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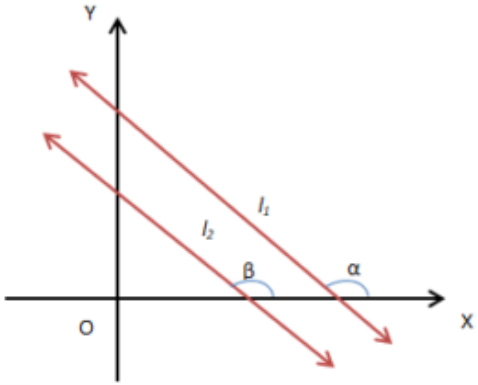
Centroid, incenter and excenter

Straight Lines 3



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B.Tech, M.Tech - IIT-Roorkee

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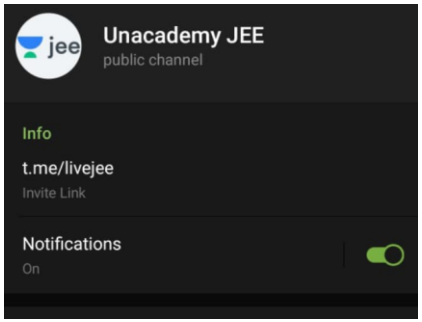

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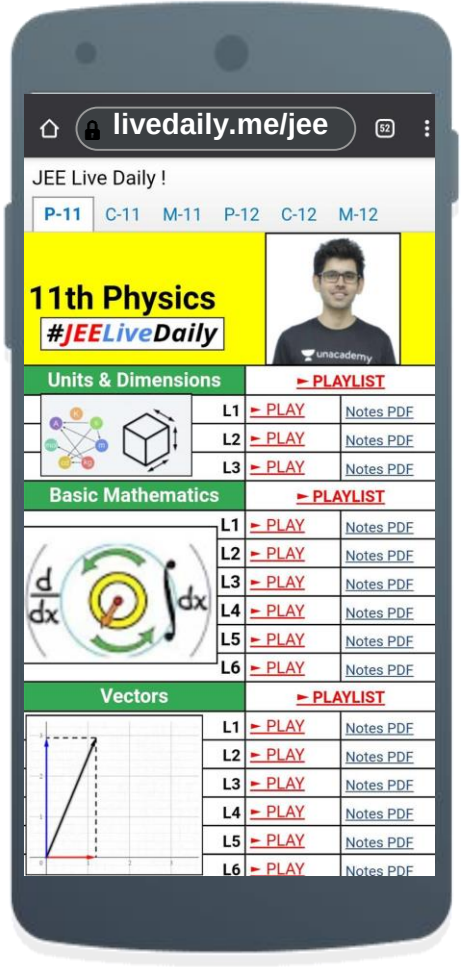

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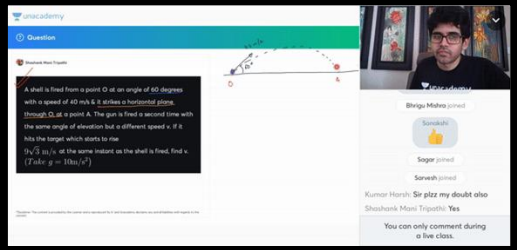

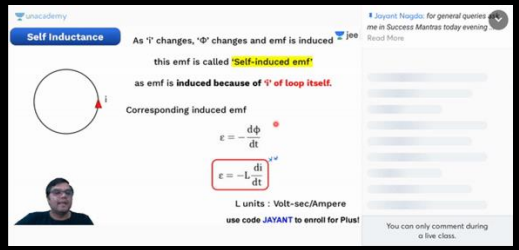

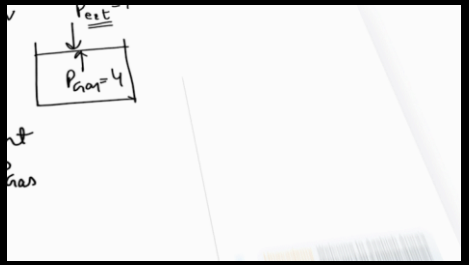

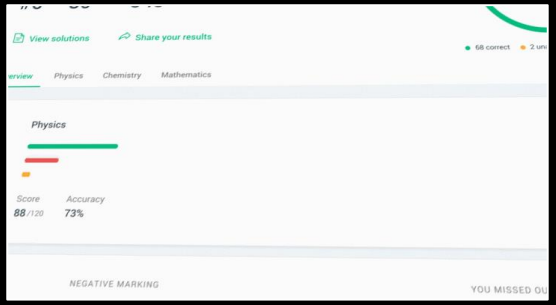

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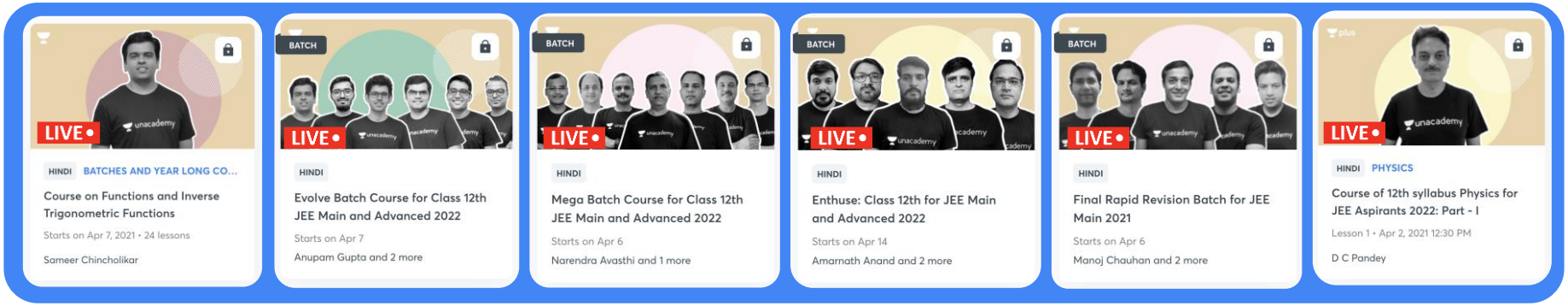

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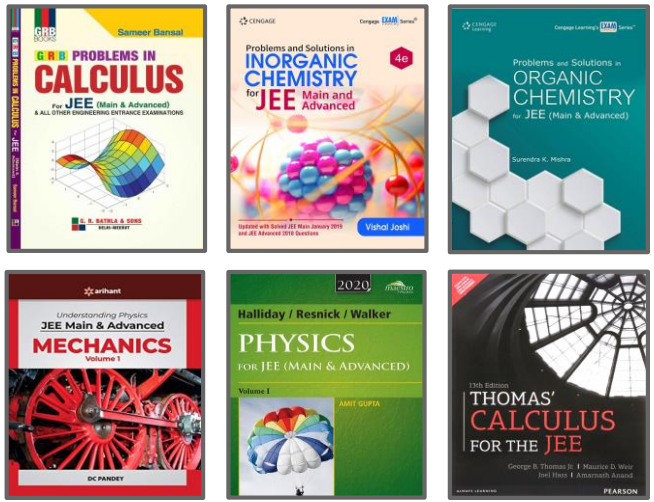

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Top Results

Bratin Mondal

100 %ile

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

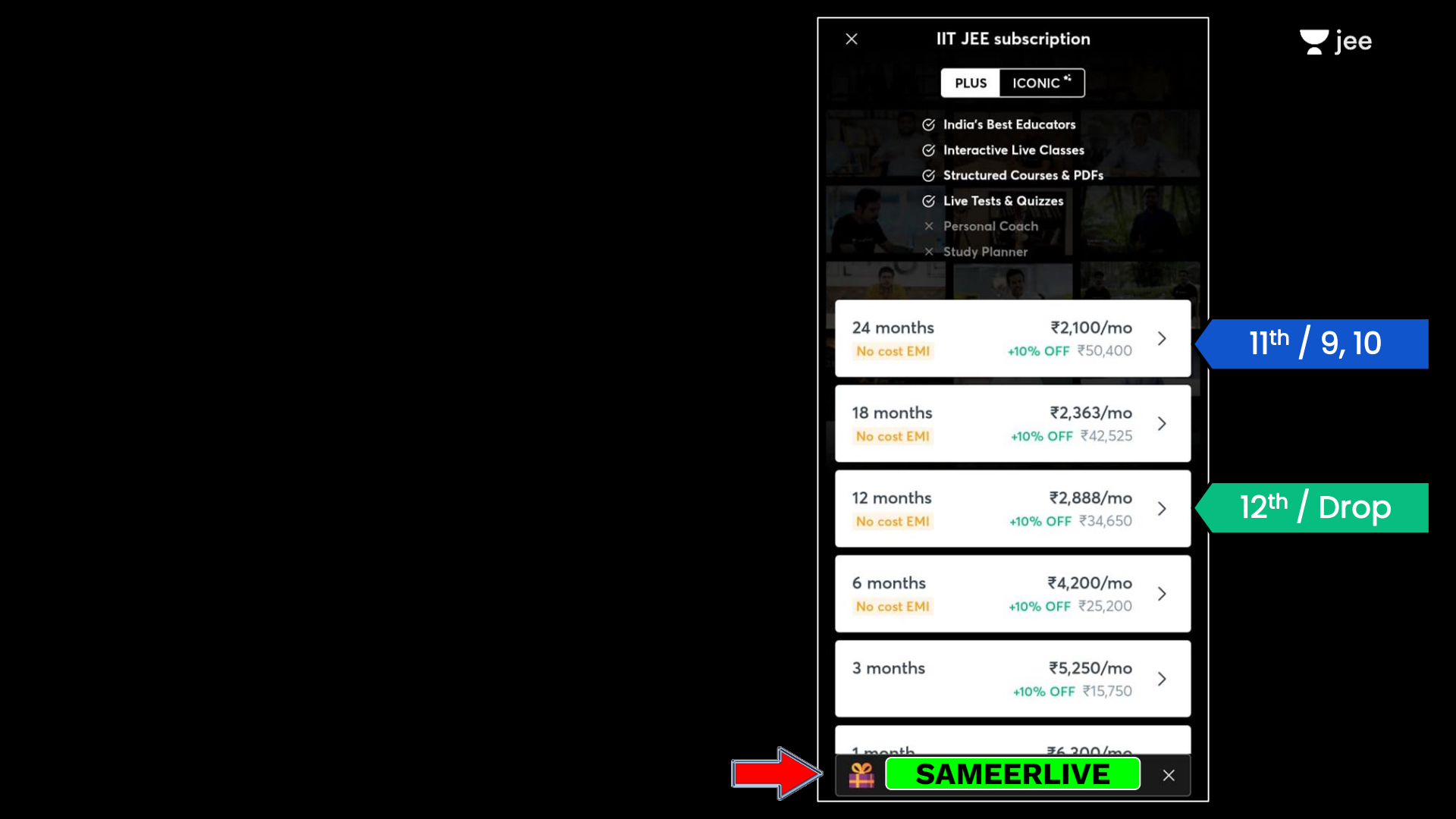
Ayush Kale
98.85

Ayush Gupta
98.67

Megh Gupta
98.59

Naman Goyal
98.48

MIHIR PRAJAPATI
98.16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+10% OFF ₹34,650
6 months
No cost EMI
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+10% OFF ₹25,200
3 months
₹5,250/mo
+10% OFF ₹15,750
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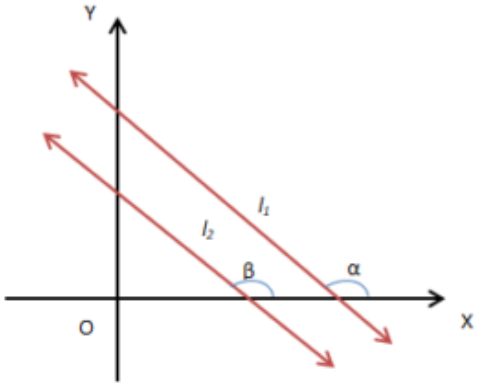
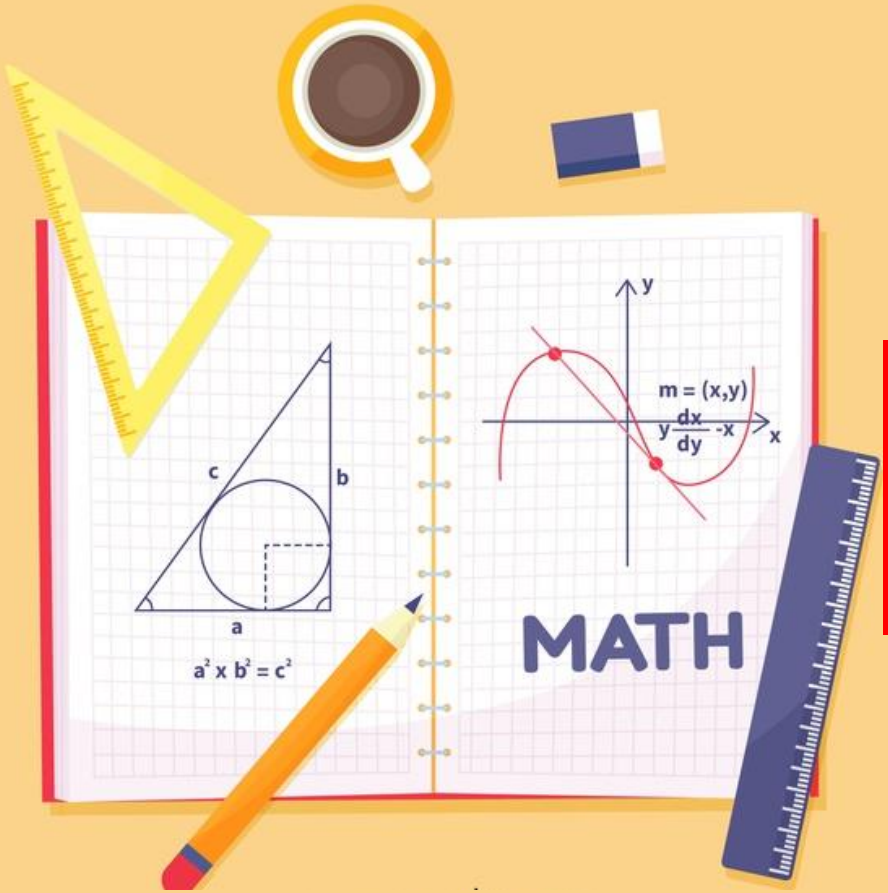
Centroid, incenter and excenter

Straight Lines 3

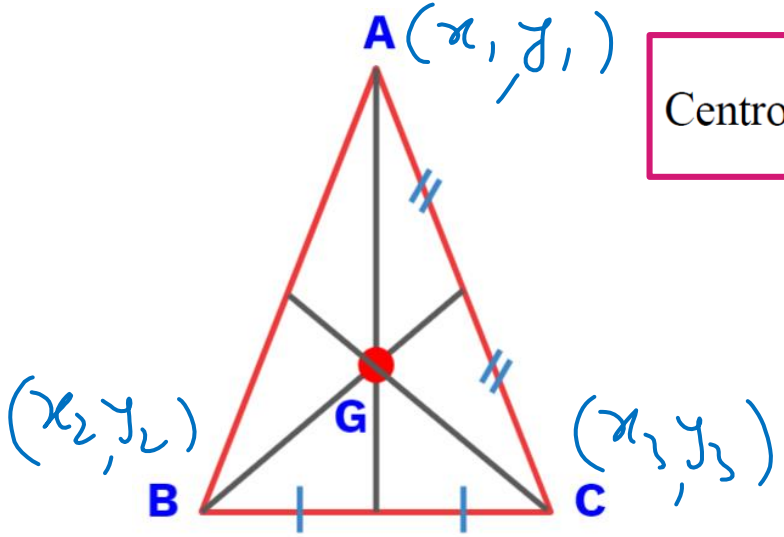




Important Points of a Triangle

1. Centroid

The centroid of a triangle is the point of intersection of its medians.

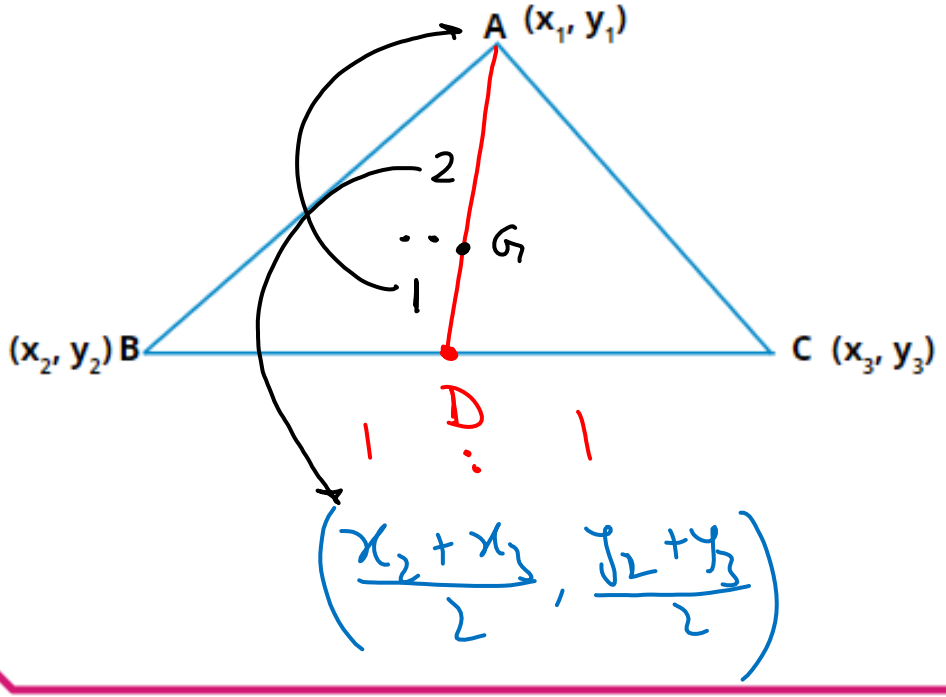


$$\text{Centroid } G \equiv \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$$

1. Centroid

1. Median through A **bisects** the side BC.

2. Centroid Divides the median in the ratio **2:1**



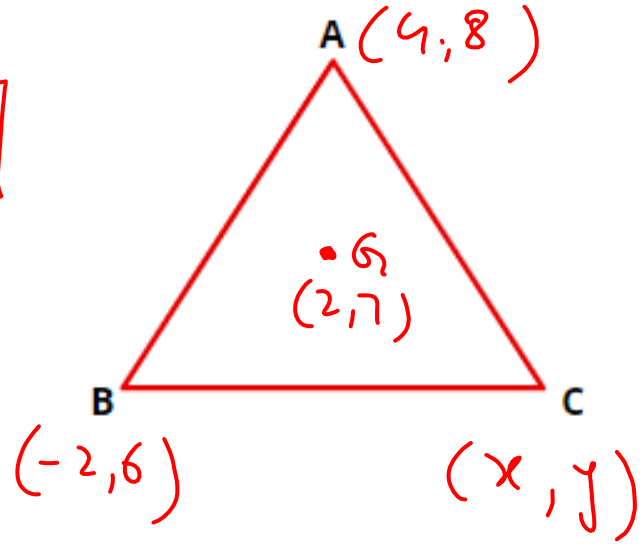
$$\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$$

The centroid of a triangle is (2,7) and two of its vertices are (4, 8) and (–2, 6) the third vertex is

A. (0, 0) **B.** (4, 7) **C.** (7, 4) **D.** (7, 7)

$$2 = \frac{4-2+x}{3} \Rightarrow \boxed{x=4}$$

$$7 = \frac{8+6+y}{3} \Rightarrow \boxed{y=7}$$



The vertices of a triangle are (ab, 1/ab), (bc, 1/bc) and (ca, 1/ca) where a, b, c Are the roots of the equation $x^3 - 3x^2 + 6x + 1 = 0$. The coordinates of its centroid are.

A. (1, 2) **B.** (2, -1) **C.** (1, -1) **D.** (2, 3)

$a + b + c = 3$

$ab + bc + ca = 6$

$abc = -1$

$G \equiv$

$x = \frac{ab + bc + ca}{3} = \frac{6}{3} = 2$

$y = \frac{\left(\frac{1}{ab} + \frac{1}{bc} + \frac{1}{ca}\right)}{3}$

$$y = \frac{a+b+c}{3abc}$$

$$y = \frac{3}{3(-1)}$$

$$\boxed{y = -1}$$

Let A(1, 0), B(6, 2) and C(3/2, 6) be the vertices of a triangle ABC. If P is a point inside the triangle ABC such that the triangles APC, APB and BPC have equal areas, then the length of the line segment PQ, where Q is the point (-7/6, -1/3), is_____

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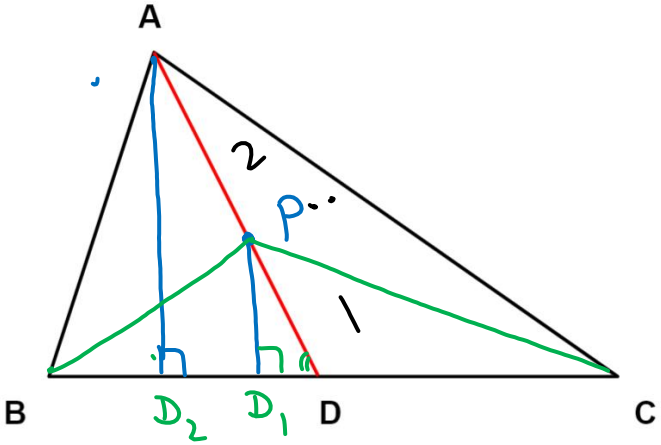


$\triangle ADD_2 \sim \triangle PDD_1$

$\Rightarrow \frac{AD_2}{PD_1} = \frac{AD}{PD}$

$ar(\triangle APC) = \frac{1}{2}(BC)(AD_2)$

$ar(\triangle PBC) = \frac{1}{2}(BC)\left(\frac{AD_2}{3}\right) = \frac{\Delta}{3}$

$= \frac{AD}{\left(\frac{AD}{3}\right)} = \frac{3}{1}$

$\Rightarrow PD_1 = \frac{AD_2}{3}$

$A \equiv (1, 0)$

$B \equiv (6, 2)$

$C \equiv \left(\frac{3}{2}, 6\right)$

$P \equiv$ Centroid

$\equiv \left(\frac{17/2}{3}, \frac{8}{3}\right)$

$\boxed{P \equiv \left(\frac{17}{6}, \frac{8}{3}\right)}$

$Q \equiv \left(-\frac{7}{6}, -\frac{1}{3}\right)$

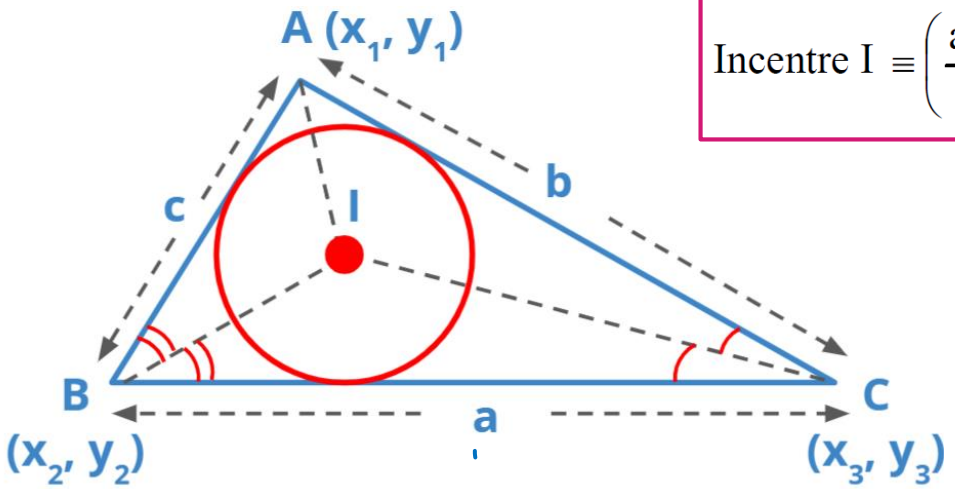
$$PQ = \sqrt{\left(\frac{17}{6} + \frac{7}{6}\right)^2 + \left(\frac{8}{3} + \frac{1}{3}\right)^2}$$

$$= \sqrt{16 + 9}$$

$$= \boxed{5}$$

2. Incentre

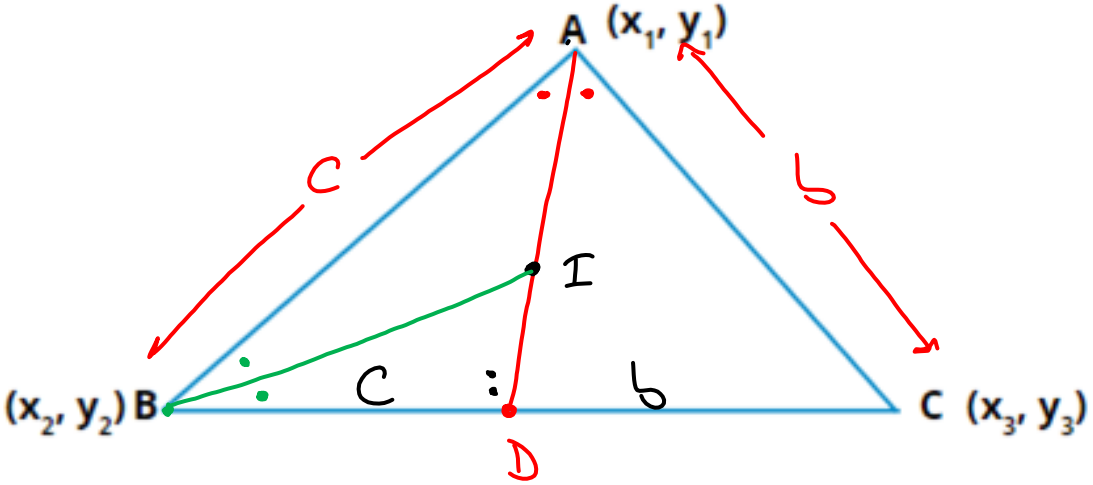
The incentre of a triangle is the point of intersection of internal bisector of the angles.



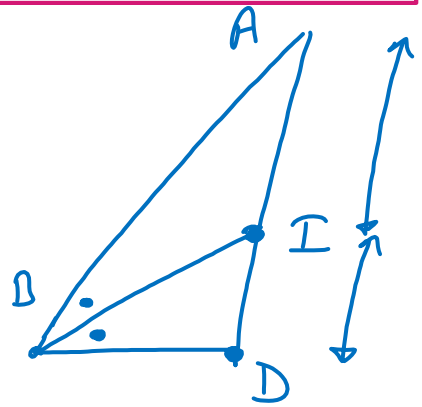
$$\text{Incentre } I \equiv \left(\frac{ax_1 + bx_2 + cx_3}{a+b+c}, \frac{ay_1 + by_2 + cy_3}{a+b+c} \right)$$

2. Incentre

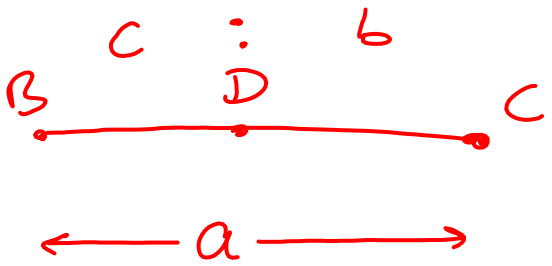
Angle Bisector Theorem:
Angle Bisector divides the opposite side in the ratio of the length of containing sides.



$$\left(\frac{bx_2+cx_3}{b+c}, \frac{by_2+cy_3}{b+c}\right)$$

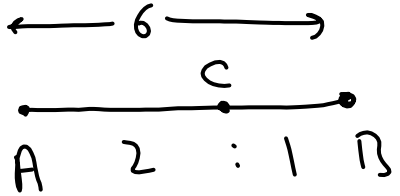


$$\frac{DI}{IA} = \frac{BD}{AB}$$



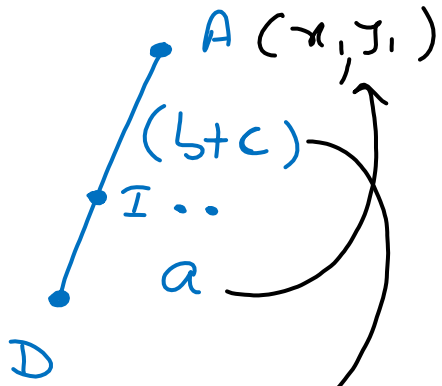
$$BD = \frac{a}{b+c} \times c$$

Eg:



$$AC = \frac{6}{3} \times 2 = 4$$

$$\frac{DI}{IA} = \frac{\frac{a\alpha}{b+c}}{\alpha} = \frac{a}{b+c}$$

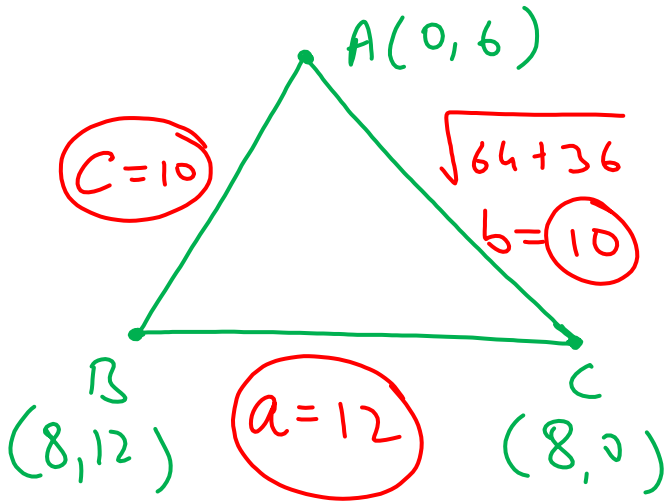


$$\left(\frac{bx_2+cx_3}{b+c}, \frac{by_2+cy_3}{b+c}\right)$$

$$\frac{ax_1+bx_2+cx_3}{a+b+c}$$

Find the coordinates of incentre of the triangle whose vertices are (0, 6), (8, 12) and (8, 0)

A. (5, 2) **B.** (5, 6) **C.** (7, 4) **D.** (6, 7)



$$x = \frac{12(0) + 10(8) + 8(10)}{32}$$

$$= \frac{10 \times 8 \times 2}{32} = 5$$

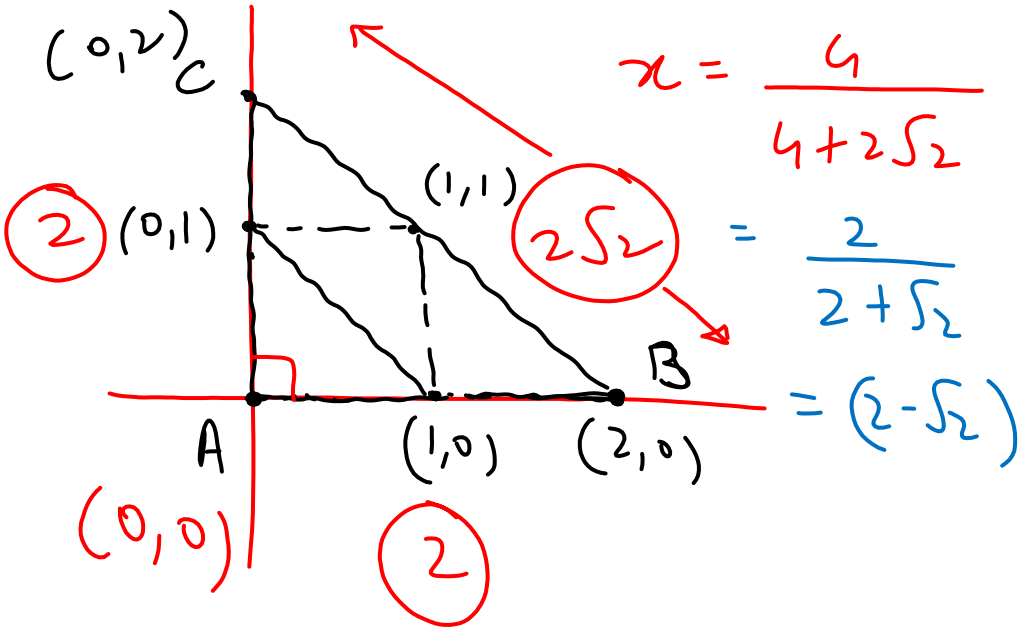
$$y = \frac{12 \times 6 + 10 \times 12 + 10 \times 0}{32}$$

$$= 6$$

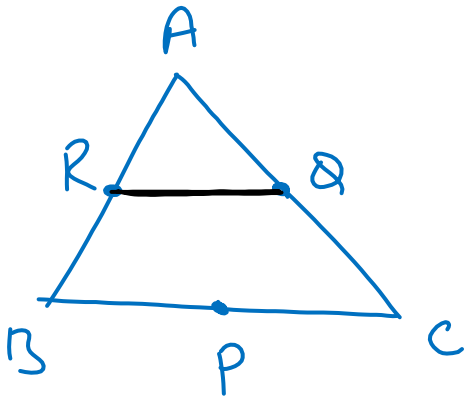
The x-coordinate of the incentre of the triangle that has the coordinates of mid points of its sides as (0, 1) (1, 1) and (1, 0) is:

A. 2 + √2 **B.** 2 - √2 **C.** 1 - √2 **D.** 1 + √2

2013 M

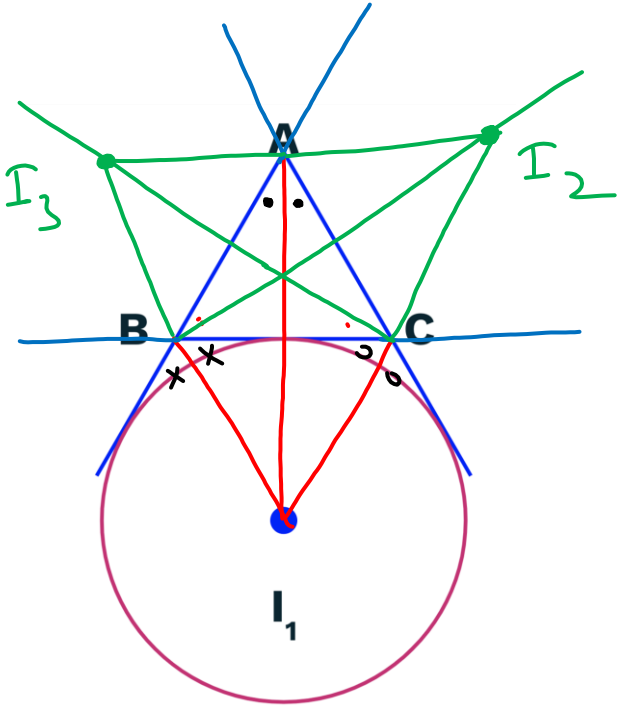


$$x = \frac{4}{4+2\sqrt{2}} = \frac{2}{2+\sqrt{2}} = (2-\sqrt{2})$$



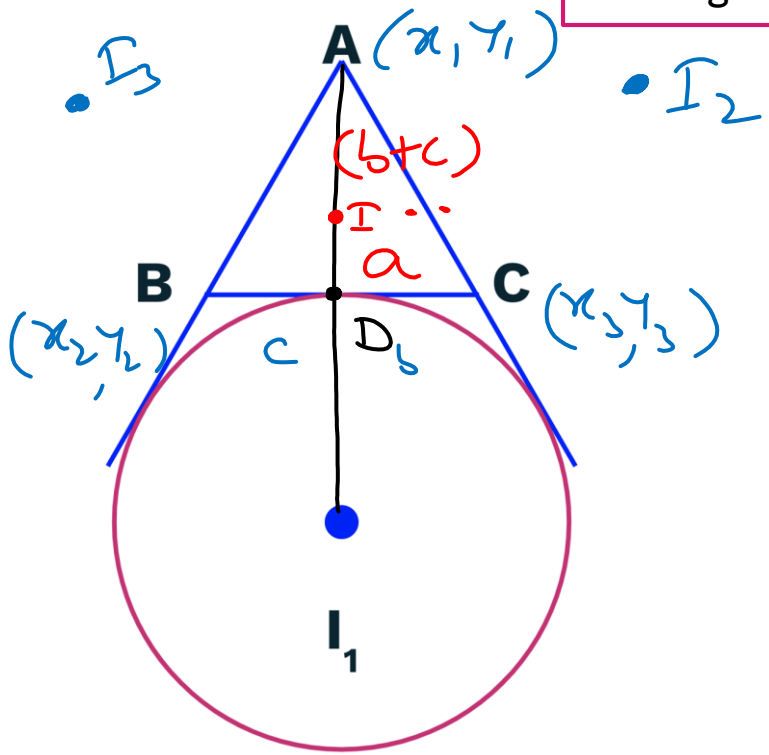
3. Excentre

Excenter is the point of concurrency of two external angle bisectors and one internal angle bisector.



3. Excentre

Incenter and Excenter are **Harmonic Conjugates** of each other with respect to the angle bisector.



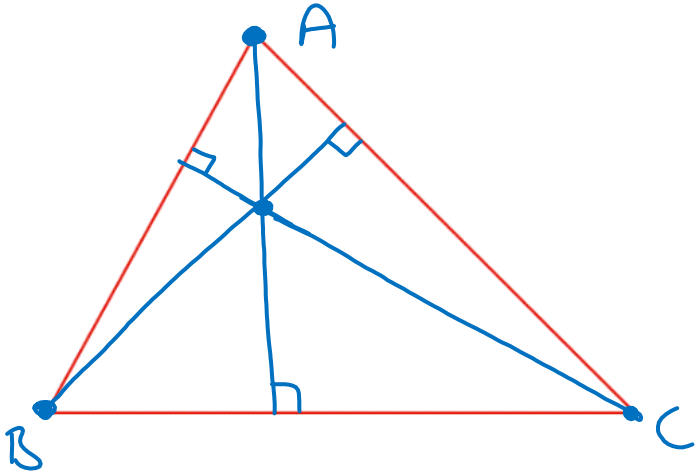
$$I_1 = \left(\frac{-ax_1 + bx_2 + cx_3}{-a+b+c}, \frac{-ay_1 + by_2 + cy_3}{-a+b+c} \right)$$

$$I_2 = \left(\frac{ax_1 - bx_2 + cx_3}{a-b+c}, \frac{ay_1 - by_2 + cy_3}{a-b+c} \right)$$

$$I_3 = \left(\frac{ax_1 + bx_2 - cx_3}{a+b-c}, \frac{ay_1 + by_2 - cy_3}{a+b-c} \right)$$

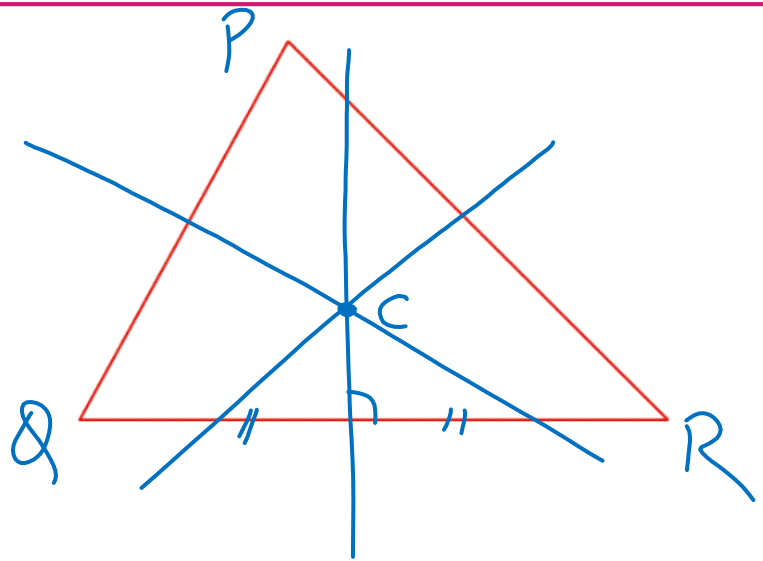
4. Orthocenter

It is the point of intersection of Altitudes of a Triangle



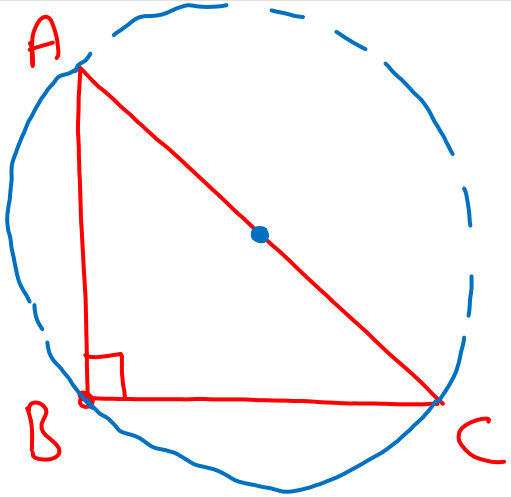
5. Circumcenter

It is the point of intersection of Perpendicular Bisectors of a Triangle



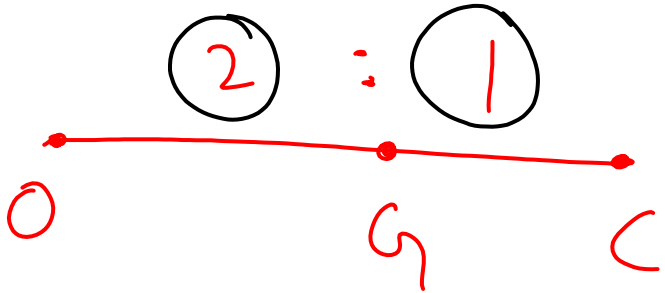
Important Results

In right angled triangle orthocenter is at the vertex with 90° and circumcenter is mid point of hypotenuse.



Important Results

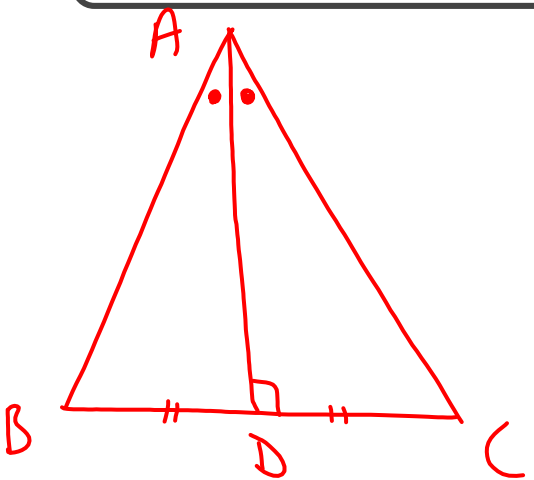
Orthocentre, Centroid & Circumcentre are always collinear & centroid divides the line joining orthocentre & circumcentre in the ratio 2:1.

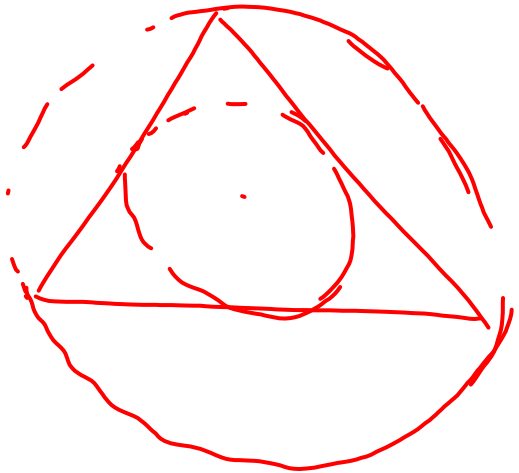


$\overline{ONGC}$

Important Results

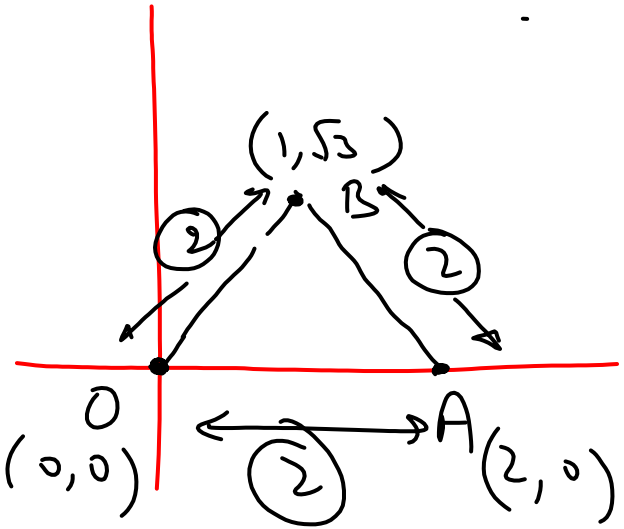
In an isosceles triangle G, O, I & C lie on the same line and in an equilateral triangle, all these four points coincide.





The incentre of the triangle with vertices (1, √3), (0,0) and (2, 0) is

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



Equilateral Δ

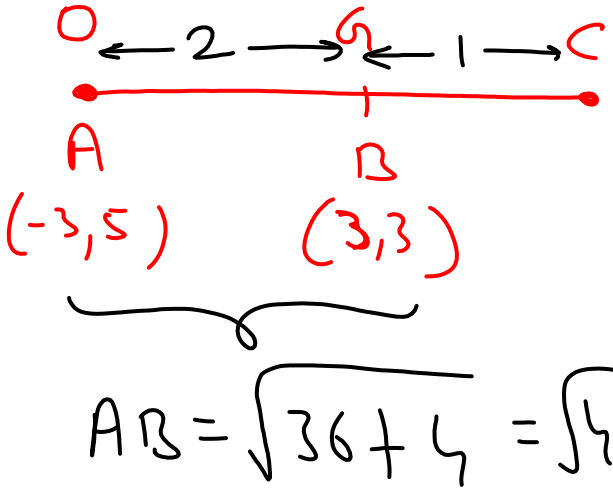
$I \equiv G \equiv \left(1, \frac{\sqrt{3}}{3}\right)$

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

Let the orthocentre and centroid of a triangle be A(-3, 5) and B(3, 3) respectively. If C is the circumcentre of this triangle, then the radius of the circle having line segment AC as diameter, is :

A. $2\sqrt{10}$ B. $3\sqrt{\frac{5}{2}}$ C. $\frac{3\sqrt{5}}{2}$ D. $\sqrt{10}$

2018 M



$AB = \sqrt{36+4} = \sqrt{40}$

$\frac{2}{3}AC = AB$

$AC = \frac{3}{2}\sqrt{40}$

$$\therefore \text{radius} = \frac{AC}{2}$$

$$= \frac{3}{4}\sqrt{40}$$

$$= 3\sqrt{\frac{40}{16}}$$

$$= 3\sqrt{\frac{5}{2}}$$

O(0, 0) is one of the vertices of triangle whose circumcentre is S(3, 4) and centroid G(6, 8). Then, the triangle

A. Is right angled

B. Must be equilateral

C. Must be right-angled isosceles

D. Is isosceles

HW-1

If in a triangle ABC, A (1, 10), Circumcentre (-1/3, 2/3) and Orthocentre (11/3, 4/3) are given. Then find the coordinate of midpoint of side opposite to A.

A. (1, 6)

B. (1, 5)

C. (1, -3)

D. (1, -11/3)

HW-2

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jee

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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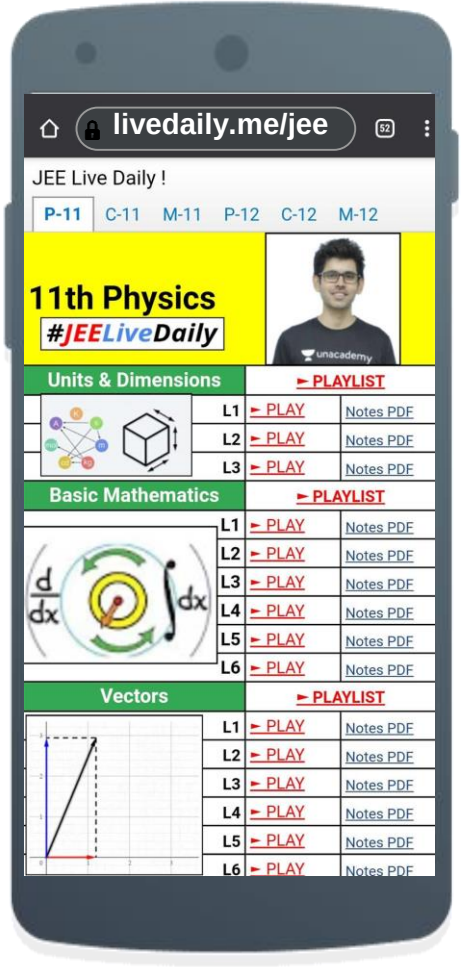

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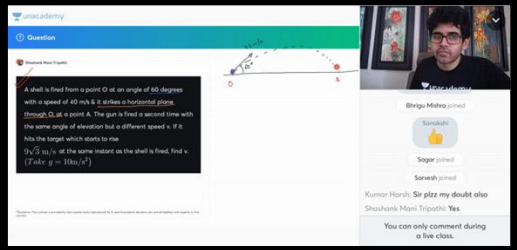

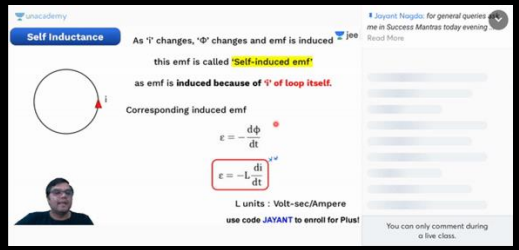

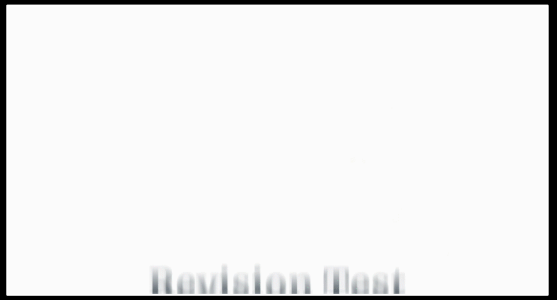

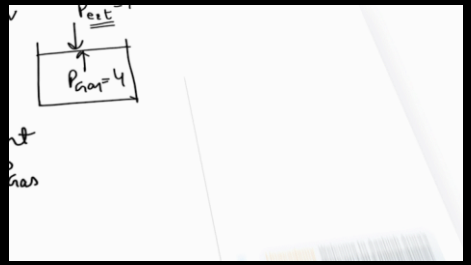

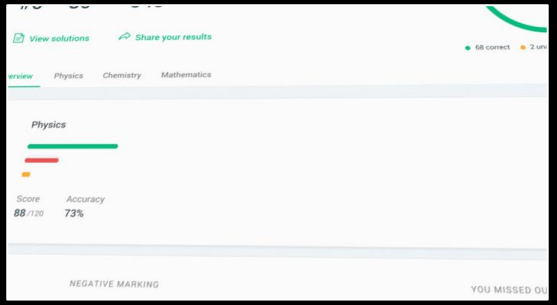

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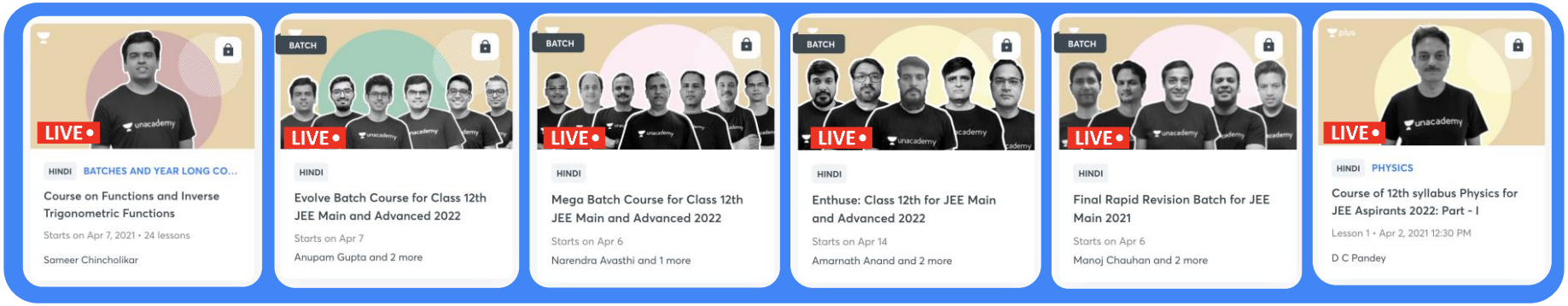

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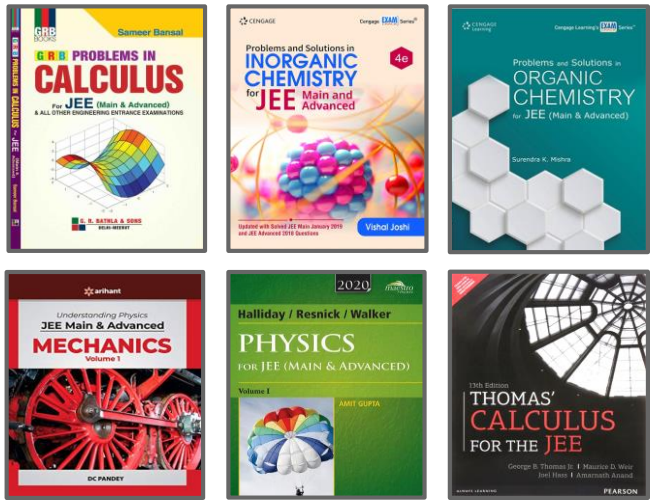

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Mihir Kothari
99.39

Sahil
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Vaibhav Dhanuka
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Shrish
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Ayush Kale
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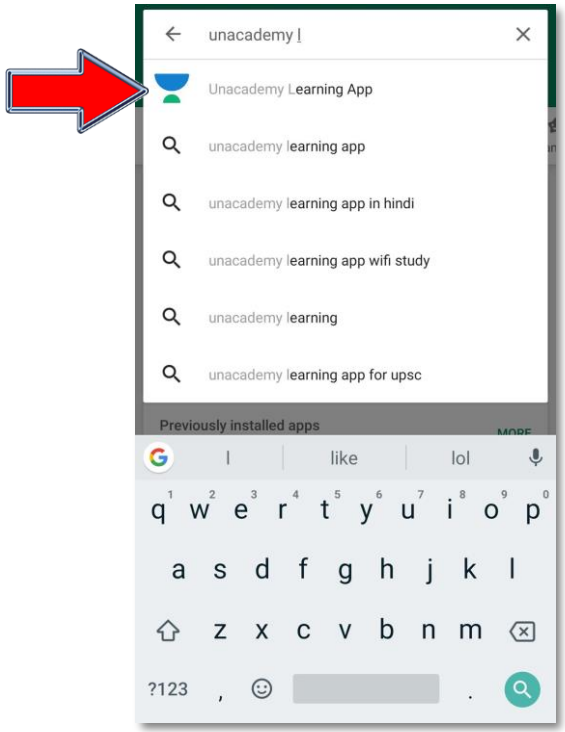
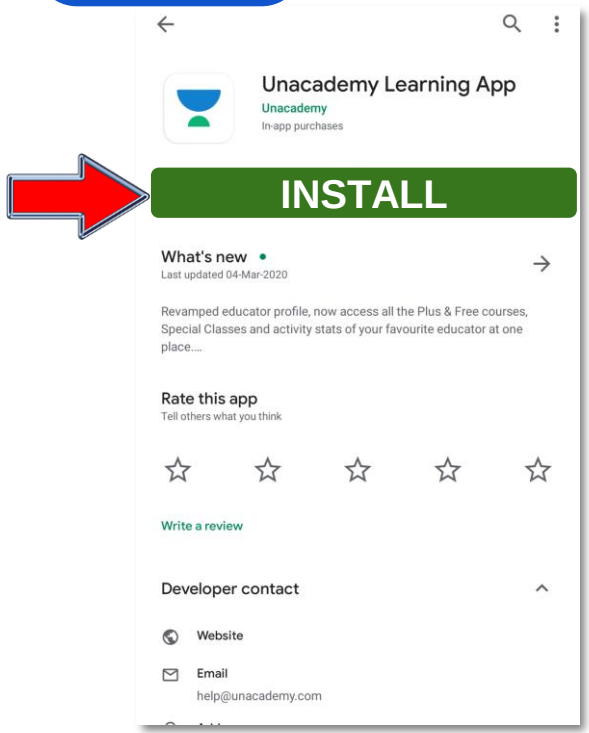
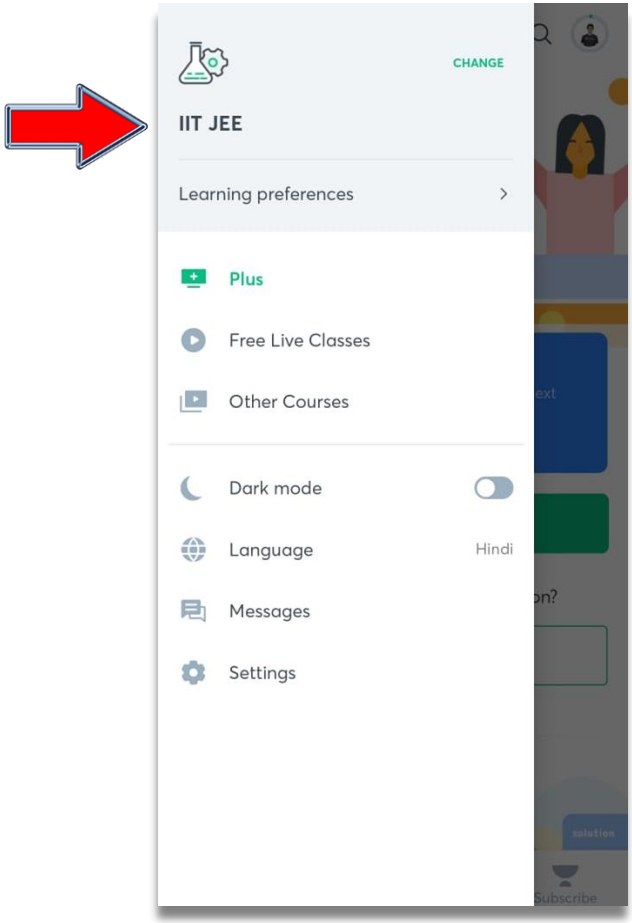


Step 2

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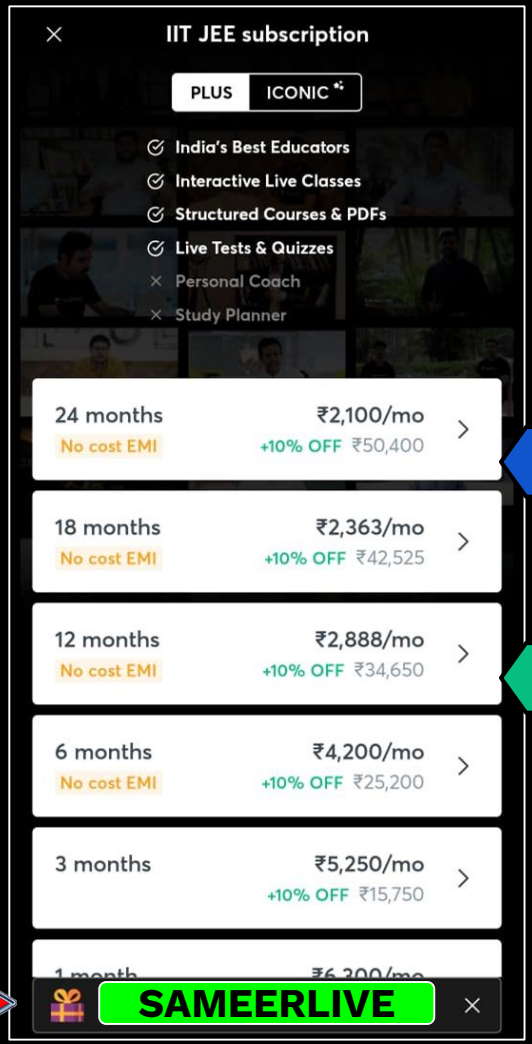

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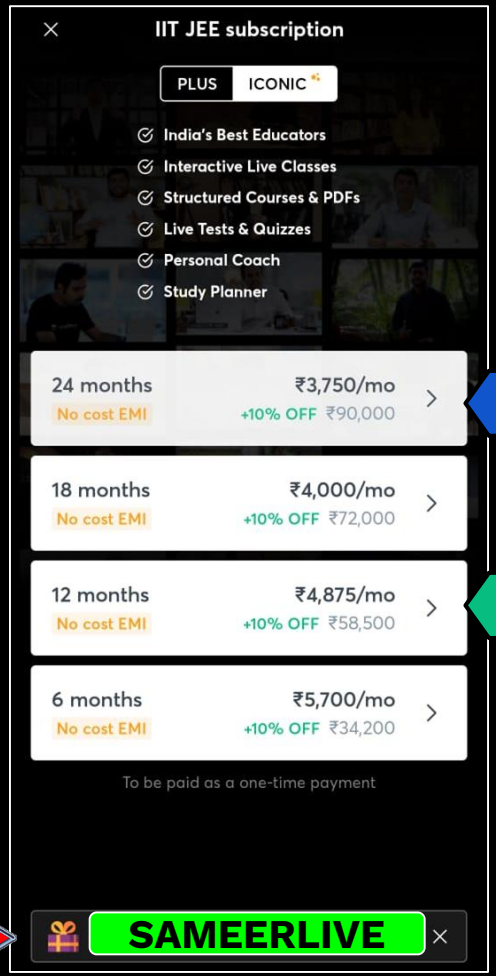

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