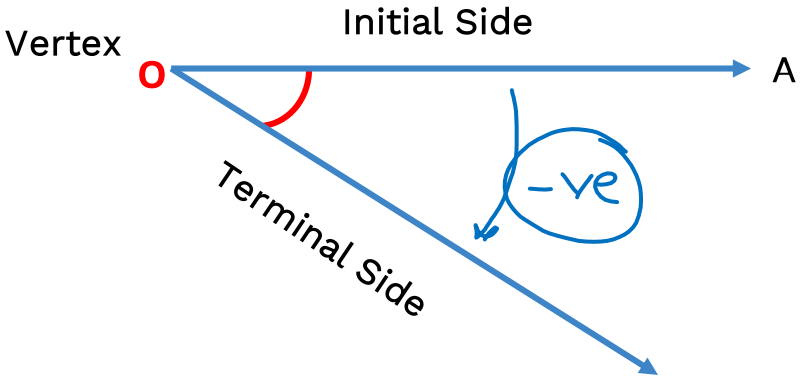
Angle is a measure of rotation of a given ray about its initial point.



1. Positive angle (anticlockwise measurement)

Angles

Angle is a measure of rotation of a given ray about its initial point.

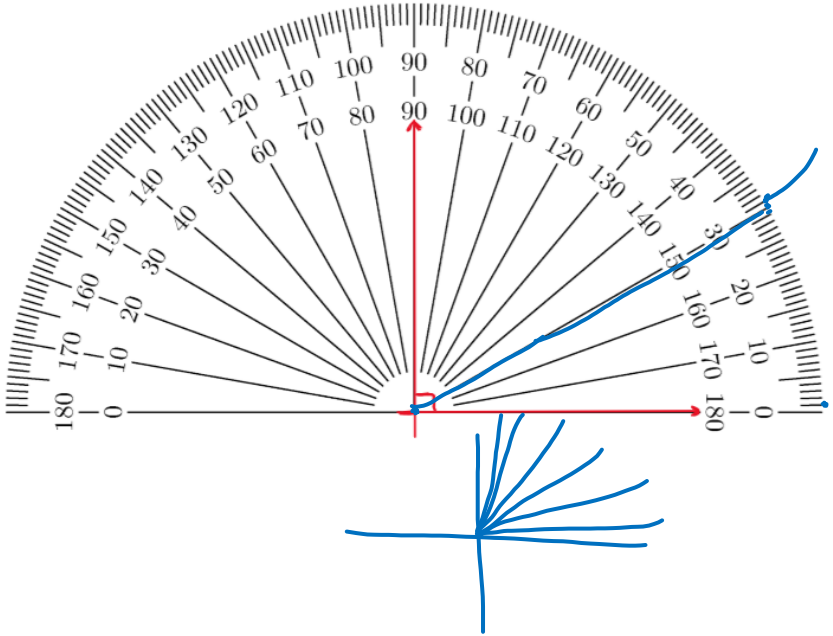


2 Negative angle (clockwise measurement)

System of Measurement of Angles

1 Sexagesimal or English system : (Degree)

d : °
m : ′
s : ″



1 right angle = 90 degree (=90^0)

1 degree (=1^0) = 60 minutes (=60’)

1 minute (=1’) = 60 seconds (=60”)

Example: Express 90' in degrees

$60' \longrightarrow 1^\circ$

$90' \longrightarrow \frac{1^\circ \times 90}{60} = 1.5^\circ$

Example: Express 30.54° in degrees, minutes and seconds

30.54°

$30^\circ + 0.54^\circ$

$30^\circ + (0.54 \times 60)'$

$30^\circ + (32.4)'$

$30^\circ\ 32'\ (0.4)'$

$30^\circ\ 32'\ (0.4 \times 60)''$

$30^\circ\ 32'\ 24''$

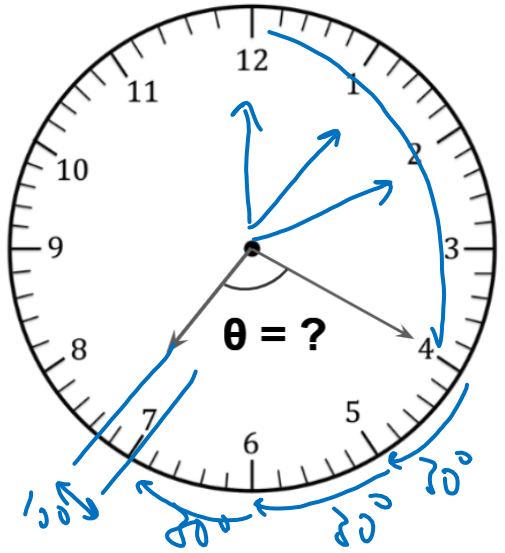
Find the angle between the minute and hour hand at 7:20 P.M.

A. 90^0 B. 95^0 C. 100^0 D. 115^0

$$\frac{360^\circ}{12} = 30^\circ$$

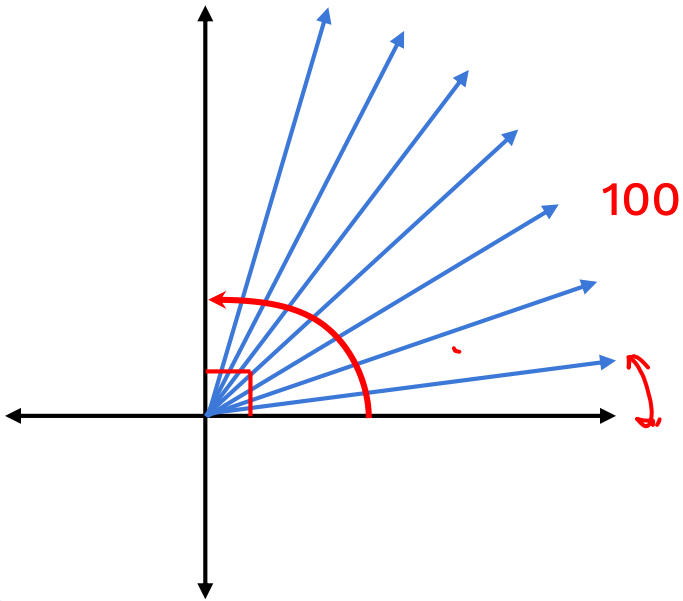
60 min $\rightarrow 30^\circ$

20 min $\rightarrow \frac{30 \times 20}{60} = 10^\circ$



System of Measurement of Angles

2 Centesimal or French system : (Grade)



1 right angle = 100 grade (=100^g)

1 grade = 100 minutes (=100')

1 minute = 100 seconds (=100'')

Interconversion of Degree & Grade

1 Rt angle $= 90^\circ = 100^g$

$1^\circ = \left(\frac{10}{9}\right)^g \longrightarrow x^\circ = \left(x \times \frac{10}{9}\right)^g$

$1^g = \left(\frac{9}{10}\right)^\circ \longrightarrow x^g = \left(x \times \frac{9}{10}\right)^\circ$

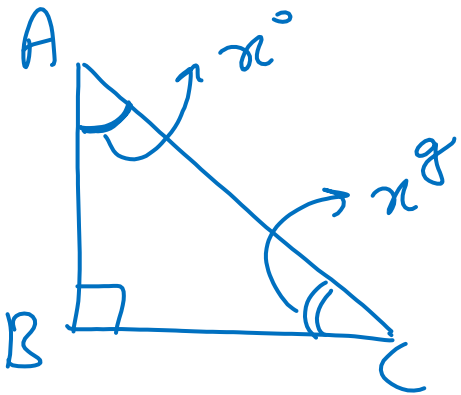
Interconversion of Degree & Grade

Example: Express 81^0 in grade measure.

$$\left(81 \times \frac{10}{9}\right)^g$$

$$90^g$$

In right angle triangle ABC, right angled at B, Angle A in degrees and angle C in grades are numerically equal. Find angle A.



$$x^\circ + x^g = 90^\circ$$

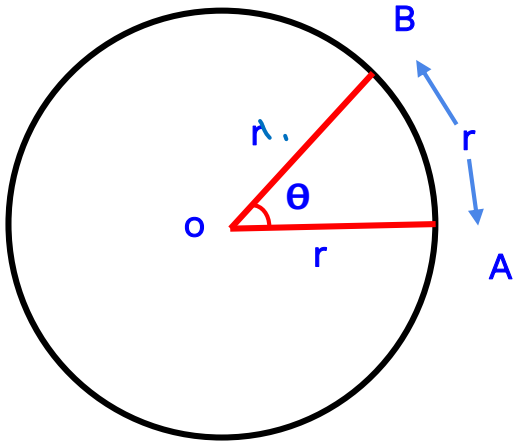
$$x^\circ + \left(x \times \frac{9}{10}\right)^\circ = 90^\circ$$

$$\frac{19x^\circ}{10} = 90 \Rightarrow \boxed{x^\circ = \frac{900}{19}}$$

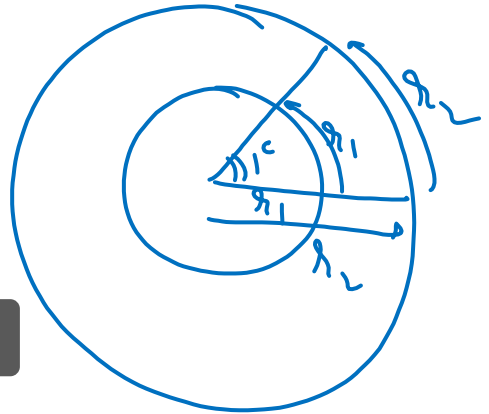
System of Measurement of Angles

3 Circular System : (Radian)

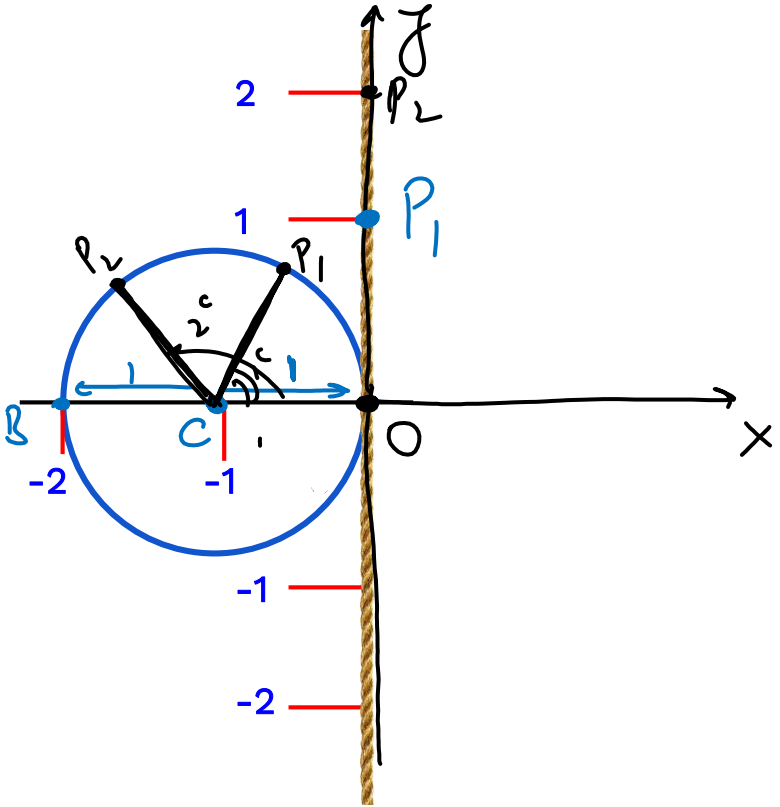
The angle subtended by an arc of a circle whose length is equal to the radius of the circle at the centre of the circle is called a radian. In this system the unit of measurement is radian (c).



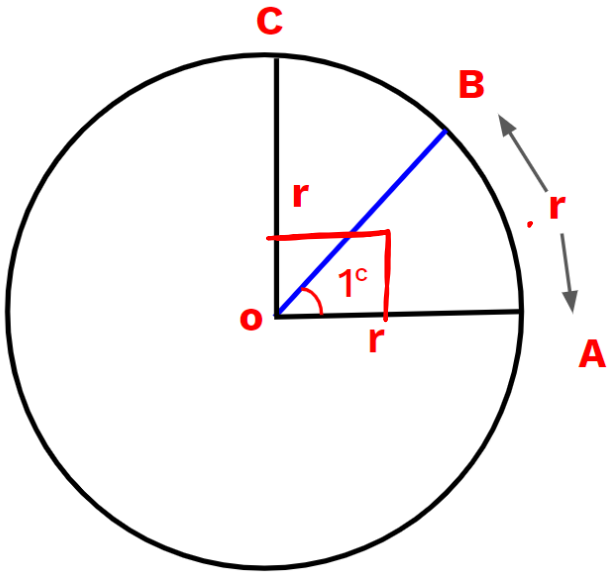
θ = 1 radian



Relation between Radians & Real Numbers



How much is 1 radian?



$$\frac{\ell(AB)}{\ell(AC)} = \frac{\angle AOB}{\angle AOC}$$

$$\frac{\ell}{\frac{1}{2}(2\pi)} = \frac{1^c}{90^\circ}$$

$$1^c = \left(\frac{180}{\pi}\right)^\circ$$

What we know:

Angle subtended by arc at the center is directly proportional to the length of the arc.

$$1^c = \left(\frac{180}{22} \times 7\right)^\circ$$

$$\boxed{1^c \approx 57.3^\circ}$$

Relation between radian & degree

$$\pi^c = 180^\circ$$

$$1^\circ = \left(\frac{\pi}{180}\right)^c \longrightarrow x^\circ = \left(x \times \frac{\pi}{180}\right)^c$$

$$1^c = \left(\frac{180}{\pi}\right)^\circ \longrightarrow x^c = \left(x \times \frac{180}{\pi}\right)^\circ$$

Important angles in radians

1. 90^0 : $(90 \times \frac{\pi}{180})^c \rightarrow \frac{\pi}{2}^c$
2. 45^0 : $\rightarrow \frac{\pi}{4}^c$
3. 60^0 : $(60 \times \frac{\pi}{180})^c \rightarrow \frac{\pi}{3}^c$

Important angles in radians

4. 90^0

5. 180^0 : $\left(180 \times \frac{\pi}{180}\right)^c$: π^c

6. 360^0 : $(2\pi)^c$

Convert the following in radians

1. 36^0 : $\left(36 \times \frac{\pi}{180}\right)^c = \frac{\pi}{5}^c$

2. 40^g : $\left(\left(40 \times \frac{9}{10} \times \frac{\pi}{180}\right) = \frac{\pi}{5}^c\right.$

Convert the following in radians

3

$10^0 48'$: $(10^\circ \ 48')$

$\left(10^\circ + \frac{48^\circ}{60}\right)$

$\left(10^\circ + \frac{4^\circ}{5}\right)$

$\left(\frac{54}{5}\right)^\circ$

$\left(\frac{\cancel{54}^{\,3}}{5} \times \frac{\pi}{\cancel{180}\,10}\right)$

$= \frac{3\pi}{50}$

The degree measure corresponding to the given radian $\left[\frac{2\pi}{15}\right]^c$

A. 21 B. 22 C. 23 D. 24 ✓

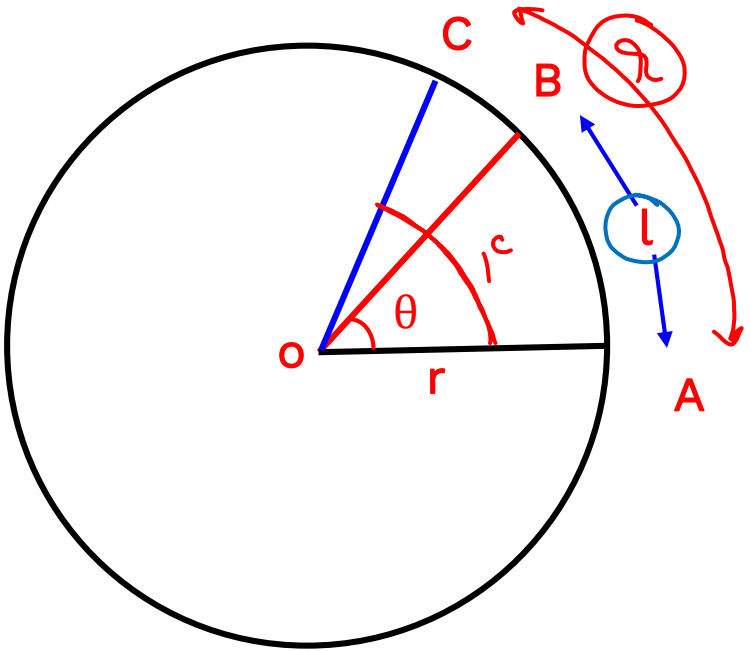
$\left(\frac{2\pi}{15}\right)^c = ?$

$\frac{2\pi}{15} \times \frac{180}{\pi} = 24$ ✓

Length of arc

If in a circle of radius r, arc of length l subtends an angle θ radian at the centre, then we have

$$l = r\theta \quad \text{or} \quad \theta = \frac{l}{r}$$

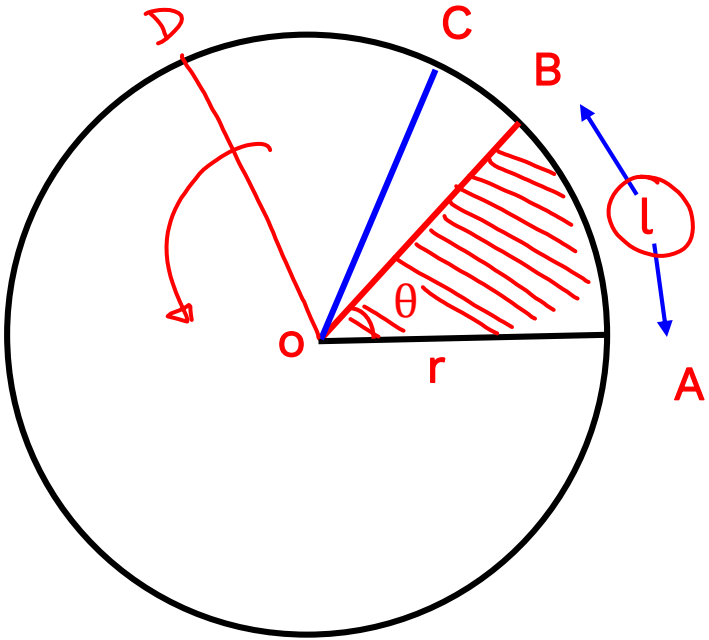


$$\frac{l(AB)}{l(AC)} = \frac{\theta^c}{\angle AOC}$$

$$\frac{l}{r} = \frac{\theta^c}{1^c} \Rightarrow \boxed{l = \theta r}$$

Area of circular sector

$$\text{Area} = \frac{1}{2}r^2\theta$$

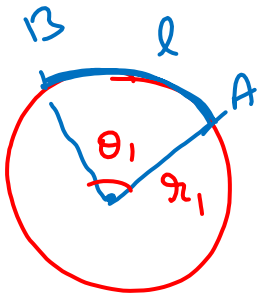


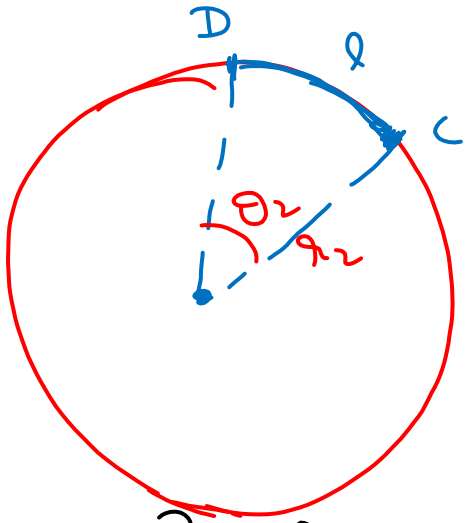
$2\pi \longrightarrow \pi r^2$

$\theta \longrightarrow \frac{\pi r^2 \times \theta}{2\pi}$

$$\text{area} = \frac{1}{2}\theta r^2$$

If the arcs of the same lengths in two circles subtend angles 65^0 and 110^0 at the centre, find the ratio of their radii.





$r_1 < r_2$

$\theta_1 > \theta_2$

$\theta_1 = 110^\circ \rightarrow r_1$

$\theta_2 = 65^\circ \rightarrow r_2$

$l = r_1\theta_2$

$l = r_2\theta_2$

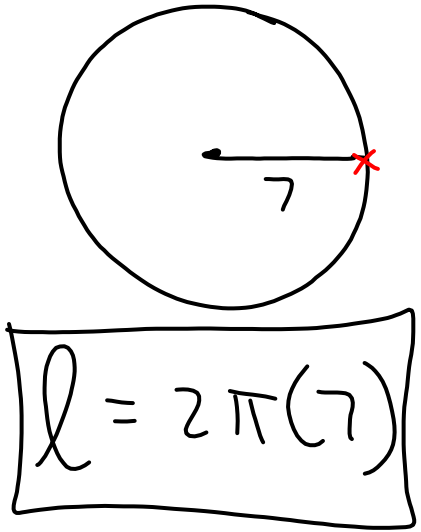
$\Rightarrow r_1\theta_1 = r_2\theta_2$

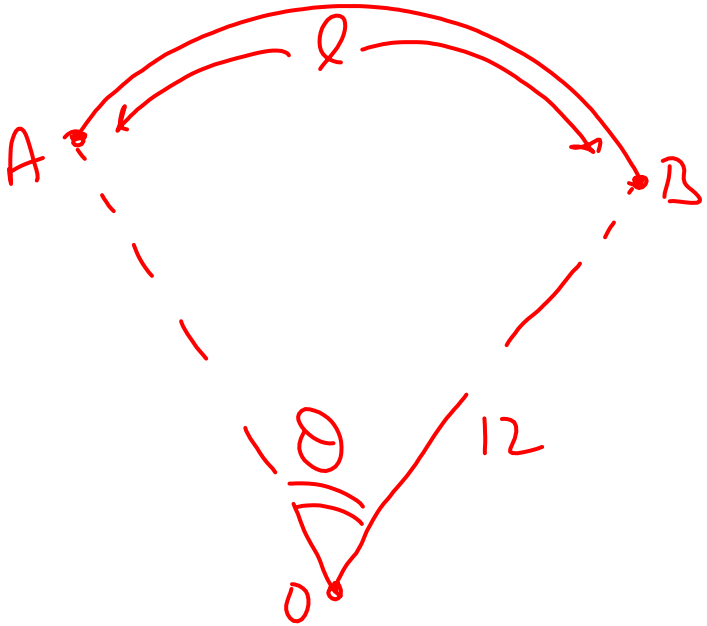
$$\ell_1\left(110\times\frac{\pi}{180}\right)^c=\ell_2\left(65\times\frac{\pi}{180}\right)^c$$

$$\frac{\ell_1}{\ell_2}=\frac{65}{110}=\frac{13}{22}$$

The circular wire of radius 7cm is cut and bend again into an arc of a circle of radius 12cm. The angle subtended by an arc at the centre of the circle is

A. 50^0 B. 210^0 C. 100^0 D. 60^0





$$\boxed{l = \theta r}$$

$$14\pi = \theta(12)$$

$$\theta^c = \frac{7\pi}{6}$$

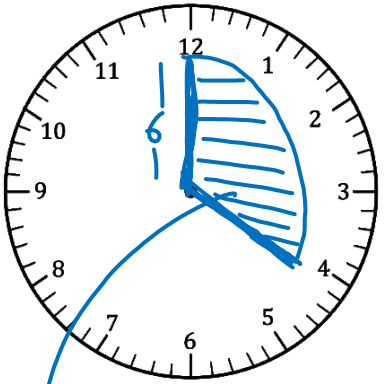
$$\therefore \theta^\circ = \frac{7\pi}{6} \times \frac{180^{30}}{\pi} = 210^\circ$$

Find the area swept by the minute hand of a clock of length 6 cm in 20 mins.

$$A = \frac{1}{2}\theta r^2$$

$$= \frac{1}{2}\left(\frac{2\pi}{3}\right)(6)^2$$

$$= \pi\left(\frac{36}{3}\right) = 12\pi$$



$$\left(120^\circ \times \frac{\pi}{180}\right)^c = \frac{2\pi}{3}$$

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

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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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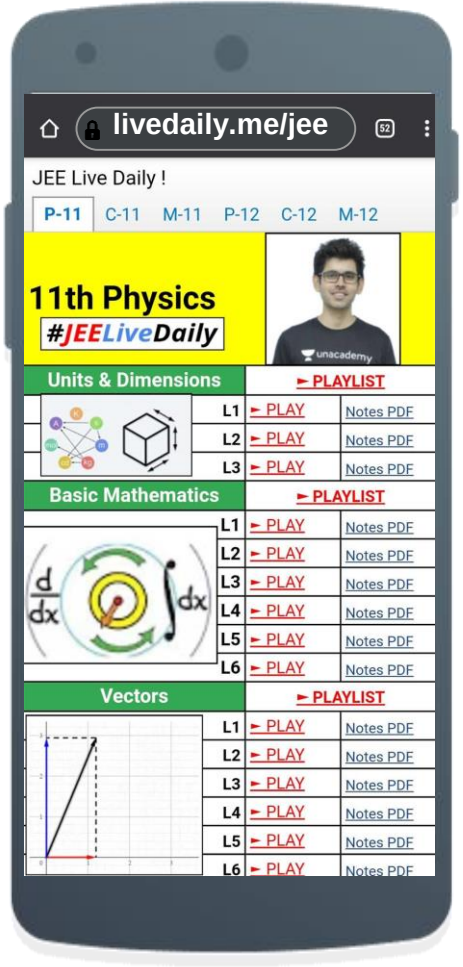

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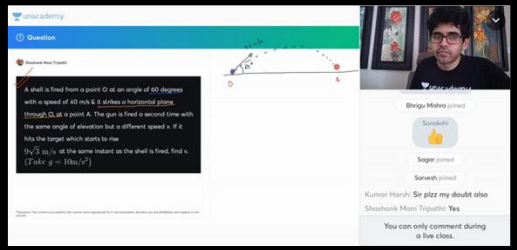

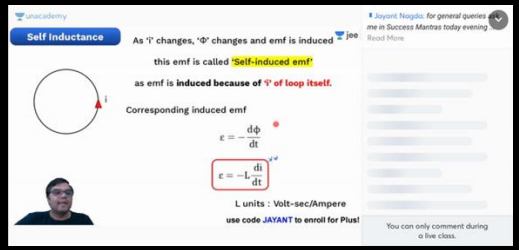

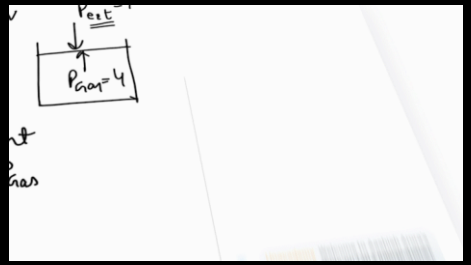

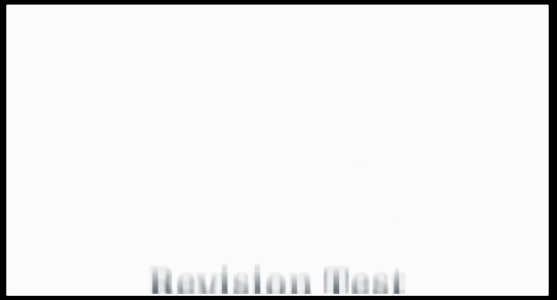

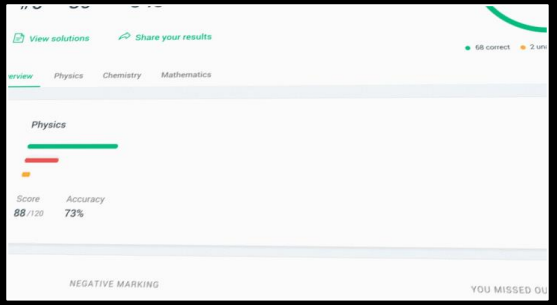

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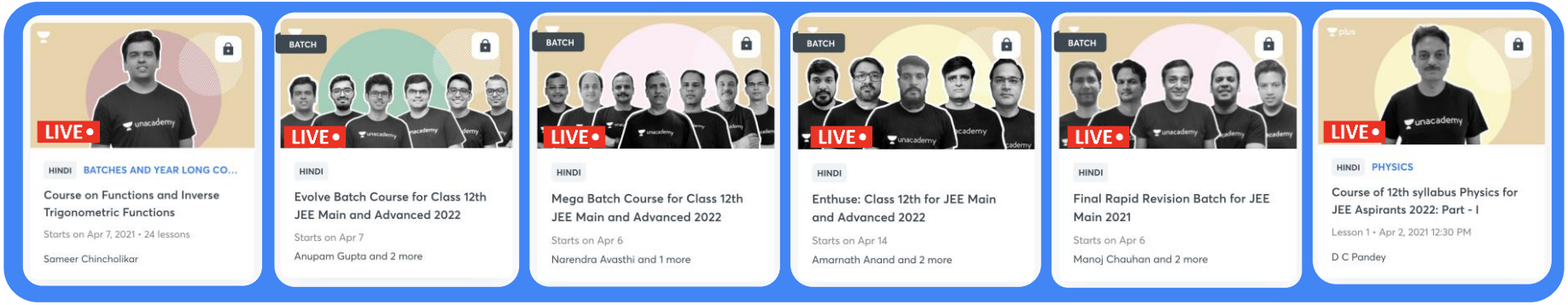

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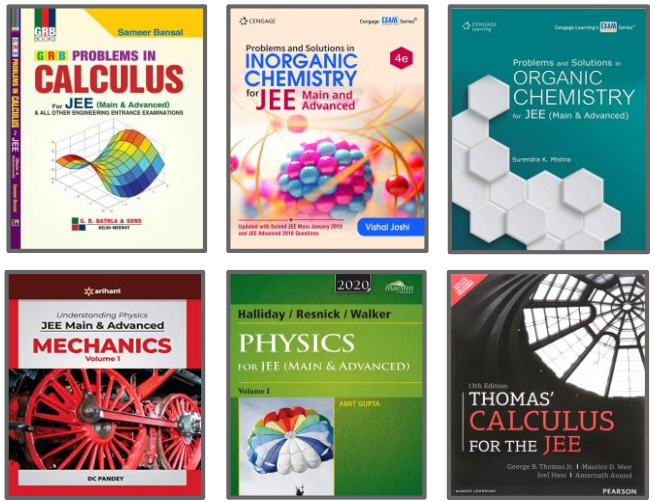

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Top Results

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
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Megh Gupta
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Naman Goyal
98.48

MIHIR PRAJAPATI
98.16

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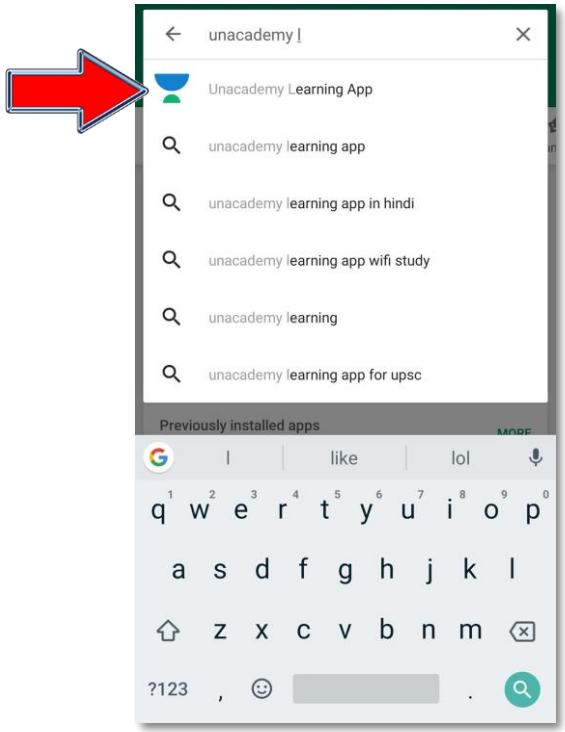
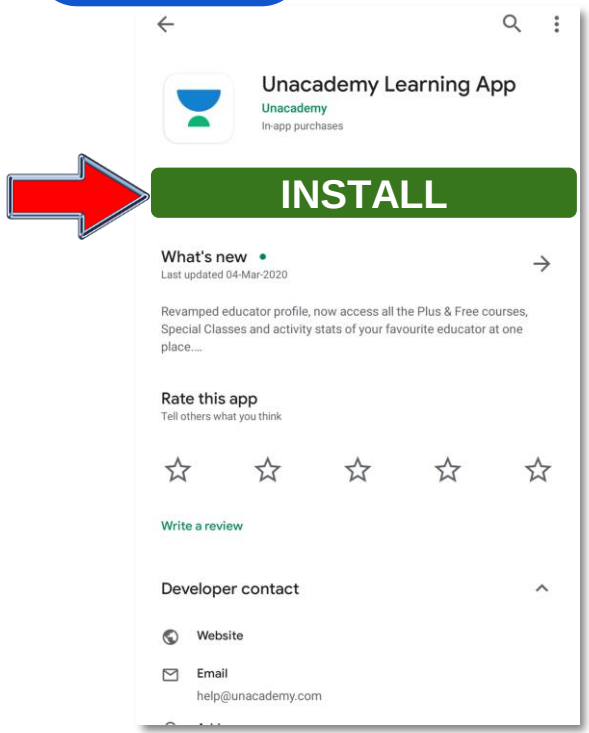
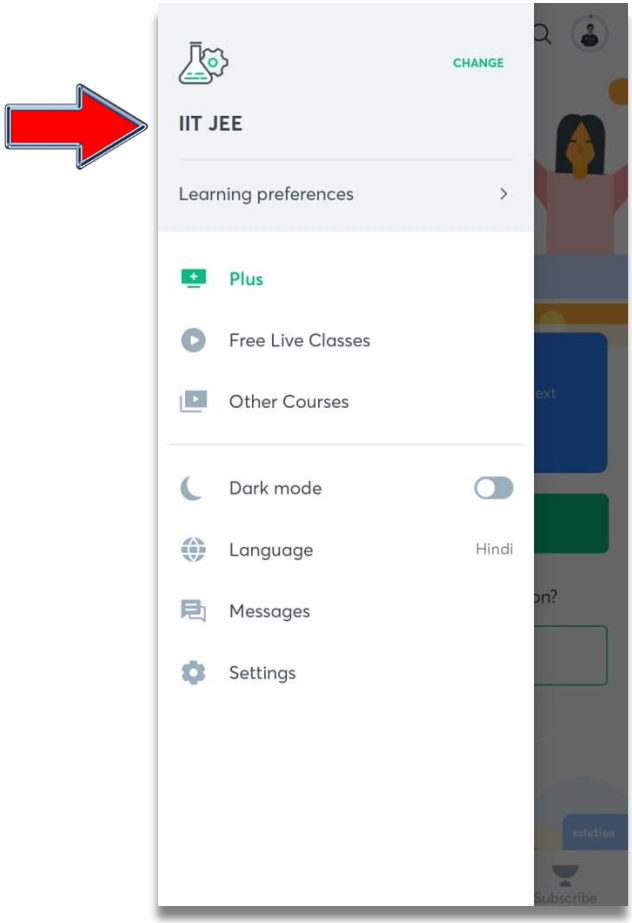
Step 1



Step 2

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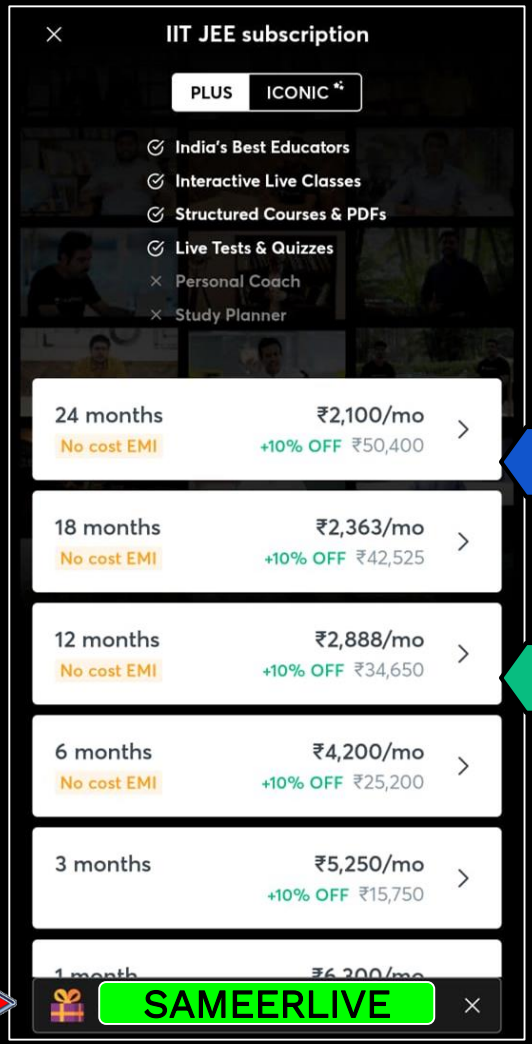

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