Nishant Jindal

$$\Delta^2 = \begin{vmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{vmatrix} \begin{vmatrix} ax_1 & ax_2 & ax_3 \\ by_1 & by_2 & by_3 \\ cz_1 & cz_2 & cz_3 \end{vmatrix} \frac{1}{abc} = \frac{1}{abc} \begin{vmatrix} d & f & f \\ f & d & f \\ f & f & d \end{vmatrix}$$

$$\Big\downarrow R_1 \to R_1 + R_2 + R_3$$

$$\begin{vmatrix} 1+1+1 & \alpha^1+\beta^1+\gamma^1 & \alpha^2+\beta^2+\gamma^2 \\ \alpha^1+\beta^1+\gamma^1 & \alpha^2+\beta^2+\gamma^2 & \alpha^3+\beta^3+\gamma^3 \\ & & \end{vmatrix} \qquad \frac{d+2f}{abc} \begin{vmatrix} 1 & 1 & 1 \\ & & \\ & & \end{vmatrix}$$

$$= \begin{vmatrix} 1 & 1 & 1 \\ \alpha & \beta & \gamma \\ \alpha^2 & \beta^2 & \gamma^2 \end{vmatrix} \begin{vmatrix} 1 & \alpha & \alpha^2 \\ 1 & \beta & \beta^2 \\ 1 & \gamma & \gamma^2 \end{vmatrix}$$

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$$\begin{vmatrix} y^2 & -xy & x^2 \\ a & b & c \\ a' & b' & c' \end{vmatrix} \xrightarrow[C_3 \to yC_3 + xC_2]{C_2 \to yC_2 + xC_1}$$

$$= \frac{1}{y^2}\begin{vmatrix} y^2 & 0 & 0 \\ a & by+ax & cy+bx \\ a' & b'y+a'x & c'y+b'x \end{vmatrix} = \begin{vmatrix} by+ax & cy+bx \\ b'y+a'x & c'y+b'x \end{vmatrix}$$

$$\downarrow C_2 \to yC_2 + xC_1$$

$$\frac{1}{y}\begin{vmatrix} ax+by & u \\ a'x+b'y & u' \end{vmatrix}$$

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$$③ - \cos q\, ① + \sin q\, ②$$

$$z(1-\cos q+\sin q) = 2-\cos^2 q-\cos q+\sin q-\sin^2 q$$

$$\boxed{z = 1}$$

$$\boxed{k=2}$$

$$\Delta =$$

$$-3z = 0$$

$$z = 0$$

$$2x+2y-2z=1$$

$$4x+4y-z=2$$

$$6x+6y+2z=3$$

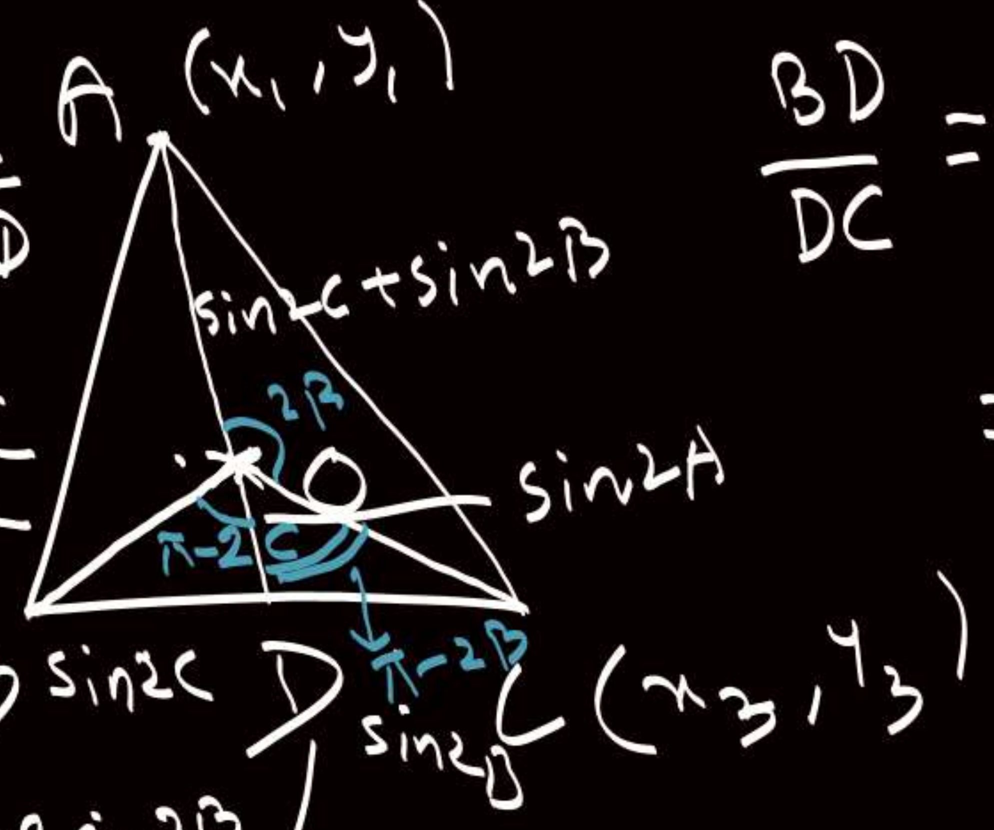
$$(x,y,z)=\left(\lambda, \frac{1}{2}-\lambda, 0\right)$$

$$\boxed{x+y=\frac{1}{2}}$$

Nishant Jindal

$$\underline{\text{Circumcentre}} = \left(\frac{(\sin 2A)x_1 + (\sin 2B)x_2 + (\sin 2C)x_3}{\sin 2A + \sin 2B + \sin 2C}, \ - \right)$$

$$\frac{OA}{OD} = \frac{\Delta AOB}{\Delta BOD} = \frac{\Delta AOC}{\Delta COD}$$



$$= \frac{\Delta AOB + \Delta AOC}{\Delta BOD + \Delta COD}$$

$$= \frac{\Delta AOB + \Delta AOC}{\Delta BOC}$$

$$= \frac{\frac{1}{2}(OA)(OB)\sin 2C + \frac{1}{2} R \times R \sin 2B}{\frac{1}{2} R \times R \sin 2A}$$

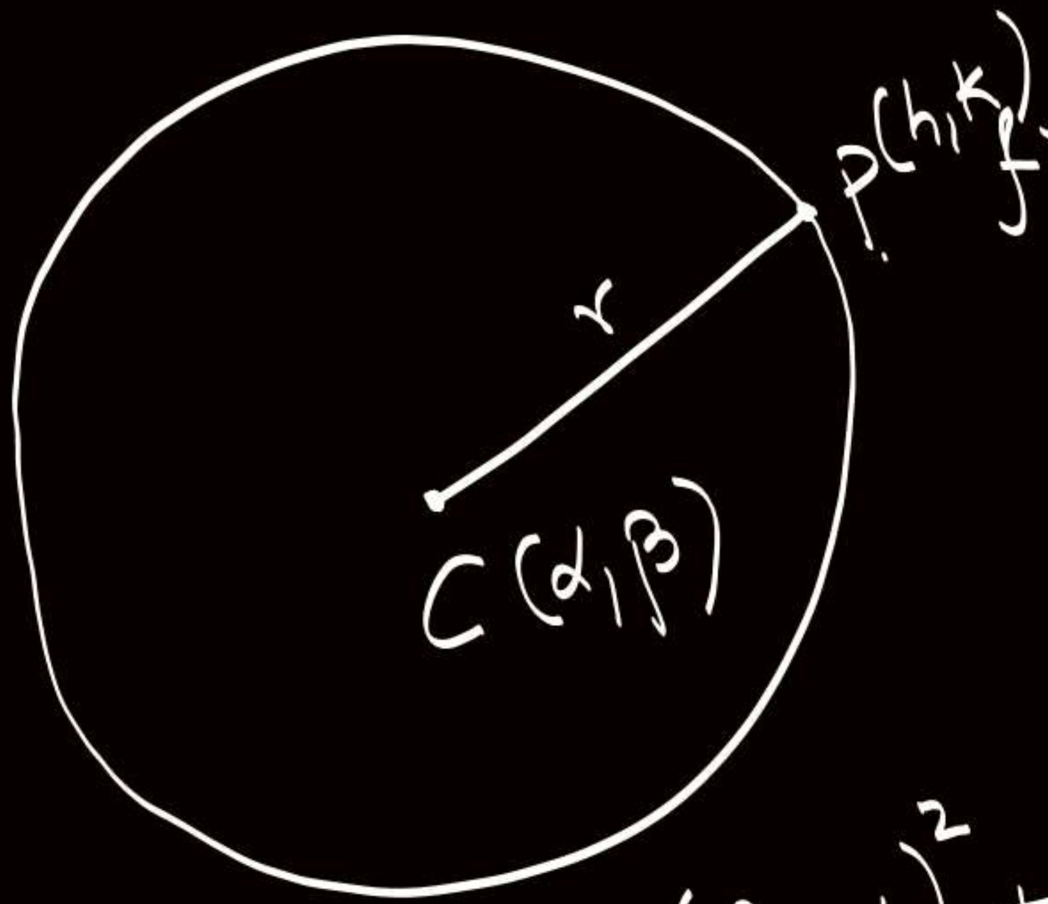
$$= \frac{\sin 2C + \sin 2B}{\sin 2A}$$

$$\frac{BD}{DC} = \frac{\Delta BOD}{\Delta COD} = \frac{\frac{1}{2}\cancel{(OB)}(OD)\sin(\pi - 2C)}{\frac{1}{2}\cancel{(OC)}(OD)\sin(\pi - 2B)}$$

$$= \frac{\sin 2C}{\sin 2B}$$

$$\left(\frac{(\sin 2B)x_2 + (\sin 2C)x_3}{\sin 2B + \sin 2C}, \ - \right)$$

Locus



find locus of P moving in plane so that its distance from C is constant = r.

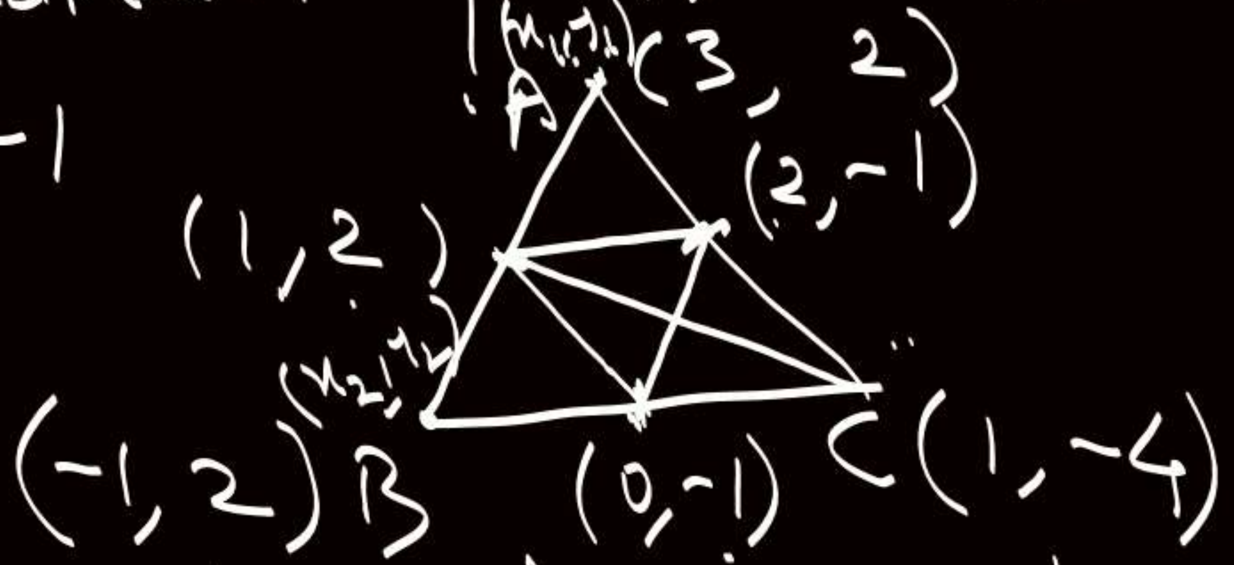
$$(h-\alpha)^2+(k-\beta)^2 = r^2$$

$$\boxed{(x-\alpha)^2+(y-\beta)^2=r^2}$$

Nishant Jindal

1. The midpoints of the sides of a triangle are $(1,2)$, $(0,-1)$ and $(2,-1)$. Find the coordinates of its vertices.

$2-1 = y-1$



$x_1+x_2 = 2$

$x_2+x_3 = 0$

$x_3+x_1 = 4$

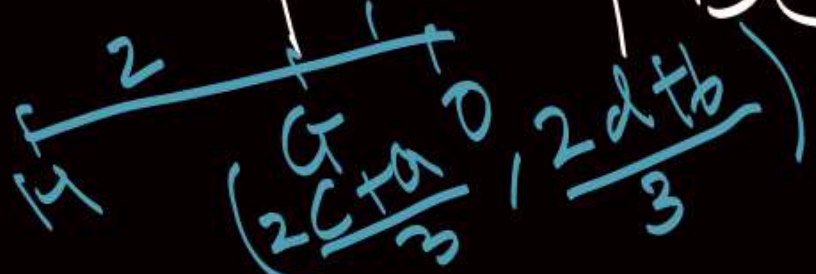
$x+1 = 2+0$

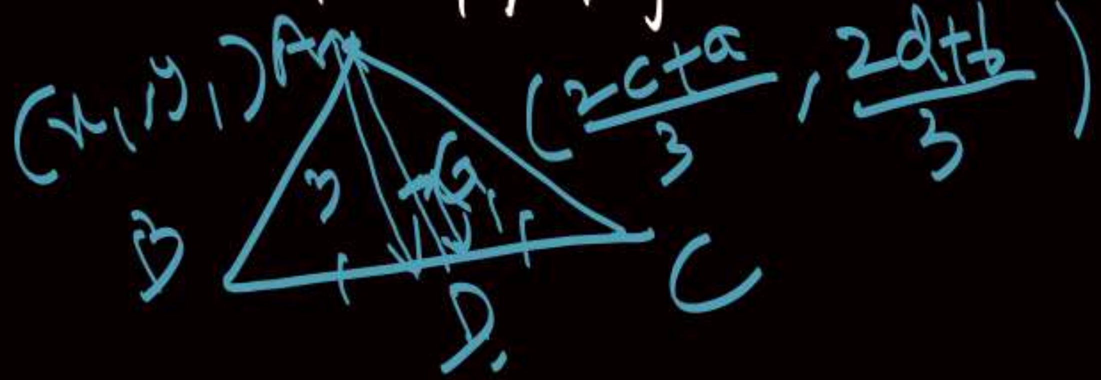
$x_1+x_2+x_3 = 3$

$D = \left(\frac{2c+a-x_1}{2}, \frac{2d+b-y_1}{2}\right)$

$D = \frac{3G - 1A}{3-1}$

2. Orthocentre and circumcentre of ΔABC are (a,b) & (c,d) respectively. If coordinates of A is (x_1, y_1), find the coordinate of middle point of BC.





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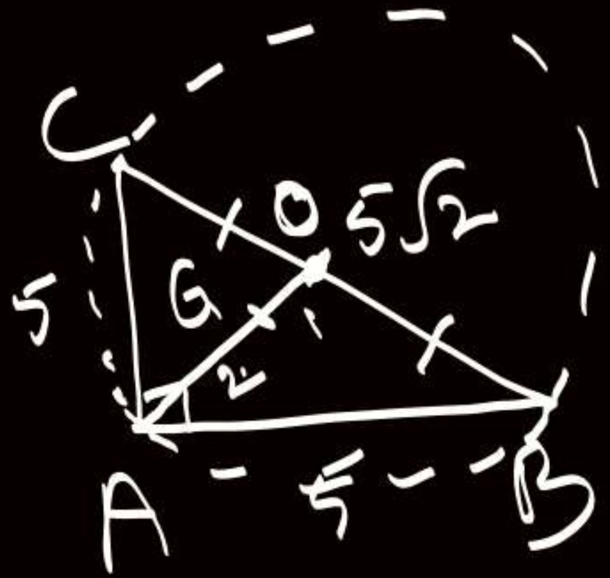
3. If the vertices of triangle are $A(2,-2)$, $B(-2,1)$ and $C(5,2)$. Find the distance b/n circumcentre and centroid.

$$AB = 5$$
$$BC = 5\sqrt{2}$$
$$CA = 5$$



$$OG = \frac{1}{3}\left(\frac{5\sqrt{2}}{2}\right)$$
$$= \frac{5\sqrt{2}}{6}$$

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4. If the area of triangle formed by points $(1,2)$, $(2,3)$, $(x,4)$ is 40, find x.

$$\frac{1}{2}\begin{vmatrix} 1 & 2 & 1 \\ 2 & 3 & 1 \\ x & 4 & 1 \end{vmatrix} = \pm 40 \Rightarrow \boxed{x = 83, -77}$$

5. If points $(a,0)$, $(0,b)$ and $(1,1)$ are collinear, find $\frac{1}{a} + \frac{1}{b}$.

$$\begin{vmatrix} a & 0 & 1 \\ 0 & b & 1 \\ 1 & 1 & 1 \end{vmatrix} = 0 = a(b-1) - b = 0$$

$$ab = a + b$$

$$\frac{1}{a} + \frac{1}{b} = 1.$$

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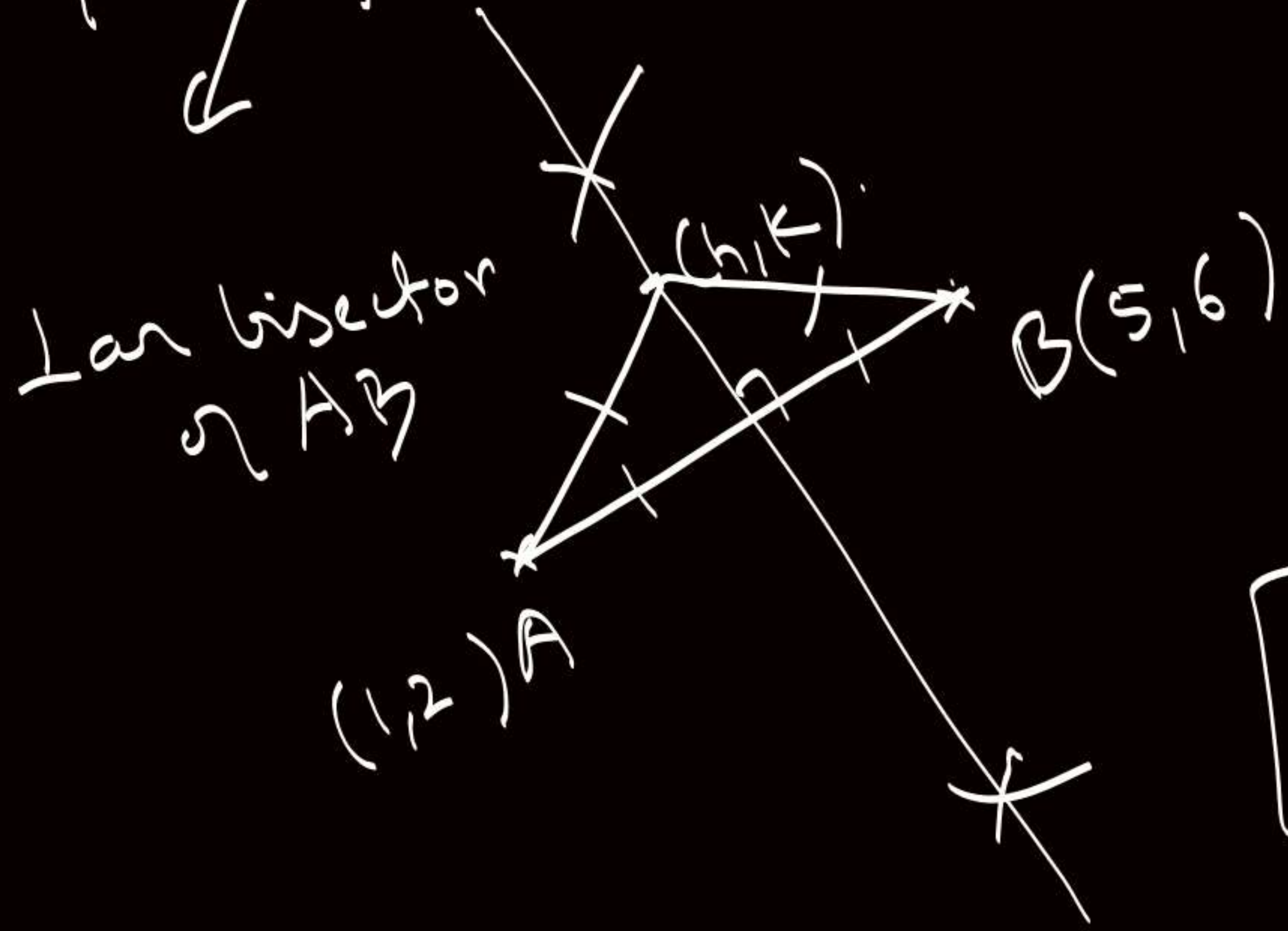
6. $A = (1,2)$, $B = (5,6)$, find locus of point P such that $PA = PB$.



$$(h-1)^2 + (k-2)^2 = (h-5)^2 + (k-6)^2$$

$$8h + 8k = 56$$

$$\boxed{x + y = 7}$$

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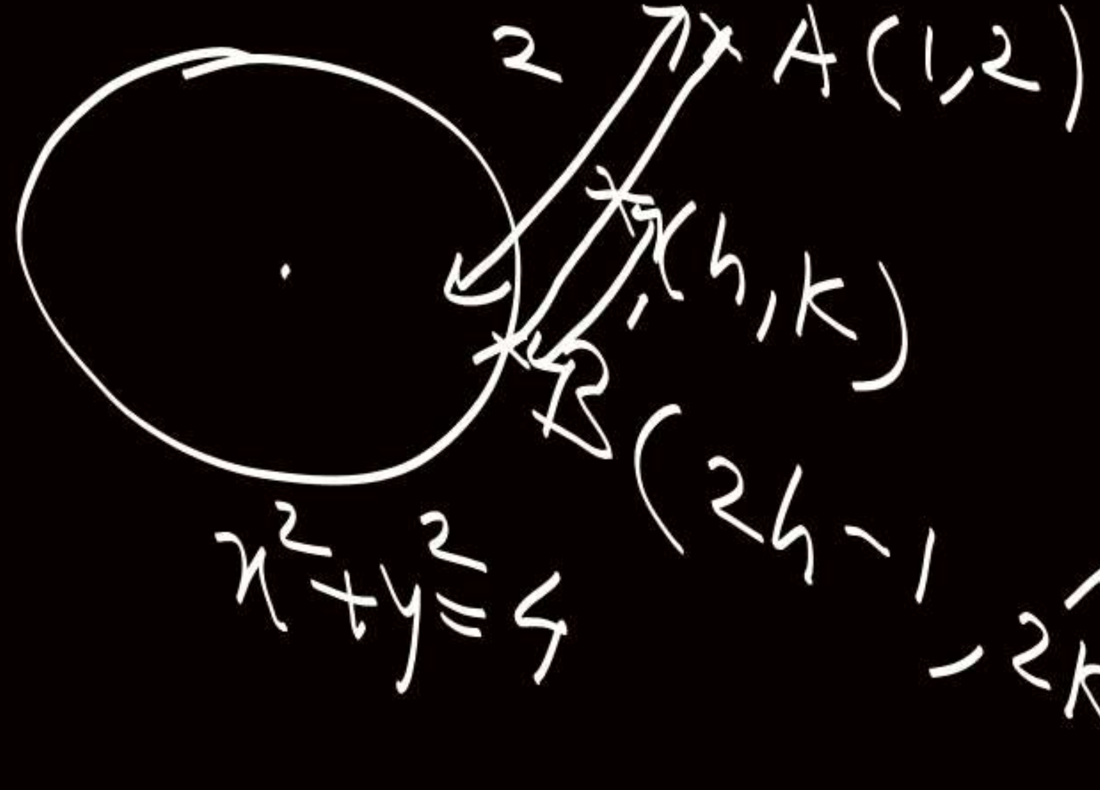
7: A(1,2) is a fixed point. A variable point B lies on curve whose equation is $x^2+y^2=4$.

Find the locus of midpoint of AB.



$$(2h-1)^2+(2k-2)^2=4$$

$$\boxed{4x^2+4y^2-4x-8y+1=0}$$

Ex-II (11-14)
Ex-IV

→ Determinants