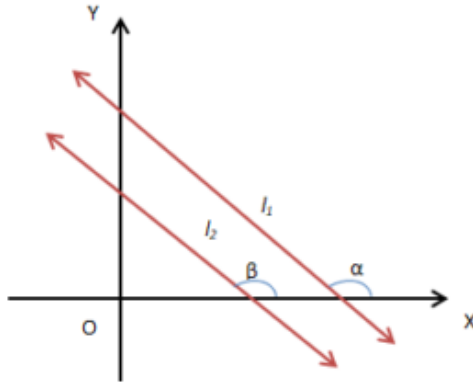


1. Coordinate Systems
2. Distance Formula

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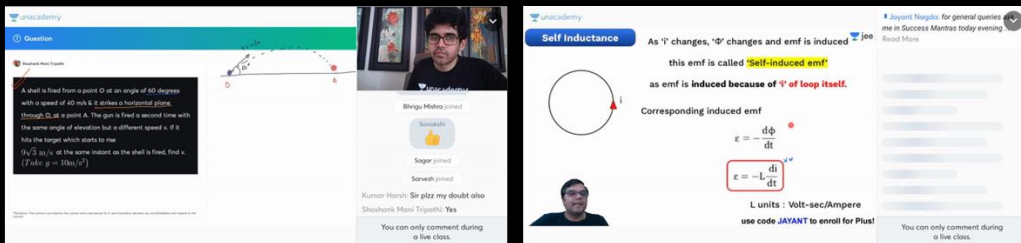
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Questions

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  $(\sqrt{3}/2) \sin(\theta)$  at the same instant as the shell is fired, find  $v$ . (Take  $g = 10 \text{ m/s}^2$ )

Shruti Mishra joined

Sagar joined

Saravali joined

Kumar Harsh: Sir plz my doubt also

Shashank Masi Tripathi: Yes

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**Self Inductance**

As  $\Phi$  changes,  $\frac{d\Phi}{dt}$  changes and emf is induced

this emf is called **Self-induced emf**

as emf is induced because of  $\Phi$  of loop itself.

Corresponding induced emf

$$\mathcal{E} = -\frac{d\Phi}{dt}$$

$$\mathcal{E} = -L \frac{di}{dt}$$

Units: Volt-sec/Ampere

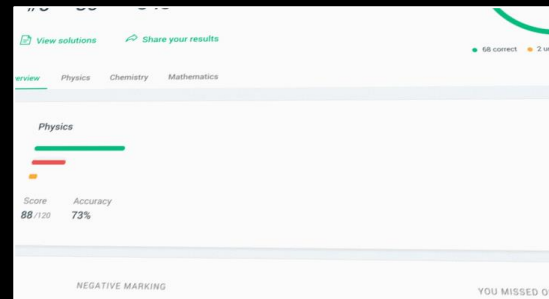
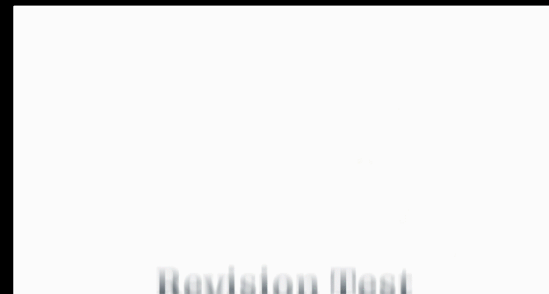
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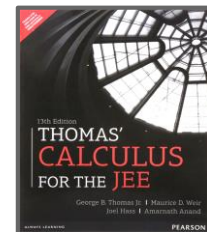
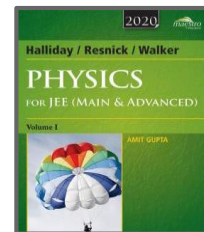
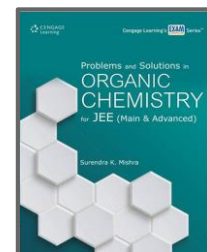
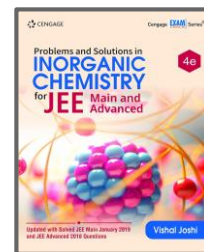
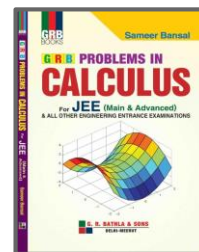
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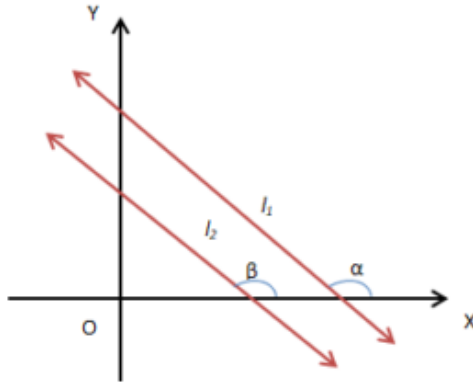


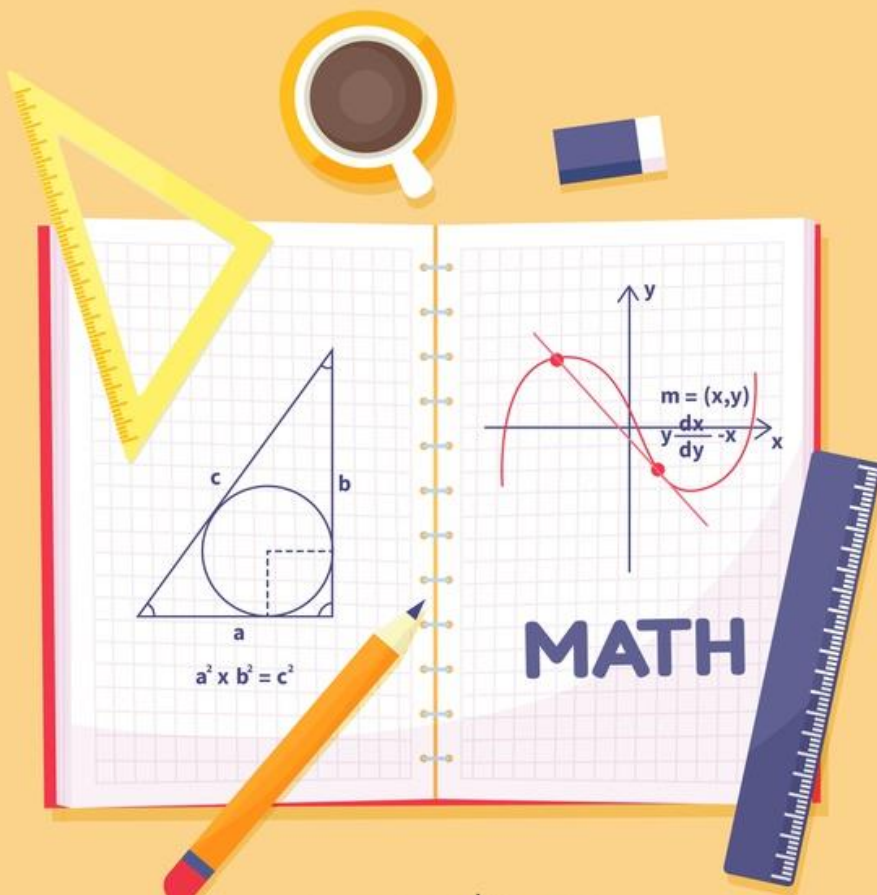


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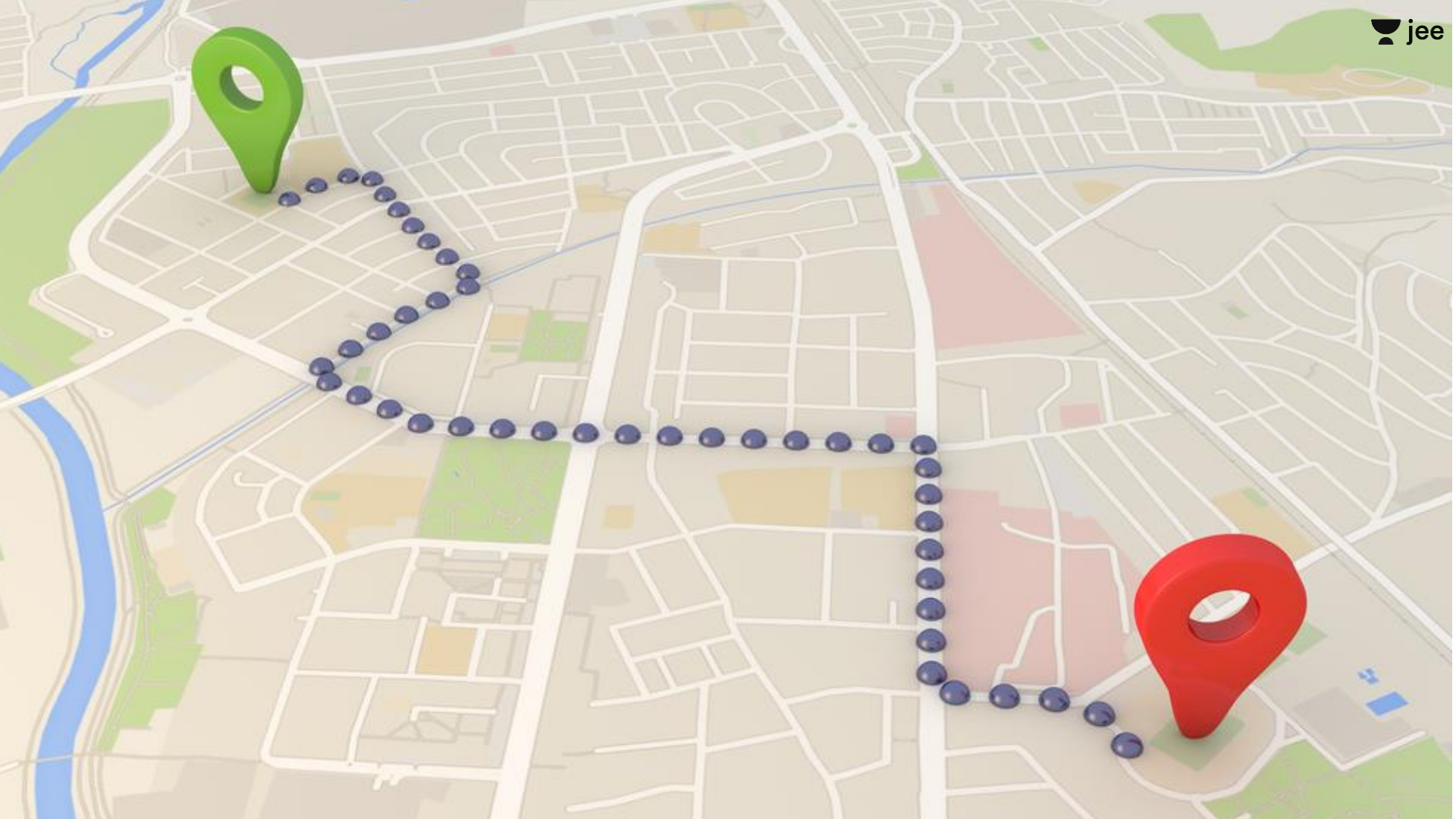
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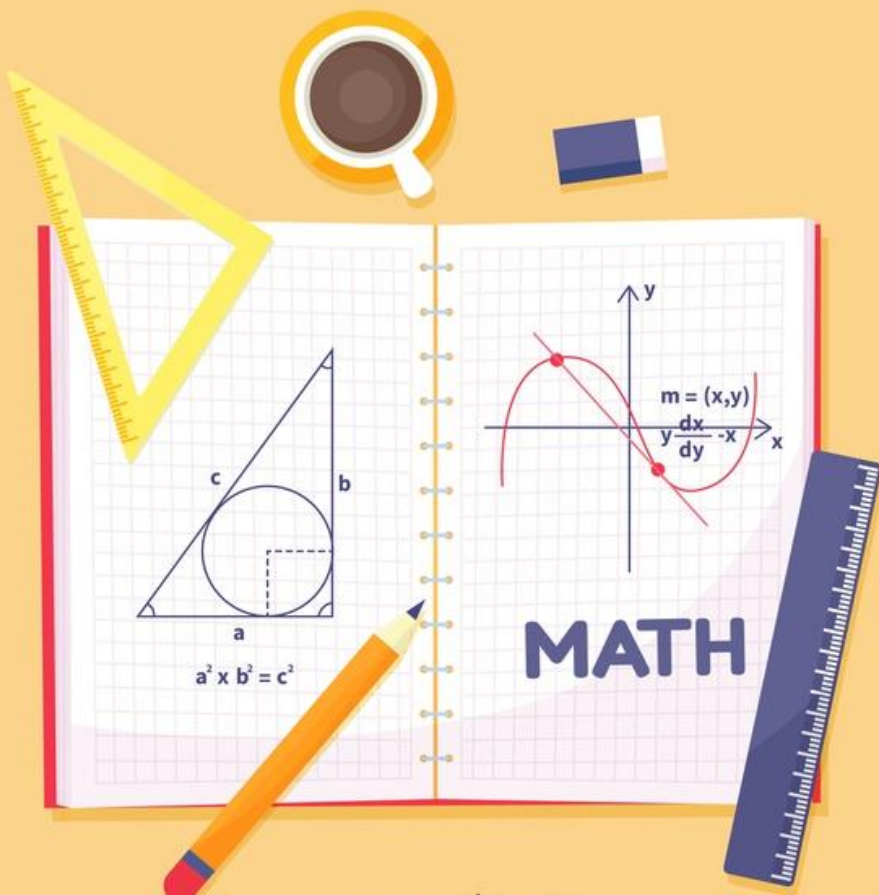
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# Coordinate Geometry





# Cartesian Coordinate System



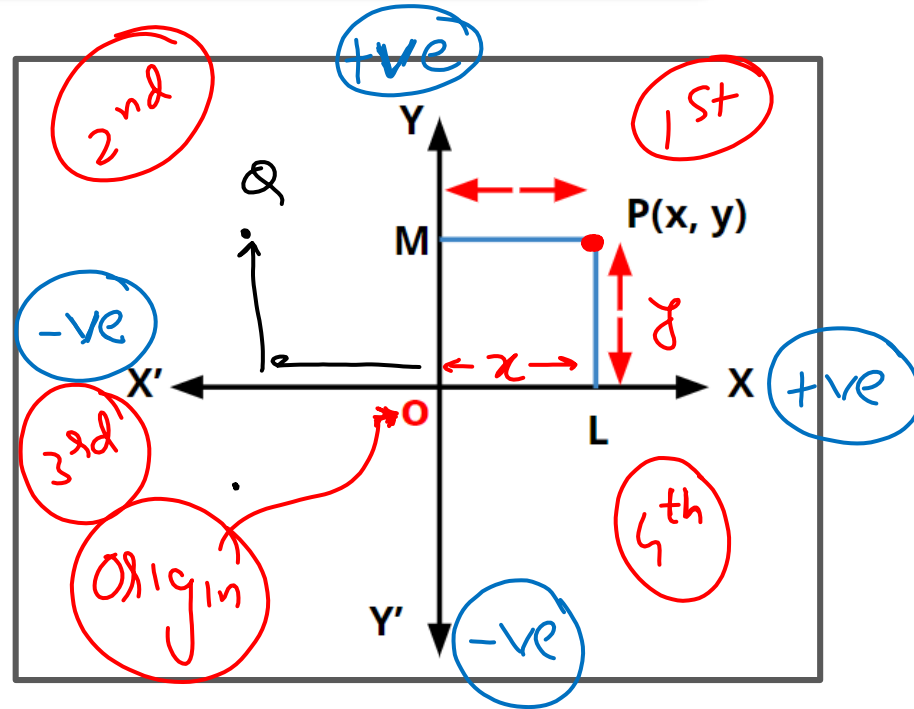
# Cartesian Coordinates of a Point

1<sup>st</sup> :  $(+, +)$

2<sup>nd</sup> :  $(-, +)$

3<sup>rd</sup> :  $(-, -)$

4<sup>th</sup> :  $(+, -)$









# Cartesian Coordinates of a Point

→ Distance from X-axis:

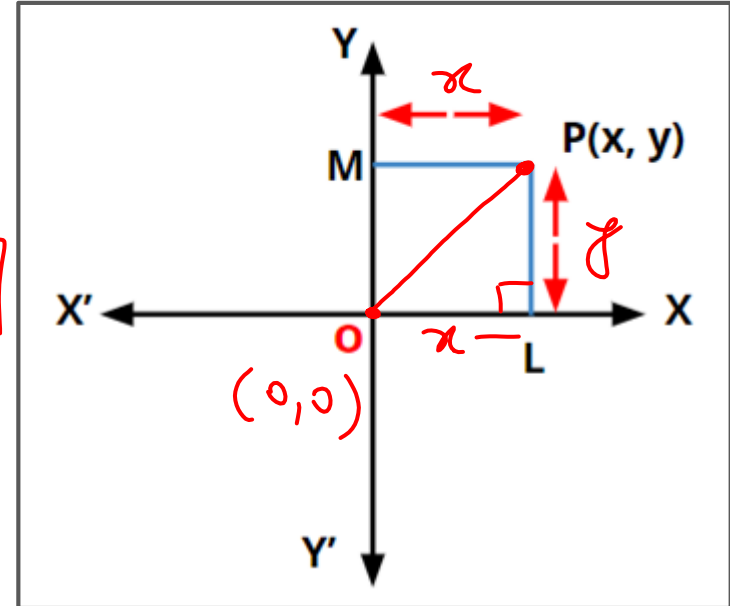
$y$

→ Distance from Y-axis:

$x$

→ Distance from Origin:

$$\sqrt{x^2 + y^2}$$





$$A = \{1, 2, 3\}$$

$$B = \{1, 2\}$$



Let A (h, k), B (1, 1) and C (2, 1) be the vertices of a right angled triangle with AC as its hypotenuse. If the area of the triangle is 1 square unit, then the set of values which 'k' can take is given by

A.  $\{-1, 3\}$

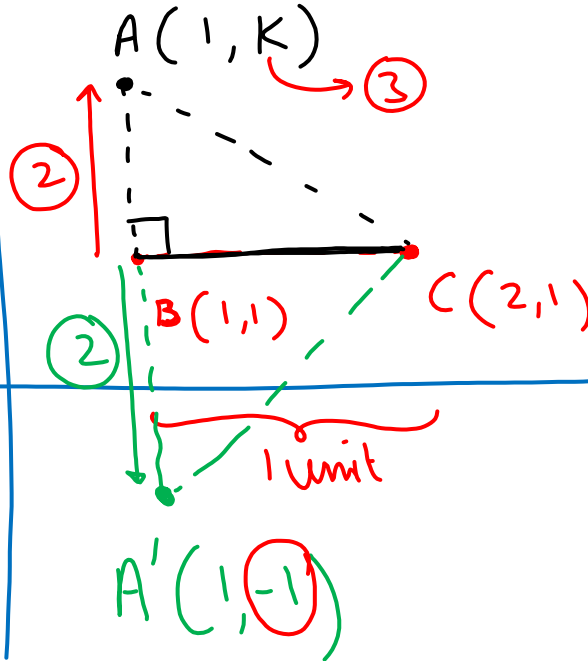
B.  $\{-3, -2\}$

C.  $\{1, 3\}$

D.  $\{0, 3\}$

$\angle B = 90^\circ$

$k = 3, -1$



$$\Delta = \frac{1}{2} (BC) (AB)$$

$$1 = \frac{1}{2} (1) (AB)$$

$AB = 2$



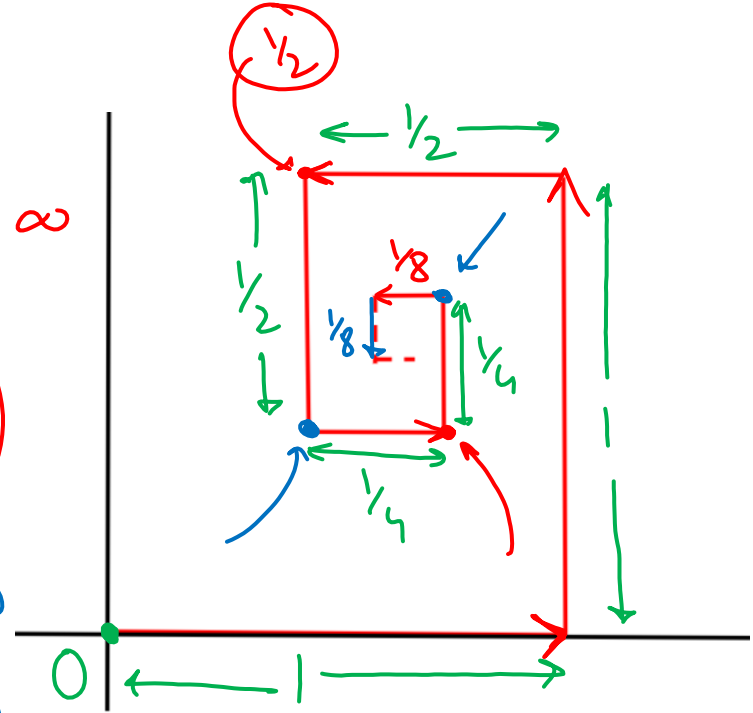


A particle starts from origin and moves in following pattern. **1 unit right** then **1 unit up**.  **$\frac{1}{2}$  units left** and  **$\frac{1}{2}$  units down**.  **$\frac{1}{4}$  units right** and  **$\frac{1}{4}$  units up** and so on. The length of each move becomes half after two steps and movement continuous indefinitely. The coordinate of the point where it ultimately converges to is :

$$x = 1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \dots \infty$$

$$= \frac{1}{1 - (-\frac{1}{2})} = \frac{1}{1 + \frac{1}{2}} = \frac{2}{3}$$

$$y = 1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \dots \infty = \frac{2}{3}$$









The vertices A and D of square ABCD lie on positive side of x and y-axis respectively. If the vertex C is the point (12, 17), then the coordinate of vertex B are

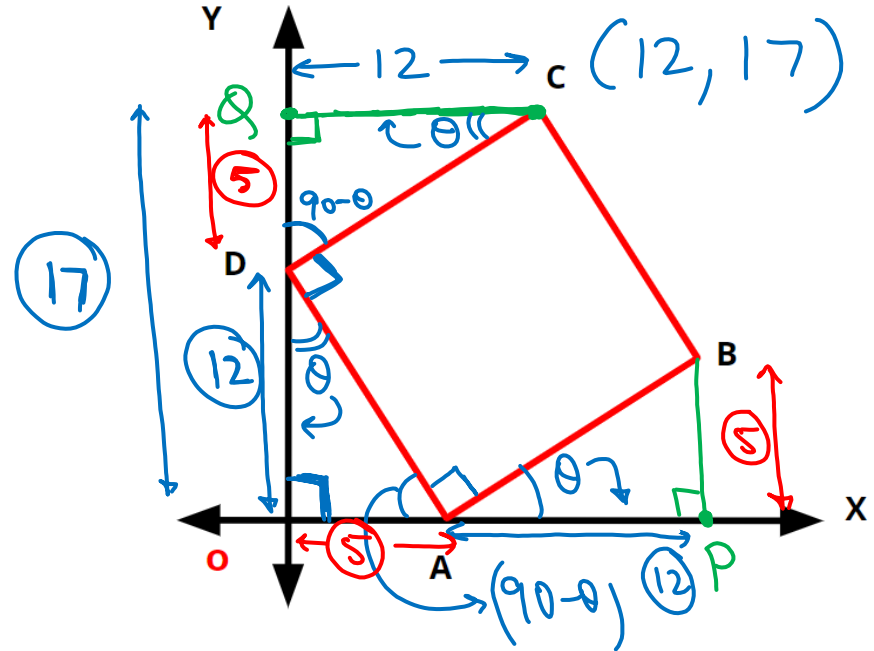
A. (14, 16)

B. (15, 3)

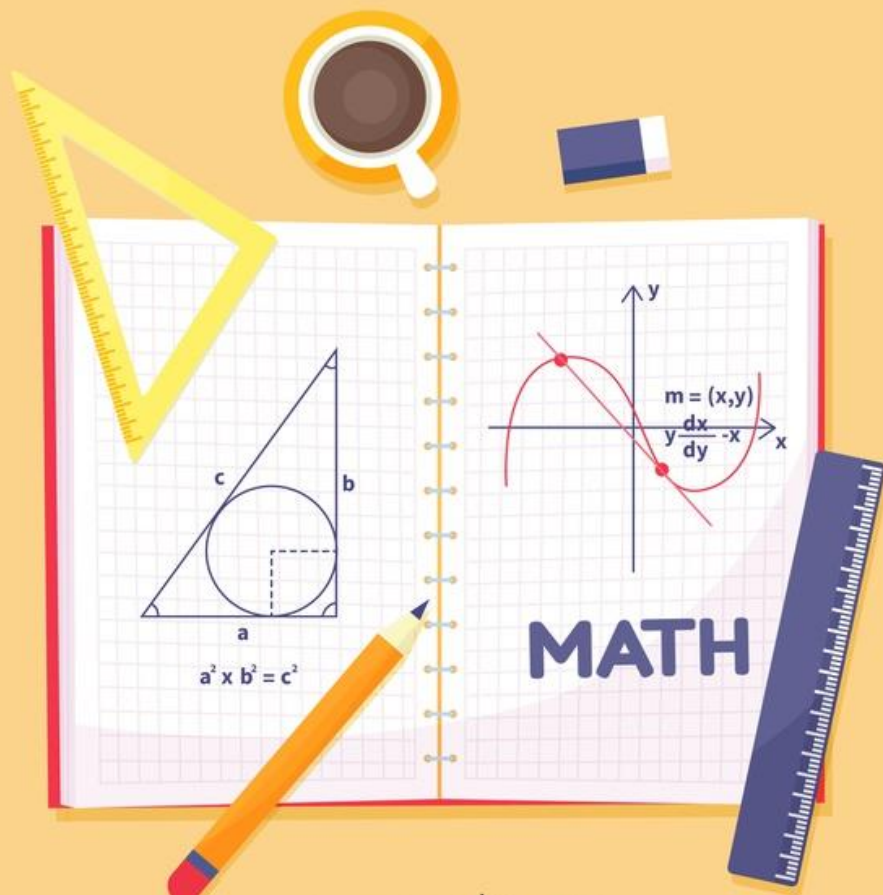
☒ C. (17, 5)

D. (17, 12)

(17, 5)



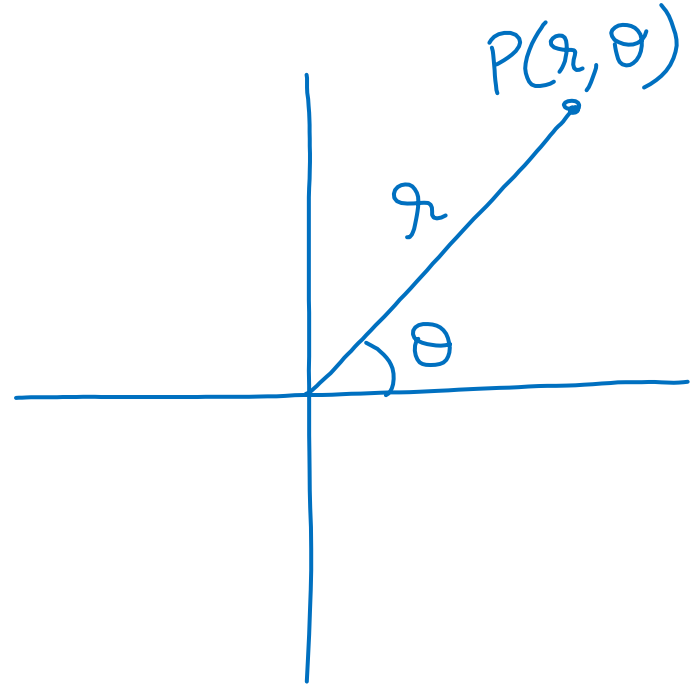
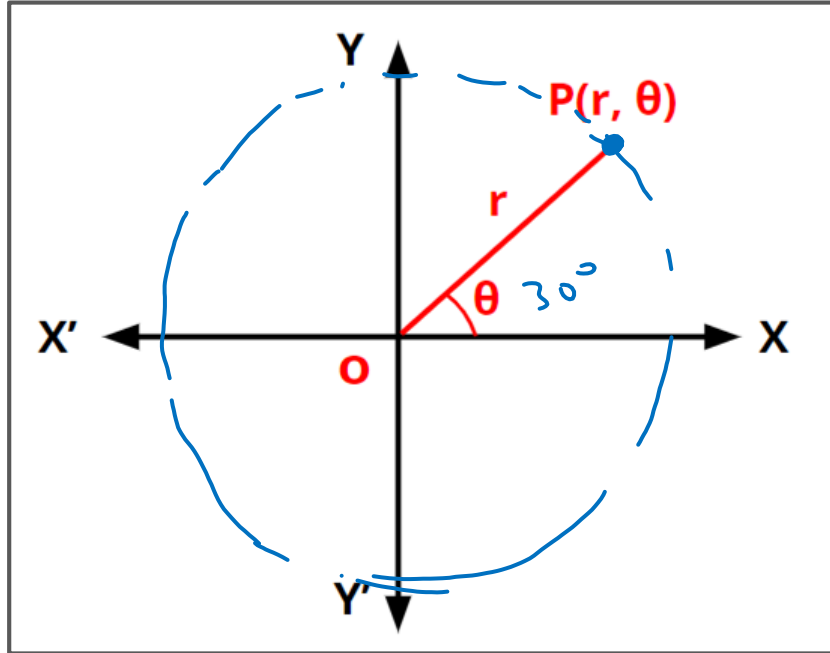




# Polar Coordinate System

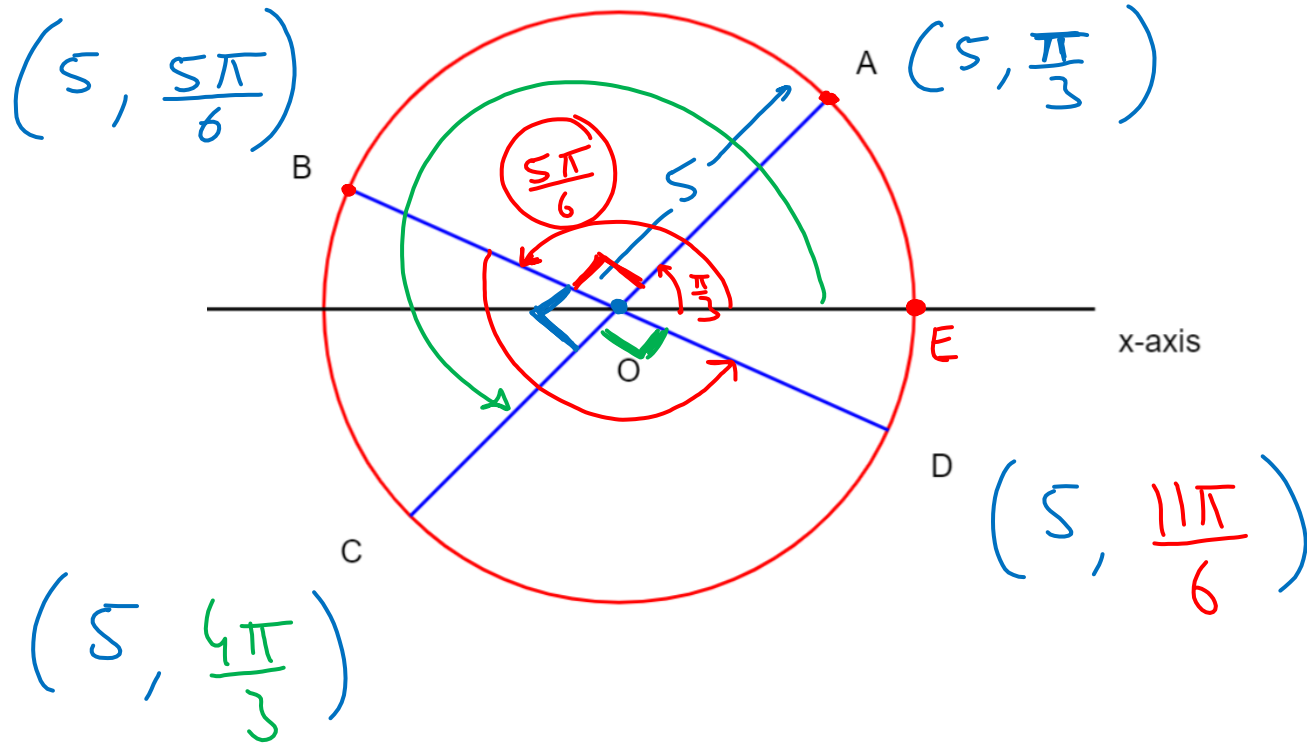


# Polar Coordinates of a point





AC and BD are chords of a circle intersecting at origin. If coordinate of A is  $(5, \pi/3)$  and  $\angle BOC = \pi/2$ . Then find coordinates of B, C and D in polar form.







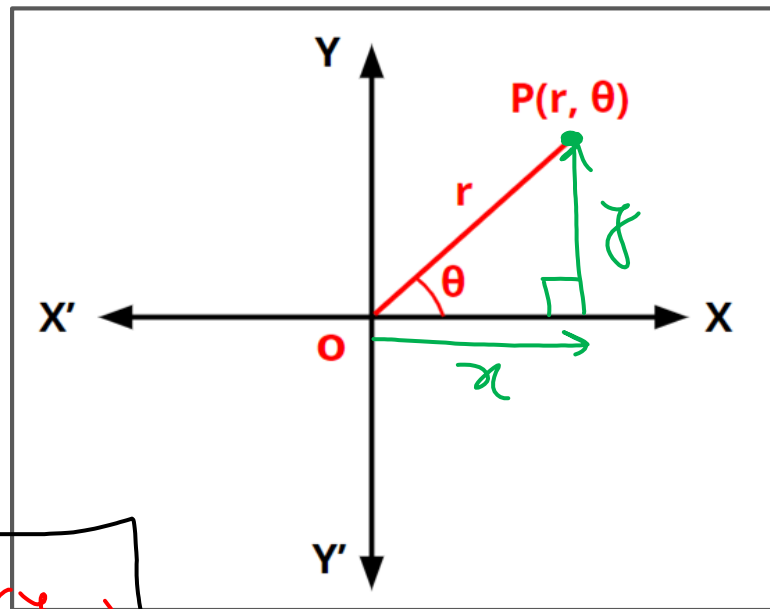


## Interconversion of Cartesian & Polar Coordinates

$$\begin{aligned}x &= r \cos \theta \\y &= r \sin \theta\end{aligned}$$

$$x^2 + y^2 = r^2 ; \tan \theta = \frac{y}{x}$$

$$r = \sqrt{x^2 + y^2} ; \theta = \tan^{-1}(y/x)$$





If a point  $P(\sqrt{3}, 1)$  is **rotated by  $45^\circ$**  about origin in anticlockwise direction and then reflected about x-axis. Then the coordinates of the new point are:

A.  $\left(\frac{\sqrt{3}-1}{\sqrt{2}}, \frac{-\sqrt{3}+1}{\sqrt{2}}\right)$

B.  $\left(\frac{\sqrt{3}-1}{\sqrt{2}}, \frac{-\sqrt{3}-1}{\sqrt{2}}\right)$

C.  $\left(\frac{-\sqrt{3}-1}{\sqrt{2}}, \frac{-\sqrt{3}-1}{\sqrt{2}}\right)$

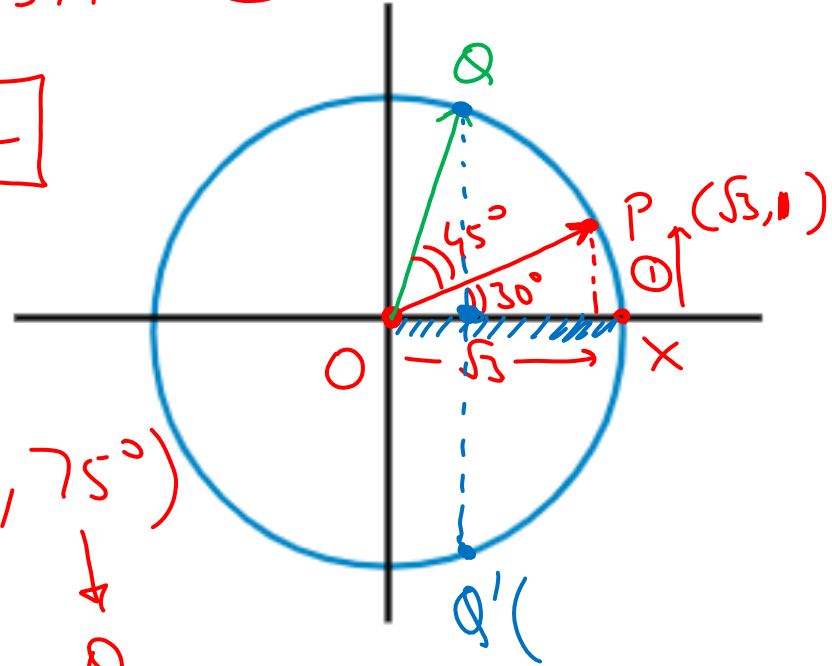
D. None

$$OP = \sqrt{3+1} = 2$$

$$OQ = 2$$

$$Q = (2, 75^\circ)$$

↓      ↓  
x      Q



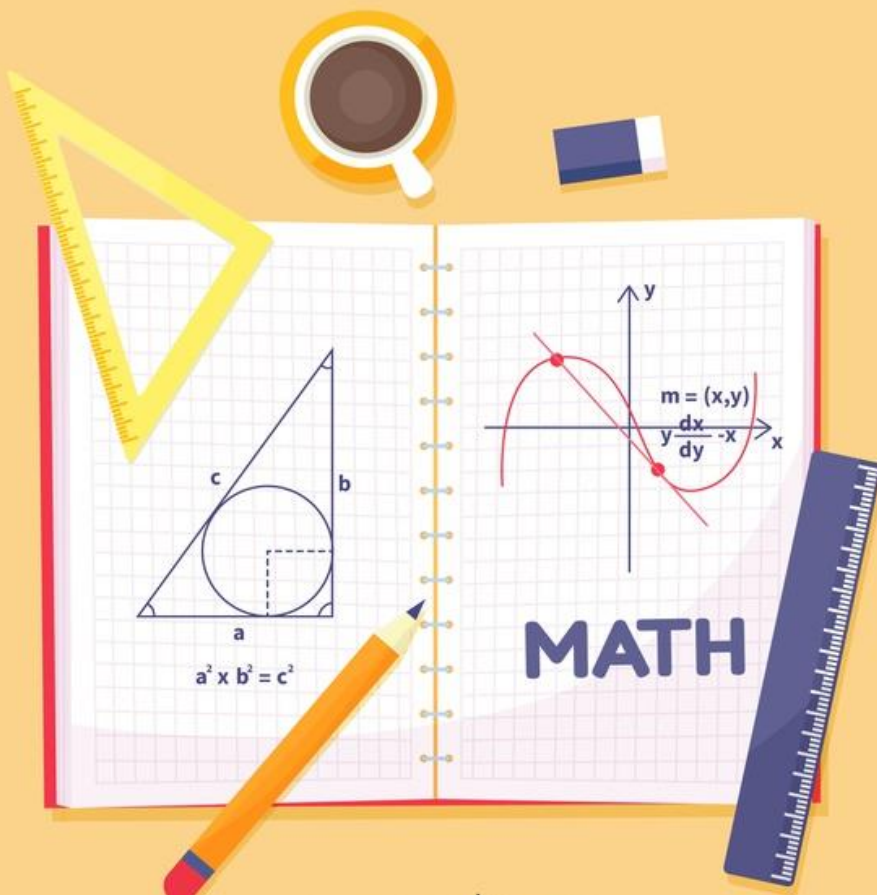
$$Q \equiv (2 \cos 75^\circ, 2 \sin 75^\circ)$$

$$\equiv \left( \cancel{2} \left( \frac{\sqrt{3}-1}{\cancel{2}\sqrt{2}} \right), \cancel{2} \left( \frac{\sqrt{3}+1}{\cancel{2}\sqrt{2}} \right) \right)$$

$$\equiv \left( \frac{\sqrt{3}-1}{\sqrt{2}}, \frac{\sqrt{3}+1}{\sqrt{2}} \right)$$

$$Q' \equiv \left( \frac{\sqrt{3}-1}{\sqrt{2}}, -\frac{\sqrt{3}-1}{\sqrt{2}} \right)$$





# Distance Formula



## Distance Formula

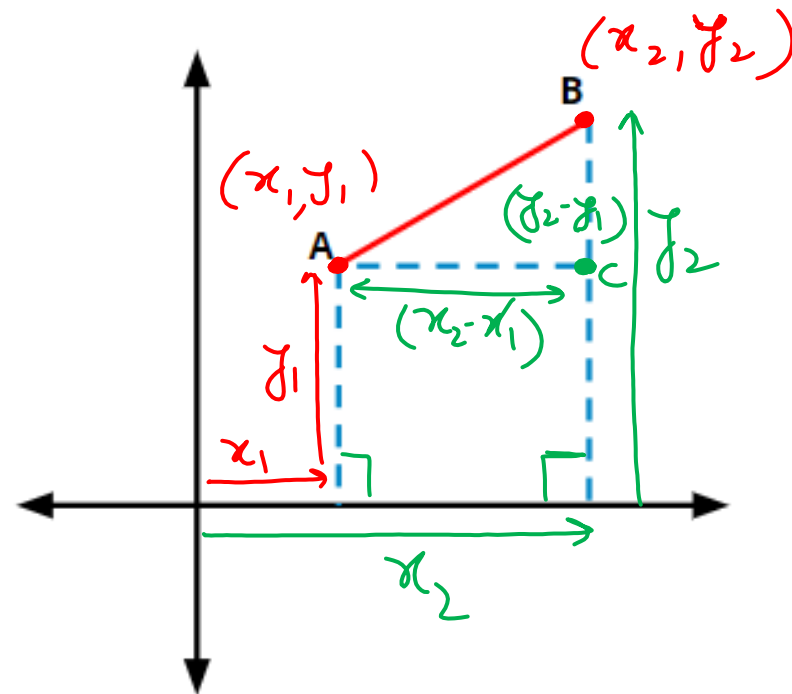
The distance between the points  $A(x_1, y_1)$  and  $B(x_2, y_2)$  is

$$\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

$$AC = (x_2 - x_1)$$

$$CB = (y_2 - y_1)$$

$$AB = \sqrt{(AC)^2 + (CB)^2}$$





$$AC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$



A triangle with vertices  $A(4, 0)$ ;  $B(-1, -1)$ ;  $C(3, 5)$  is

**A.** ✓ Isosceles and right angled

**B.** Right angled but not isosceles

**C.** Isosceles but not right angled

**D.** Neither right angled nor isosceles

$$\begin{array}{l} A = (4, 0) \\ B = (-1, -1) \\ C = (3, 5) \end{array} \left\{ \begin{array}{l} \rightarrow AB = \sqrt{25 + 1} = \sqrt{26} \\ \rightarrow BC = \sqrt{16 + 36} = \sqrt{52} \\ \rightarrow AC = \sqrt{1 + 25} = \sqrt{26} \end{array} \right.$$

$AB^2 + AC^2 = BC^2$   
 $\Rightarrow$  right angle  
Isosceles







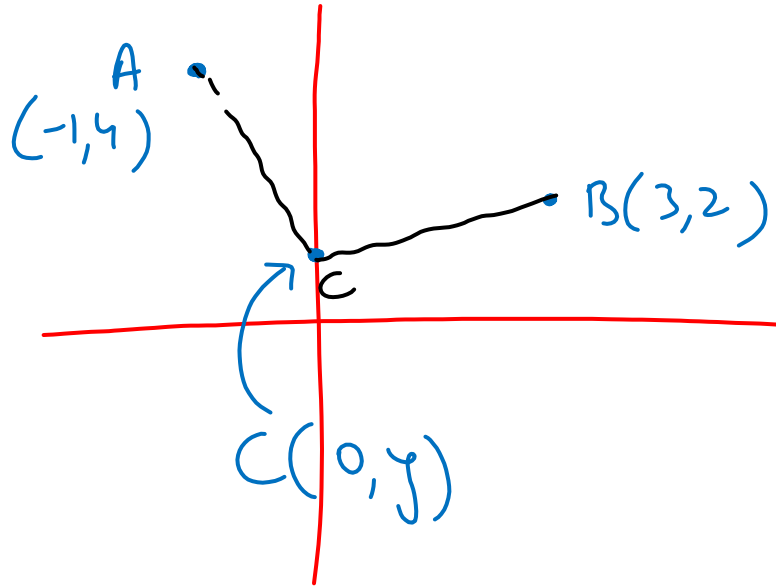
The points equidistant from A (-1, 4) and B (3, 2) lying on y-axis are:

☒ **A.** (0, 1)

**B.** (0, -1)

**C.** (0, 2)

**D.** (0, 3)



$$AC = BC$$

$$(AC)^2 = (BC)^2$$

$$1 + (4-y)^2 = 9 + (2-y)^2$$

$$\underbrace{1+16}_{17} - \cancel{8j+j^2} = \underbrace{9+4}_{13} - \cancel{4j+j^2}$$

$$17 - 13 = 4j$$

$$4 = 4j$$
$$\textcircled{j=1}$$



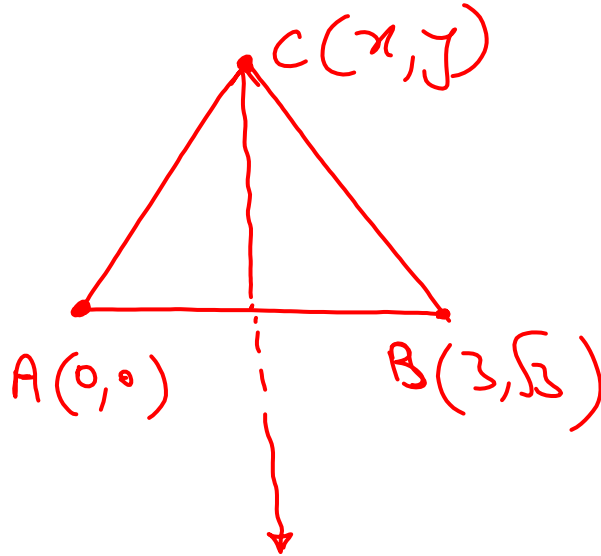
If ABC is an equilateral triangle with A(0, 0) and B(3,  $\sqrt{3}$ ). Then find the coordinates of point C.

A. (0, 1)

B. (0,  $2\sqrt{3}$ )

C. (3,  $-\sqrt{3}$ )

D. ( $\sqrt{3}$ , 3)



$$AB = \sqrt{9 + 3} = \sqrt{12}$$

$$AC = \sqrt{x^2 + y^2}$$

$$BC = \sqrt{(x-3)^2 + (y-\sqrt{3})^2}$$

$$\Rightarrow x^2 + y^2 = 12 \quad \text{--- (1)}$$

&

$$(x-3)^2 + (y-\sqrt{3})^2 = 12$$

$$\Rightarrow x^2 + y^2 - 6x - 2\sqrt{3}y = 0$$

--- (2)

using (1) & (2).

$$12 - 6x - 2\sqrt{3}y = 0$$

$$\Rightarrow 2\sqrt{3}y = 12 - 6x$$

$$\Rightarrow \sqrt{3}y = 6 - 3x$$

$$\Rightarrow \sqrt{3}y = 3(2-x)$$

$$\Rightarrow y = \sqrt{3}(2-x)$$

--- (3)

$$\Rightarrow x^2 + 3(2-x)^2 = 12$$

$$\Rightarrow x^2 + 3(4 - 4x + x^2) = 12$$

$$\Rightarrow 4x^2 - 12x = 0$$

$$\Rightarrow 4x(x-3) = 0$$

$$\boxed{x=0}, \boxed{x=3}$$

using eq (3):

$$y = \sqrt{3}(2-x)$$

$$x=0$$

$$y = 2\sqrt{3}$$

$$x=3$$

$$y = -\sqrt{3}$$



If  $A(a, b)$ ,  $B(a + r \cos \alpha, b + r \sin \alpha)$  and  $C(a + r \cos \beta, b + r \sin \beta)$  are the vertices of an equilateral triangle, then

A.  $|\alpha - \beta| = \pi/4$

B.  $|\alpha - \beta| = \pi/2$

C.  $|\alpha - \beta| = \pi/6$

✓ D.  $|\alpha - \beta| = \pi/3$

Handwritten solution:

$A \equiv (a, b)$   
 $B = (a + r \cos \alpha, b + r \sin \alpha)$   
 $C = (a + r \cos \beta, b + r \sin \beta)$

Distance calculations:

$$AB = \sqrt{r^2 \cos^2 \alpha + r^2 \sin^2 \alpha} = r$$
$$BC = \sqrt{r^2 (\cos \alpha - \cos \beta)^2 + r^2 (\sin \alpha - \sin \beta)^2}$$

Distance AC is boxed:

$$AC = r$$

Now:

$$AB = BC$$

$$(AB)^2 = (BC)^2$$

$$1 \cancel{x}^2 = \cancel{x}^2 (\cos \alpha - \cos \beta)^2 + \cancel{x}^2 (\sin \alpha - \sin \beta)^2$$

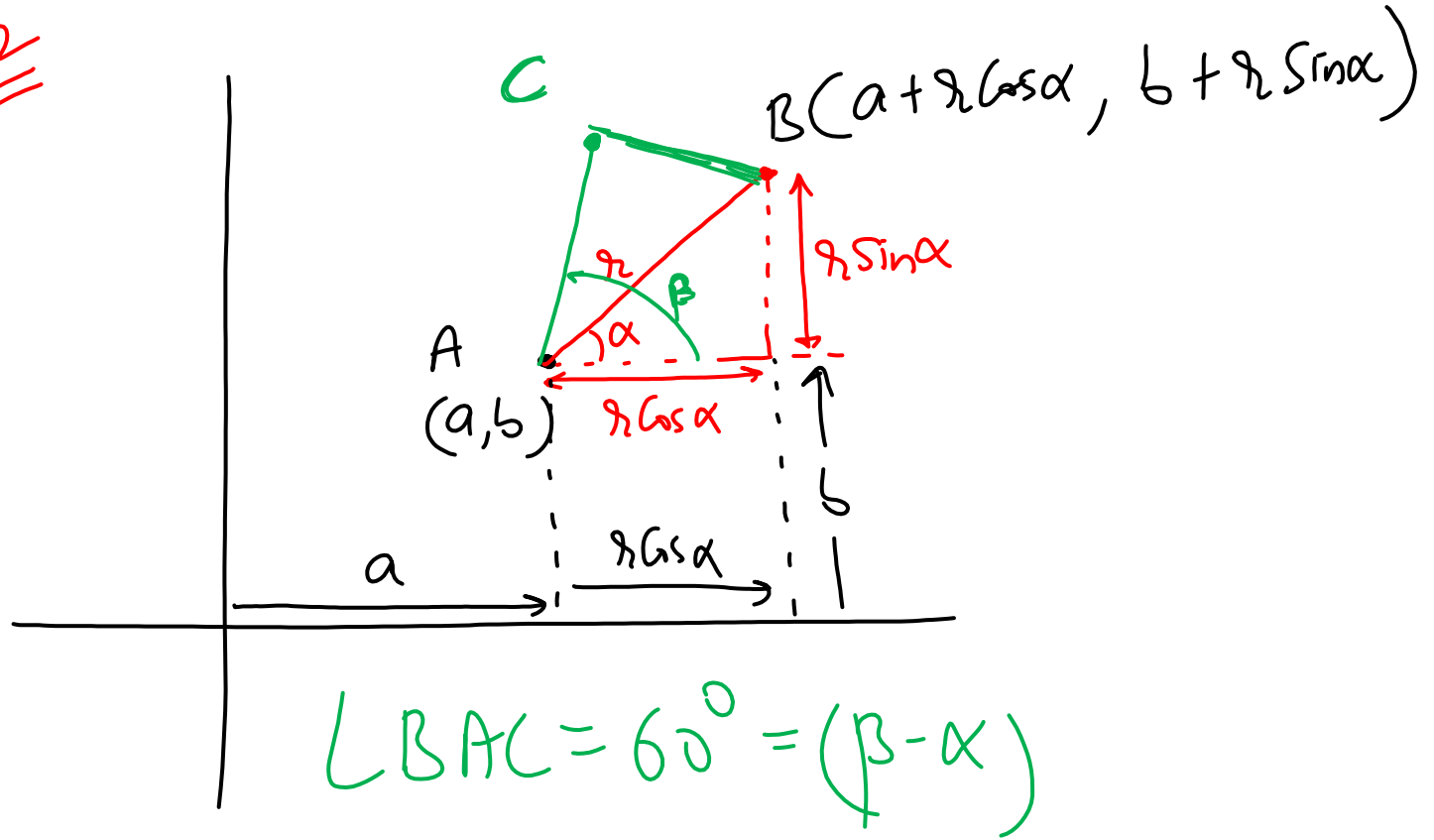
$$\Rightarrow \begin{aligned} & \cos^2 \alpha + \cos^2 \beta - 2 \cos \alpha \cos \beta \\ & + \sin^2 \alpha + \sin^2 \beta - 2 \sin \alpha \sin \beta \\ & = 1 \end{aligned}$$

$$\Rightarrow 2 - 2(\cos \alpha \cos \beta + \sin \alpha \sin \beta) = 1$$

$$\Rightarrow 2 - 2 \cos(\alpha - \beta) = 1$$

$$\Rightarrow \boxed{\cos(\alpha - \beta) = \frac{1}{2}}$$



M-2



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11<sup>th</sup>



Namo Sir | Physics

6:00 - 7:30 PM



Ashwani Sir | Chemistry

7:30 - 9:00 PM



Sameer Sir | Maths

9:00 - 10:30 PM

12<sup>th</sup>



Jayant Sir | Physics

1:30 - 3:00 PM



Anupam Sir | Chemistry

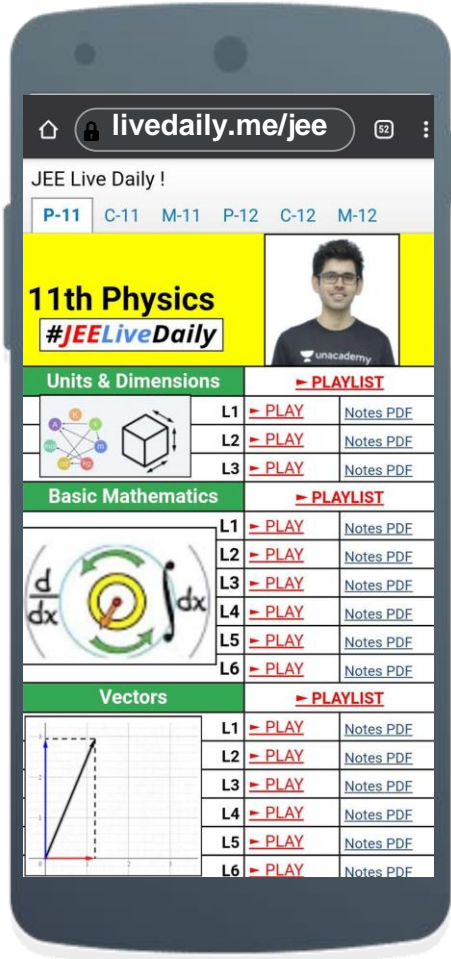
3:00 - 4:30 PM



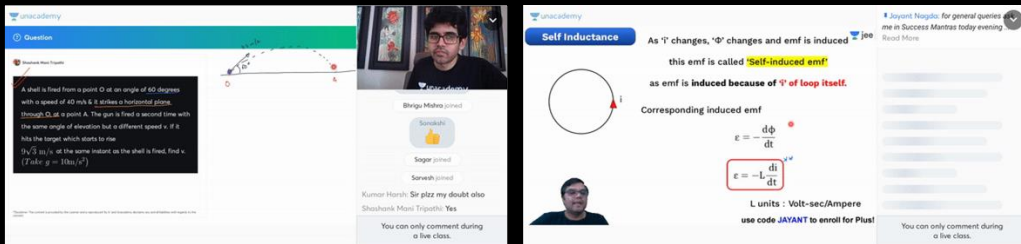
Nishant Sir | Maths

4:30 - 6:00 PM

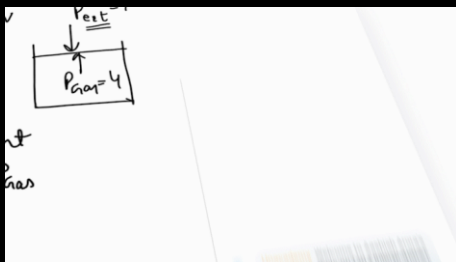
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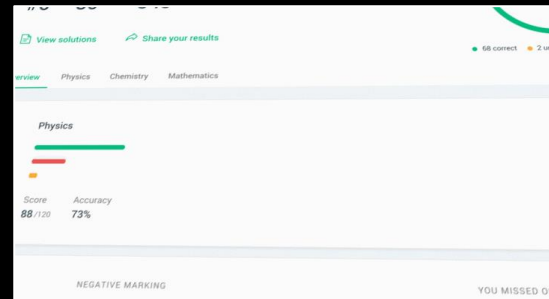
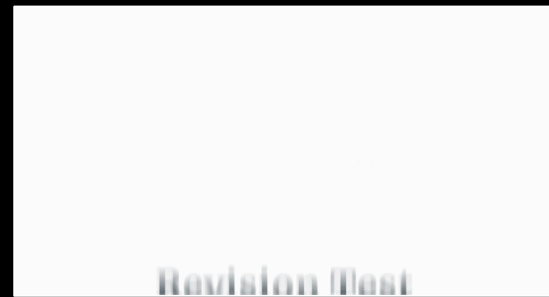


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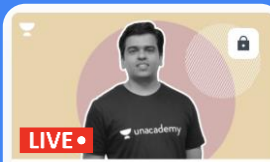


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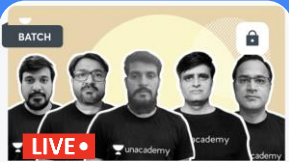
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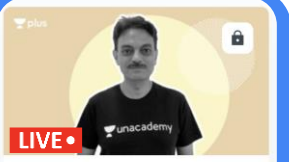
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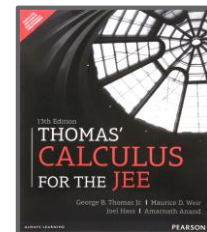
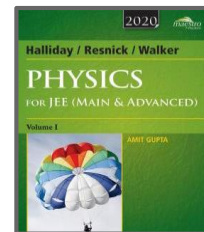
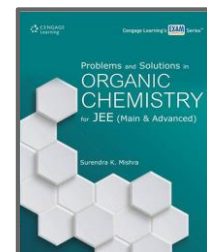
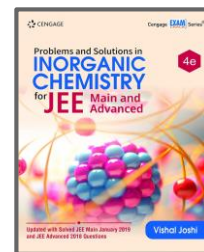
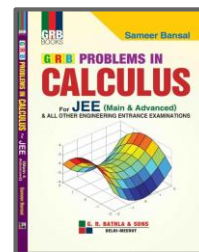
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Aravindan K  
Sundaram  
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Manas Pandey  
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Kalankar  
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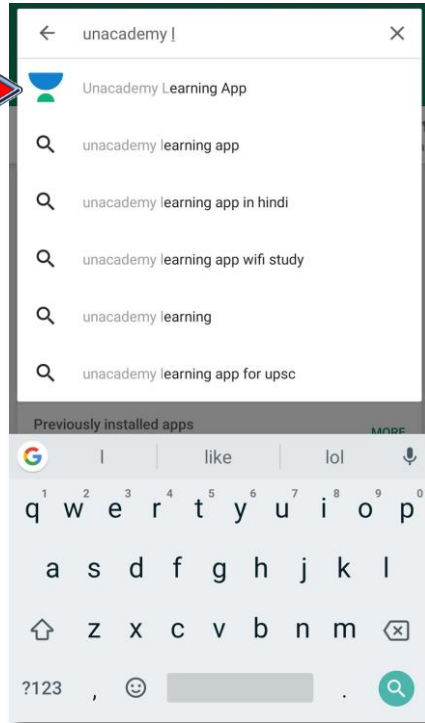


Naman Goyal  
98.48

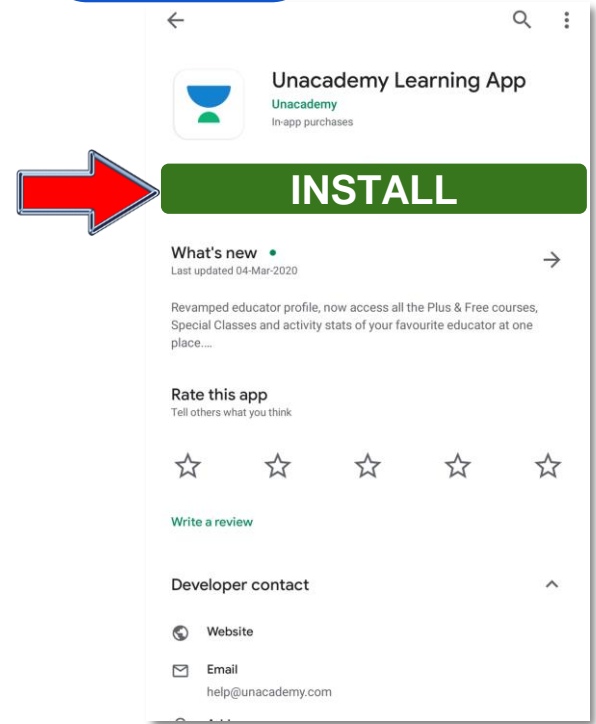


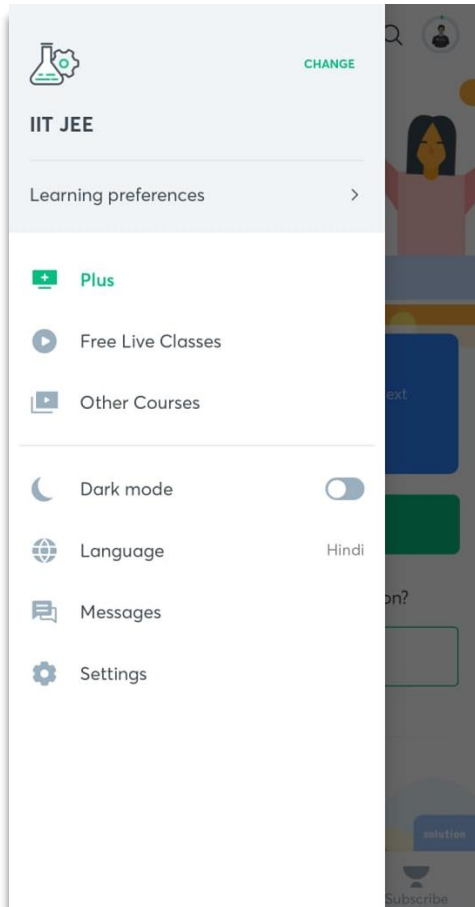
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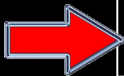
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