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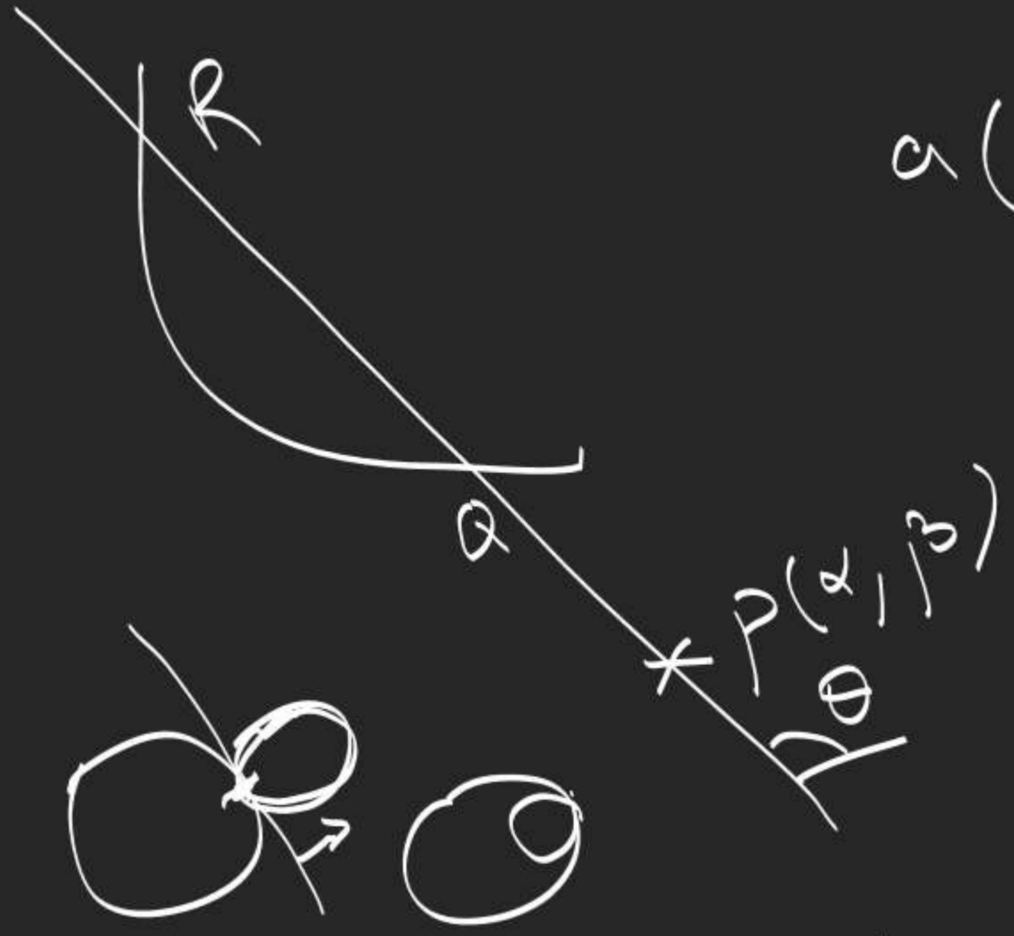

$$a(\alpha^2 + r^2 c^2\theta + 2\alpha r c\theta) + 2h(\alpha + r c\theta)(\beta + r s\theta) + b(\beta^2 + r^2 s^2\theta + 2\beta r s\theta) = 1.$$

$$r^2(a c^2\theta + 2h s\theta c\theta + b s^2\theta) + (\quad) r +$$

$$a - b = 0$$

$$h = 0$$

$$|r_1 r_2| = \frac{|a\alpha^2 + 2h\alpha\beta + b\beta^2 - 1|}{a\cos^2\theta + 2h\cos\theta\sin\theta + b\sin^2\theta}$$

$$= \frac{\quad}{\frac{a}{2}(1+\cos 2\theta) + h\sin 2\theta + \frac{b}{2}(1-\cos 2\theta)}$$

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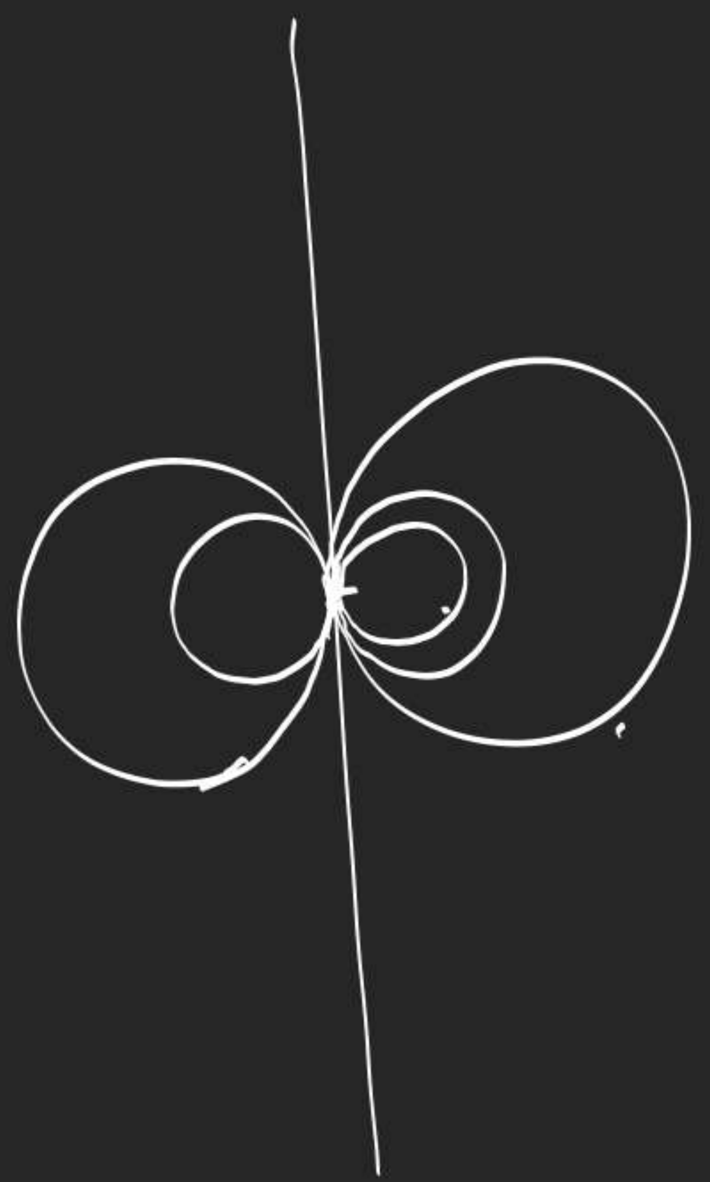
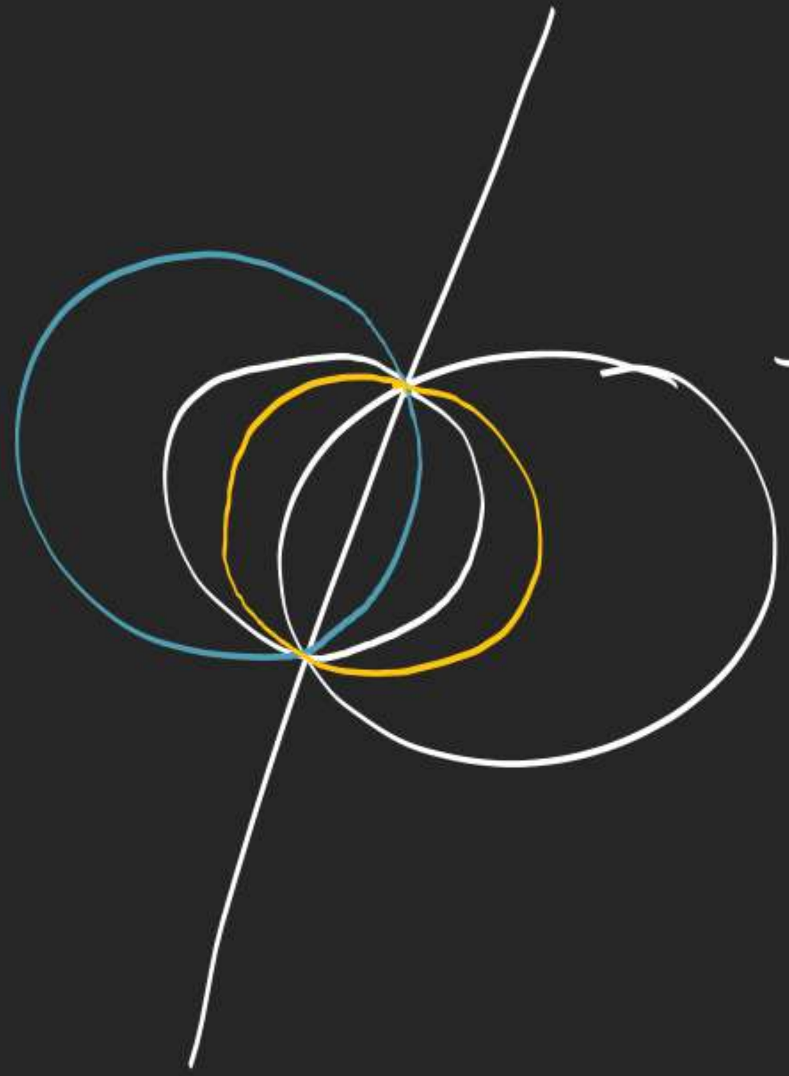
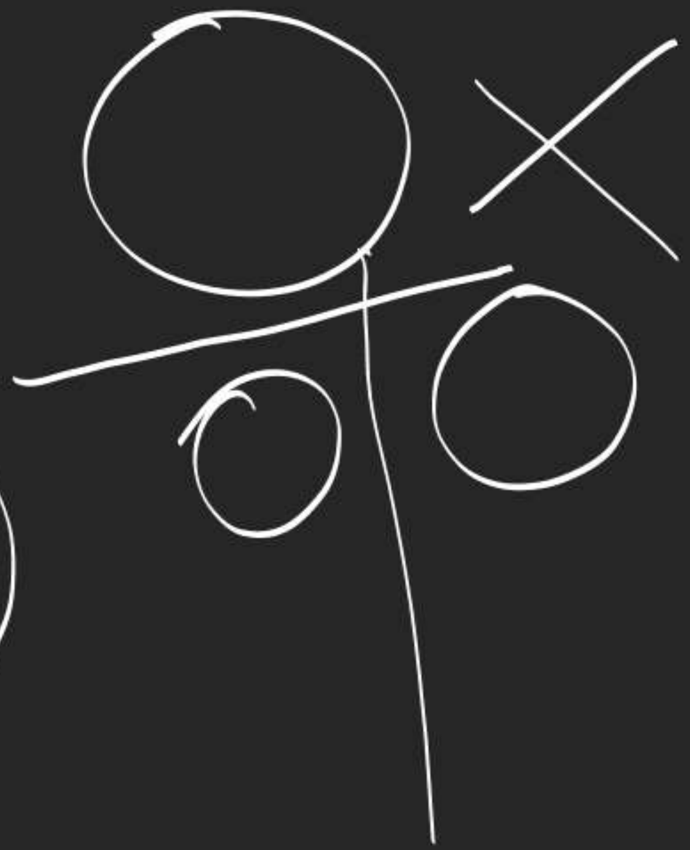
Coaxial system of Circles

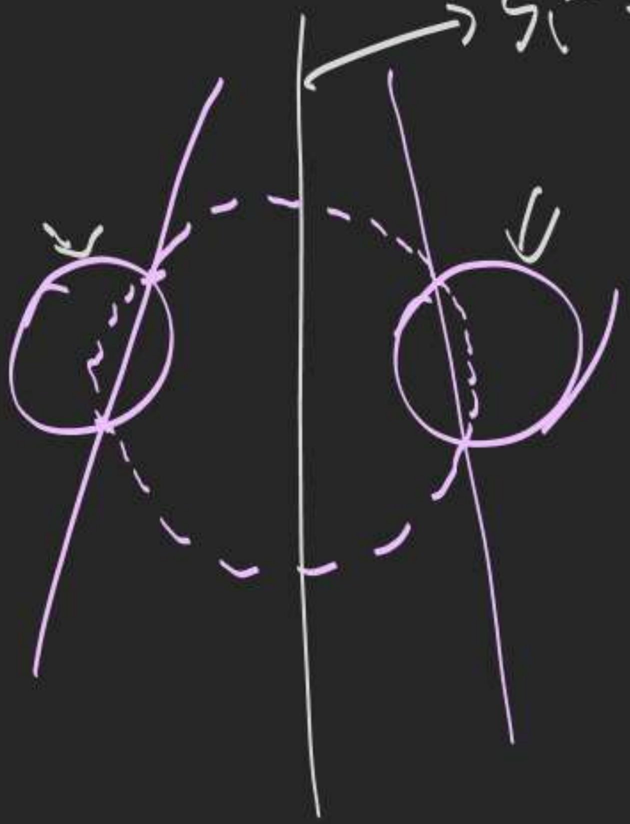






1. Line $lx+my+n=0$ intersectn circle $x^2+y^2+2g_1x+2f_1y+c_1=0$ at A, B and line $px+qy+r=0$ intersectn circle $x^2+y^2+2g_2x+2f_2y+c_2=0$ at C, D.

If A, B, C, D are concyclic, then P.T.



$$\begin{vmatrix} 2(g_1-g_2) & 2(f_1-f_2) & c_1-c_2 \\ l & m & n \\ p & q & r \end{vmatrix} = 0$$

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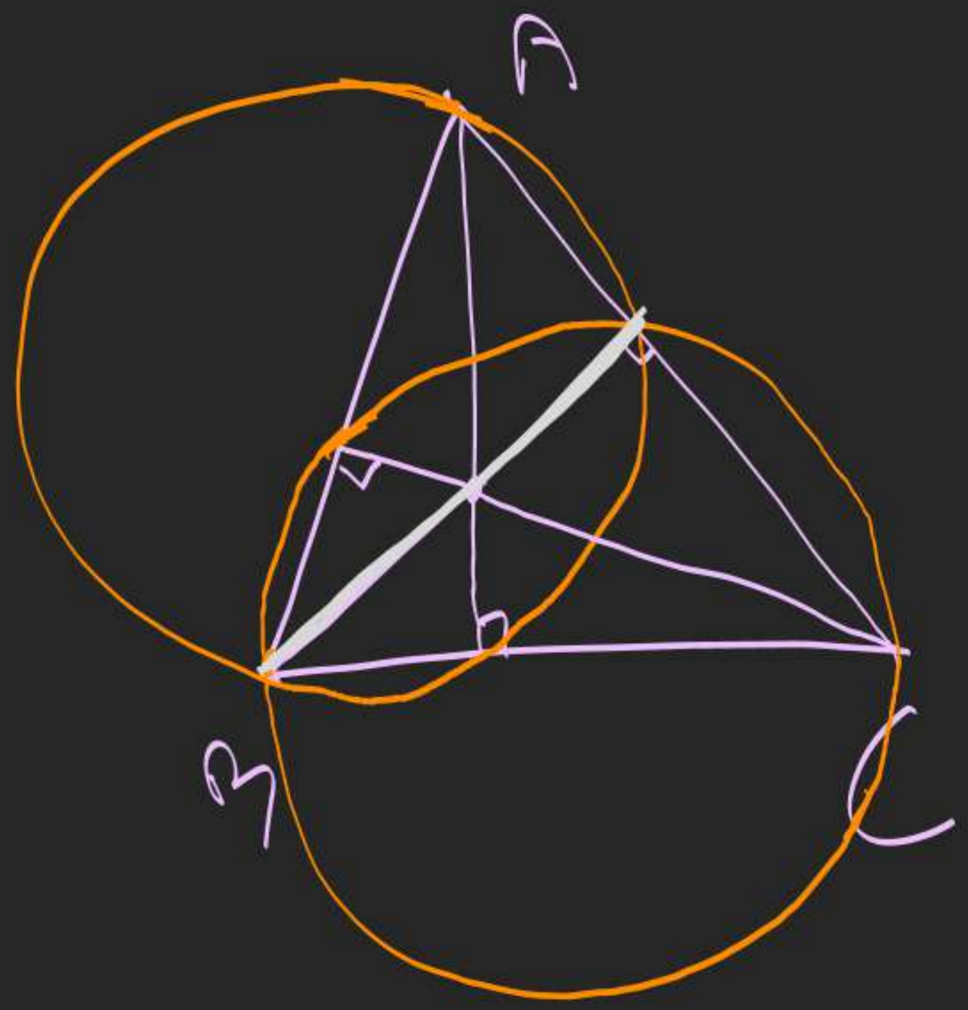
2. P.T. radical centre of 3 circles described on sides of a triangle as diameter is the orthocentre of the triangle.



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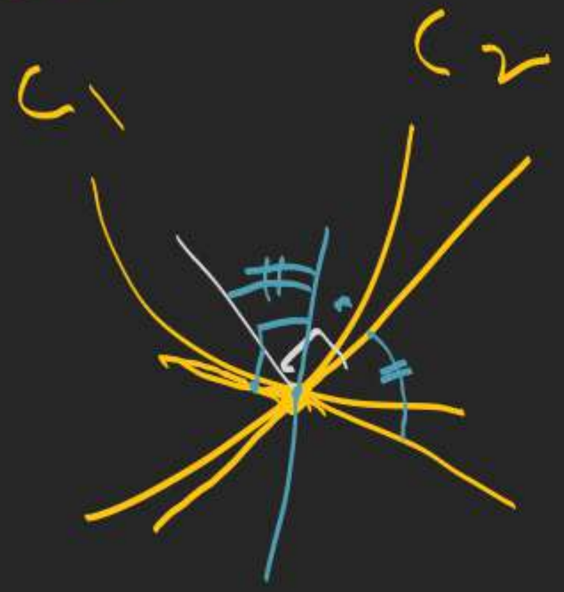
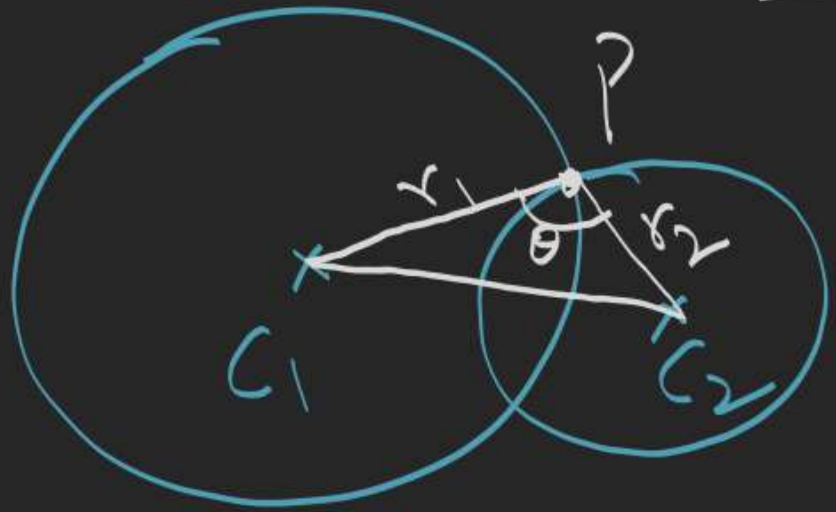
Angle b/n 2 Curves

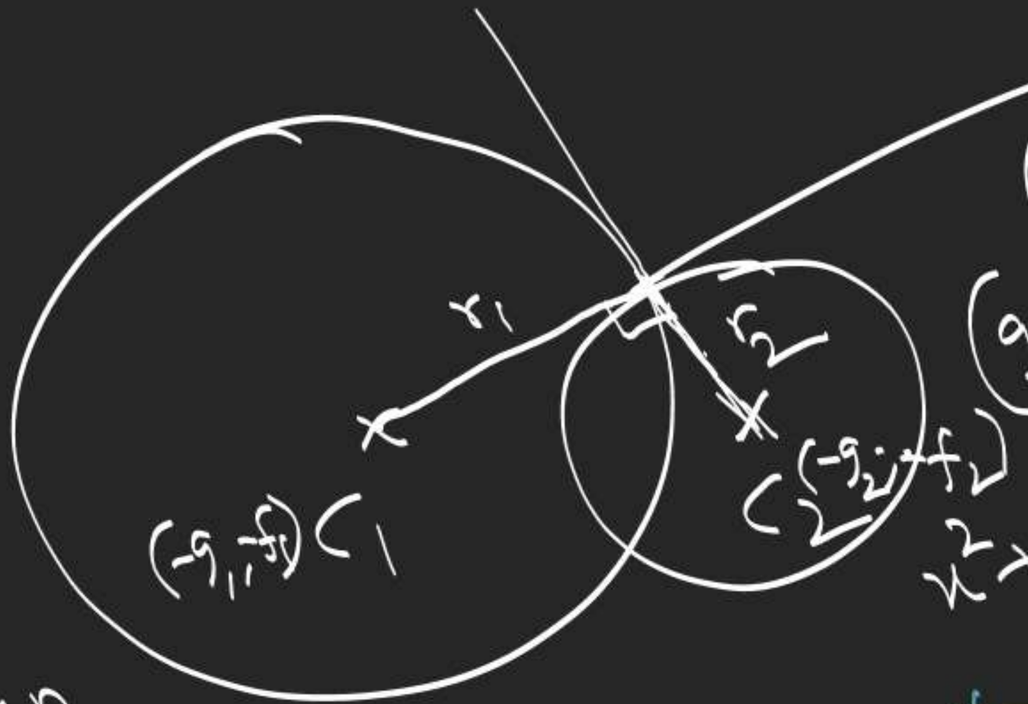
is the angle b/n the tangents or normals to curves at their intersection point.



$$\cos\theta = \frac{r_1^2 + r_2^2 - (C_1C_2)^2}{2r_1r_2}$$



Orthogonality of 2 Circles



$$(C_1C_2)^2 = r_1^2 + r_2^2$$

$$(g_1-g_2)^2 + (f_1-f_2)^2 = g_1^2 + f_1^2 - c_1 + g_2^2 + f_2^2 - c_2$$

$$x^2 + y^2 + 2g_2x + 2f_2y + c_2 = 0$$

Note →

to two given circles $x^2 + y^2 + 2g_1x + 2f_1y + c_1 = 0$

$$\boxed{2(g_1g_2 + f_1f_2) = c_1 + c_2}$$

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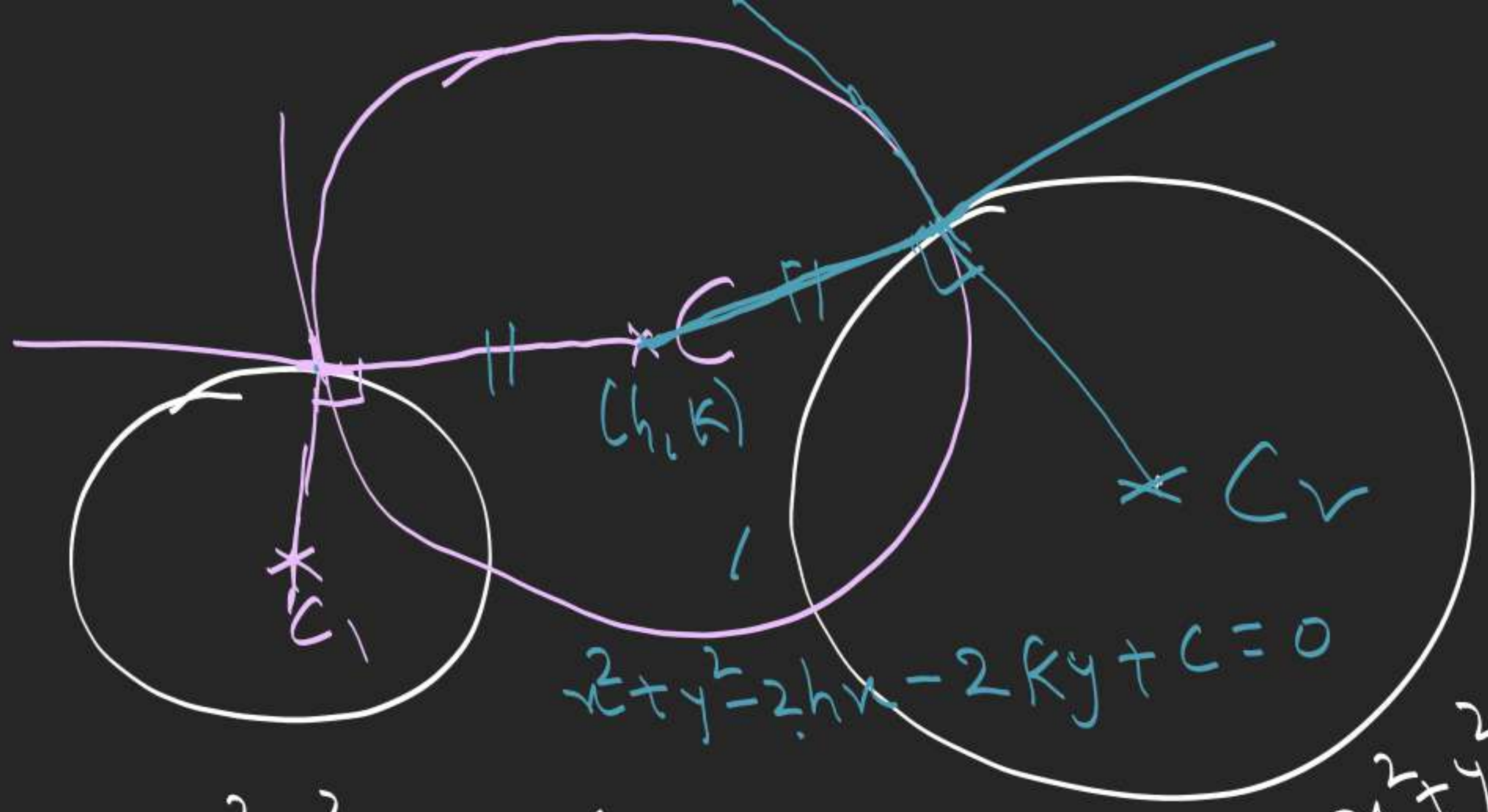

$$x^2+y^2-2hx-2ky+c=0$$

$$x^2+y^2+2g_1x+2f_1y+c_1=0$$

$$x^2+y^2+2g_2x+2f_2y+c_2=0$$

$$2\left(g_1(-h)+f_1(-k)\right)=c+c_1$$

$$2\left(g_2(-h)+f_2(-k)\right)=c+c_2$$

$$2(g_2-g_1)h+2(f_2-f_1)k=c_1-c_2$$

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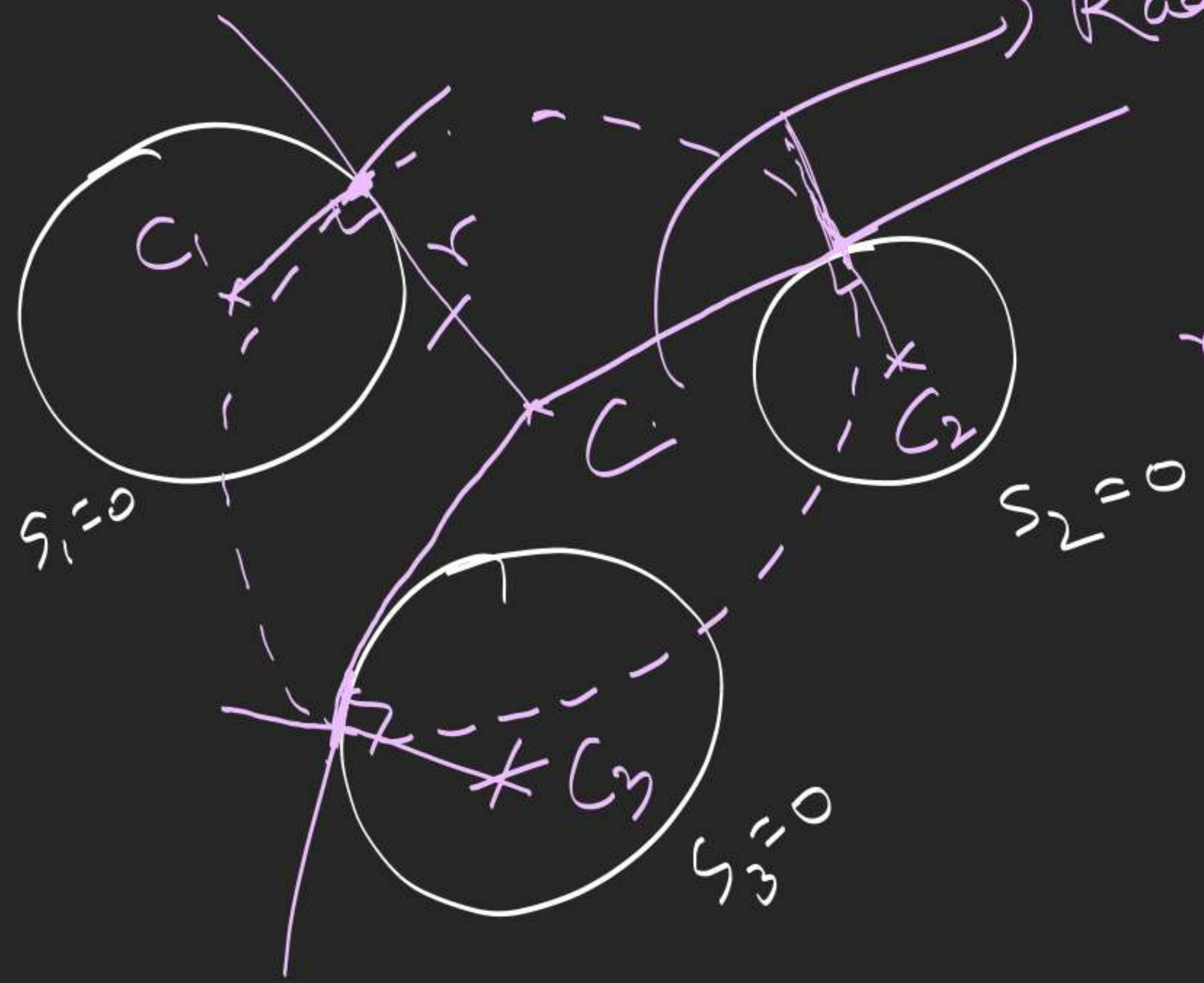
Circle orthogonal to 3 given Circles



→ Radical centre = centre = C.

radius = Length of tangent from C to S_1 or S_2 or S_3.

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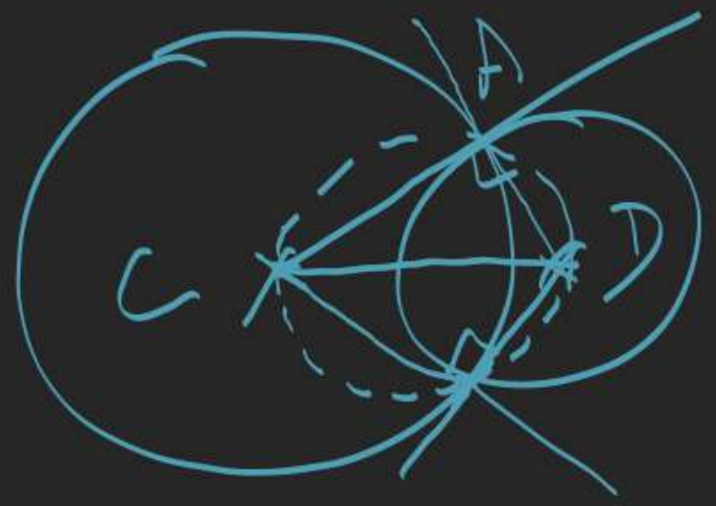
1. The circles $x^2+y^2+2g_1x+2f_1y+c_1=0$ and $x^2+y^2+2g_2x+2f_2y+c_2=0$ intersect orthogonally at A & B. If C, D are centres of these circles. Find the eqn. of circle passing thru A, B, C, D.



$$(x+g_1)(x+g_2)+(y+f_1)(y+f_2)=0.$$

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2. P.T. 2 circles both of which passes thru 2 points $(0,a)$ & $(0,-a)$ and touches the line $y=mx+d$ will cut orthogonally if $d^2 = a^2(2+m^2)$.

$$x^2+y^2-a^2+\lambda x=0$$

$$\left(-\frac{\lambda}{2},0\right)$$

$$r=\sqrt{\frac{\lambda^2}{4}+a^2}$$

$$2\,\frac{\lambda_1}{2}\,\frac{\lambda_2}{2}=-a^2-a^2$$

$$\boxed{\lambda_1\lambda_2=-4a^2}$$

$$\frac{\left|-\frac{m\lambda}{2}+d\right|}{\sqrt{1+m^2}}=\sqrt{\frac{\lambda^2}{4}+a^2} \Rightarrow \cancel{\frac{m^2\lambda^2}{4}}+d^2-md\lambda=\cancel{\frac{m^2\lambda^2}{4}}+a^2(1+m^2)+\frac{\lambda^2}{4}$$

$$\frac{\lambda^2}{4}+md\lambda+a^2(1+m^2)-d^2=0.$$

λ_1, λ_2

$$\cancel{4}\left((1+m^2)a^2-d^2\right)=-\cancel{4}a^2$$

Ex-I (26–30)

Ex-II (1–11)

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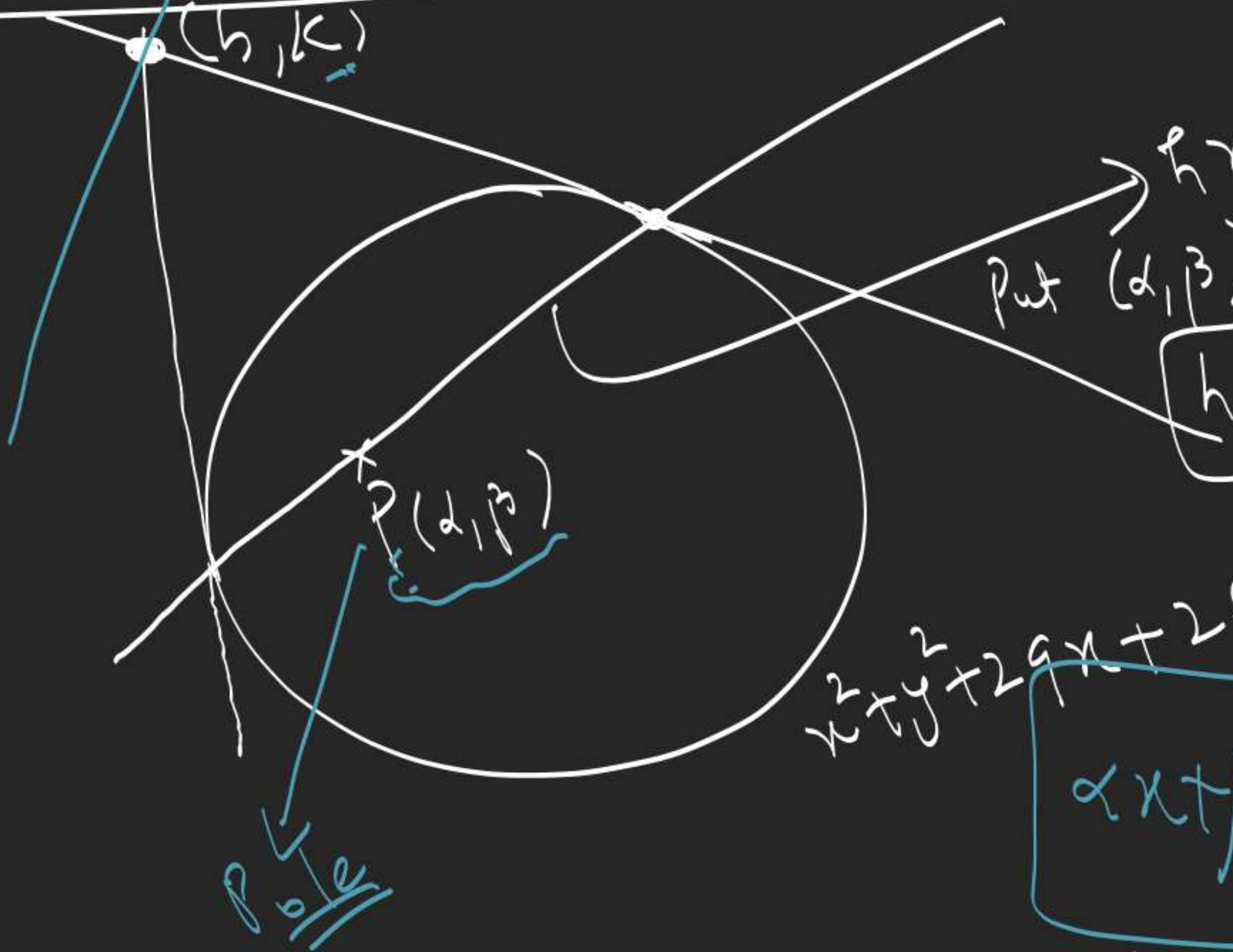
Pole & Polar

Polar of point P w.r.t Circle S

Polar

$T = 0$



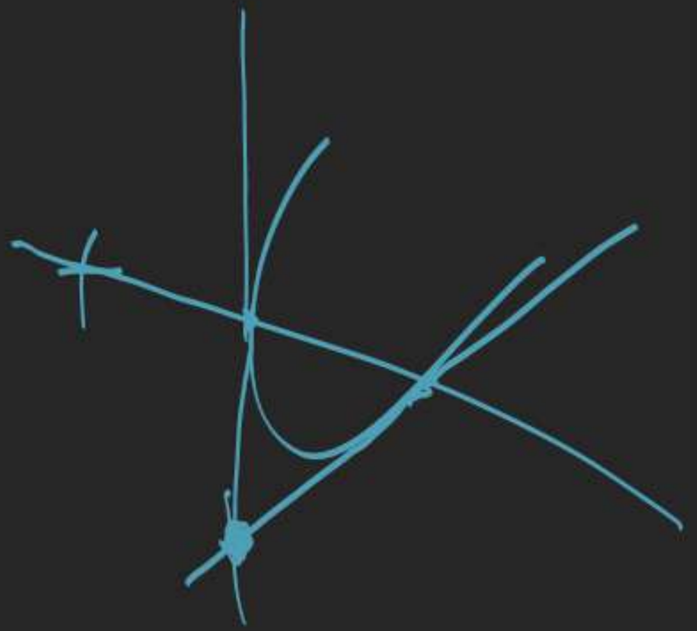
$hx+ky+g(x+h)+f(y+k)+c=0$

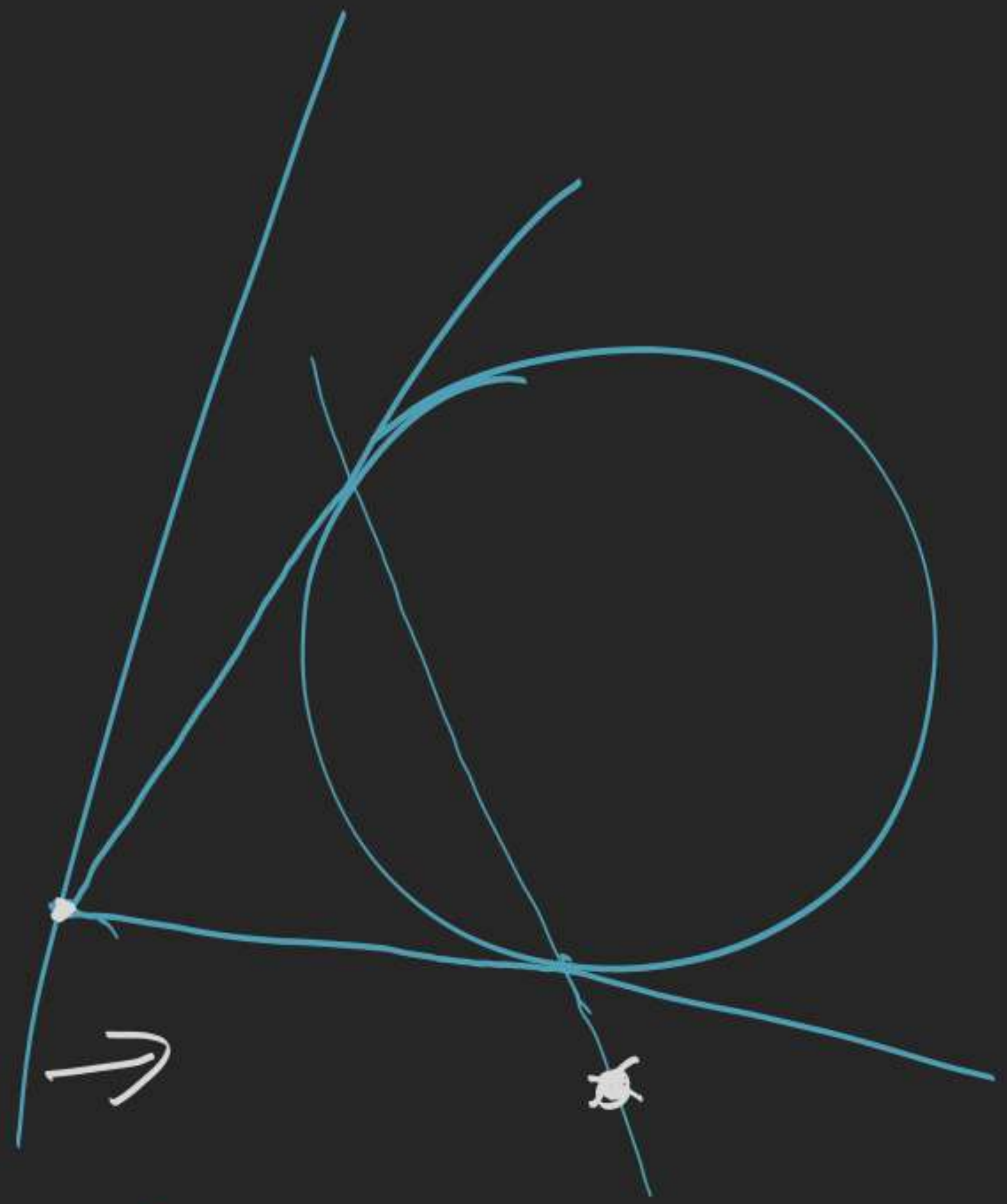
Put (α,β)

$$\boxed{h\alpha+k\beta+g(\alpha+h)+f(\beta+k)+c=0}$$

$x^2+y^2+2gx+2fy+c=0$

$$\boxed{\alpha x+\beta y+g(x+\alpha)+f(y+\beta)+c=0}$$





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