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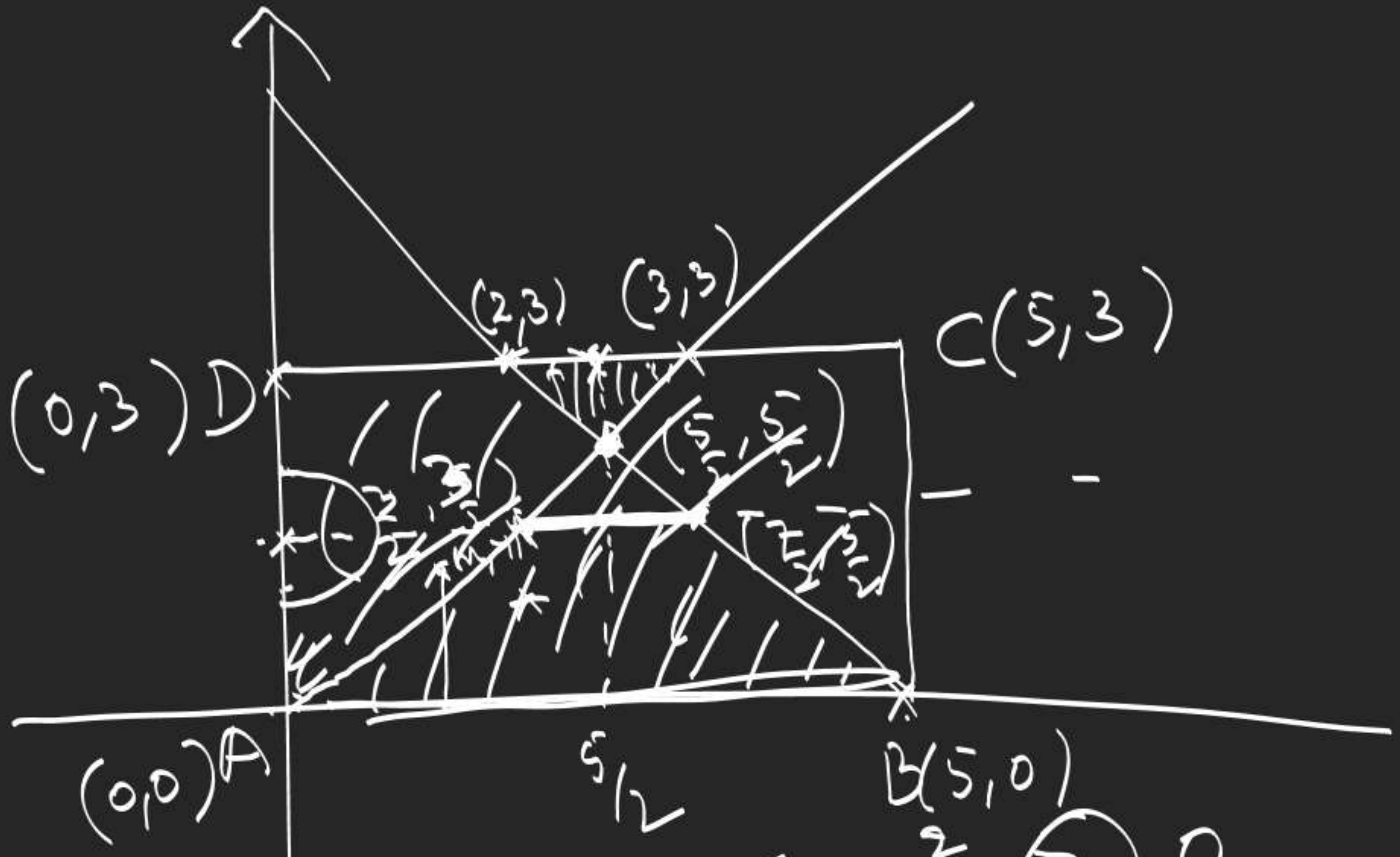

$$\left(y-\frac{3}{2}\right)^2 + x^2 - 1 \geq 0$$

$=$

BC

AB ≤ x ≤ CD

AD ≤ x ≤ xD

AD ≤ x.

$\min(2,3,4) = 2$

$\max(2,3,4) = 4$

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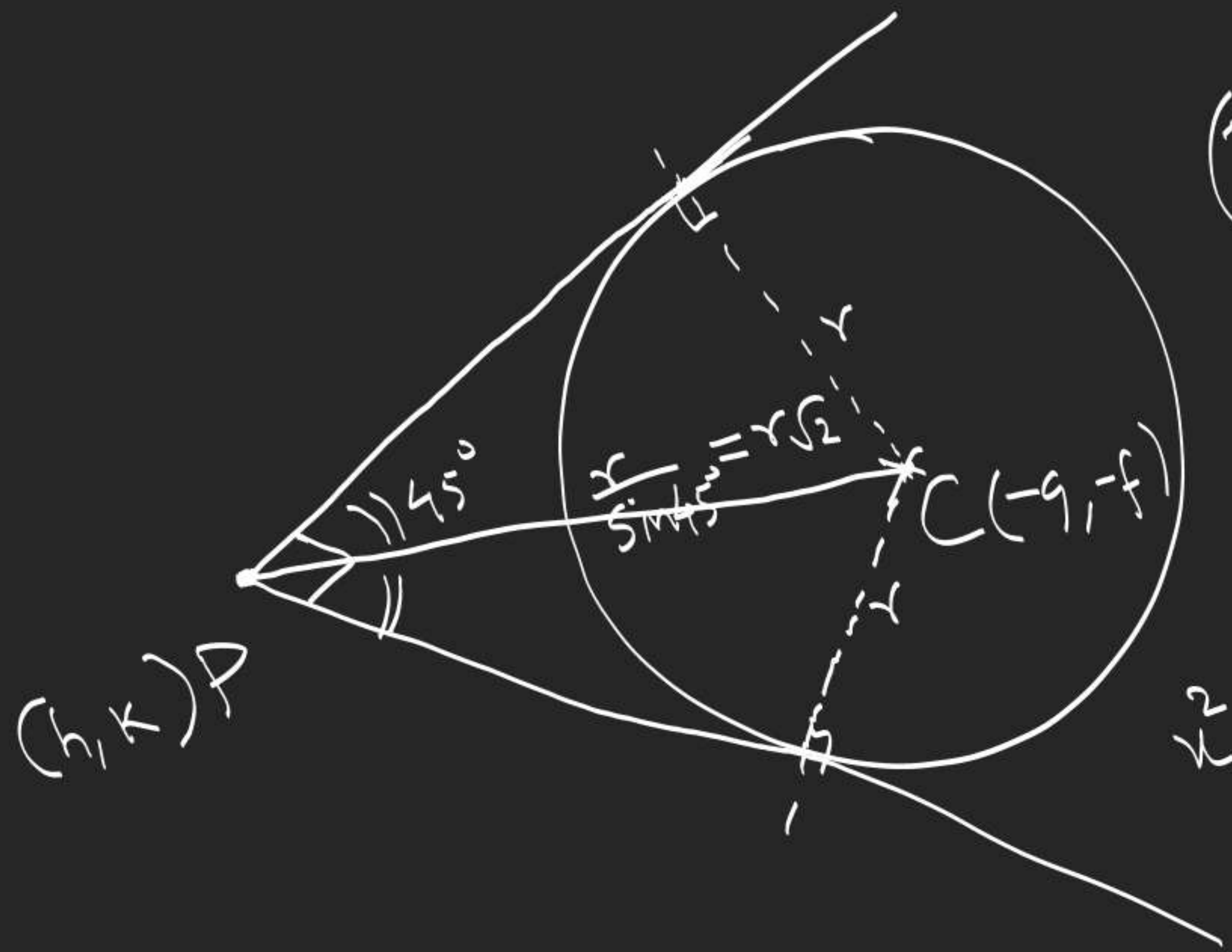
Director Circle



$$(x+g)^2+(y+f)^2 = (r\sqrt{2})^2$$

$$= 2(g^2+f^2-c)$$

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

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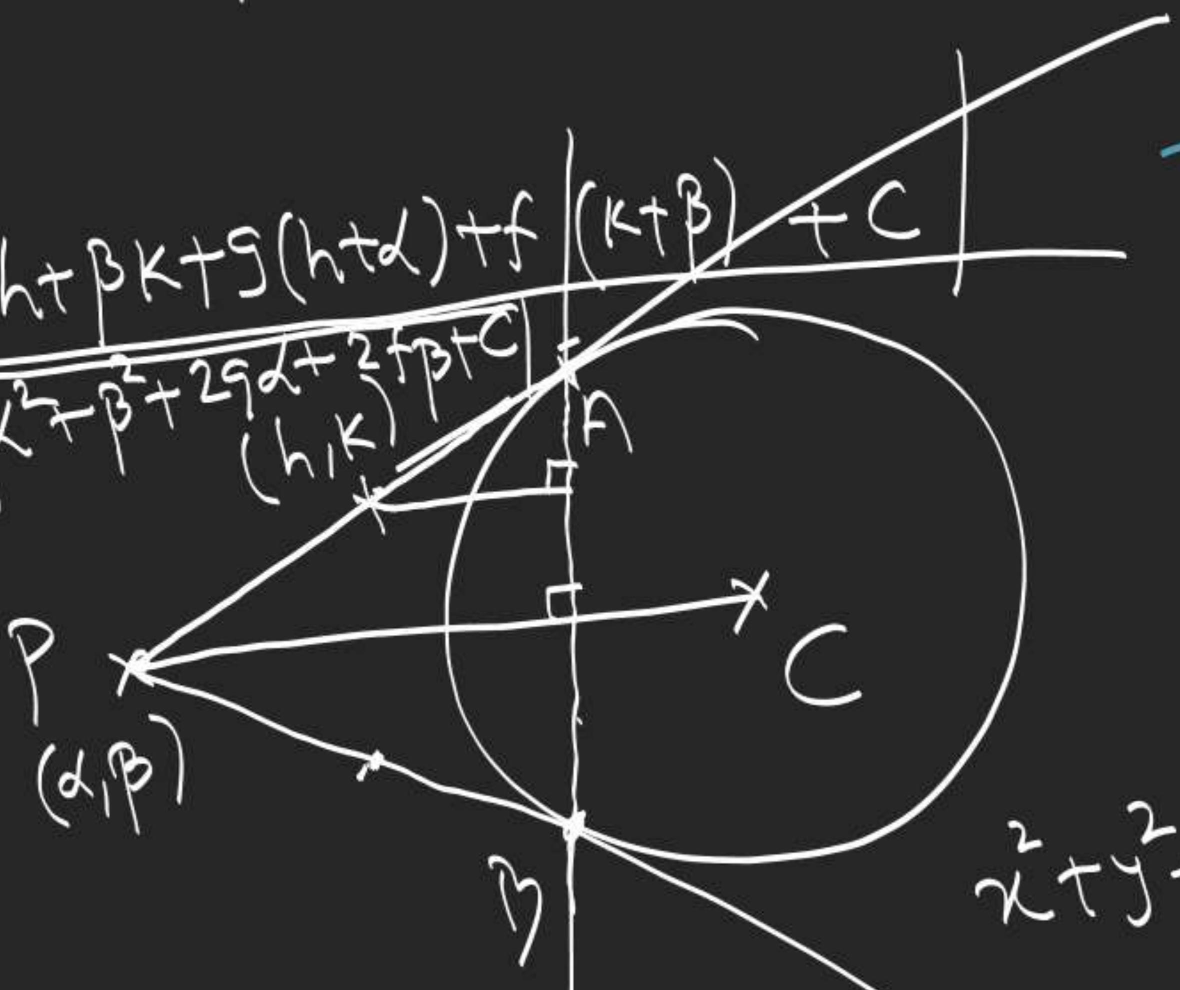
Pair of Tangents from a given point

$$\frac{\sqrt{h^2+k^2+2gh+2fk+c}}{\cancel{\sqrt{\alpha^2+\beta^2+2g\alpha+2f\beta+c}}} = \frac{|\alpha h+\beta k+g(h+\alpha)+f(k+\beta)+c|}{\cancel{\sqrt{\alpha^2+\beta^2+2g\alpha+2f\beta+c}}}$$



$$\boxed{T^2 = SS_1}$$

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

$$\longrightarrow \alpha x+\beta y+g(x+\alpha)+f(y+\beta)+c=0$$

$$(x^2+y^2+2gx+2fy+c)(\alpha^2+\beta^2+2g\alpha+2f\beta+c)$$

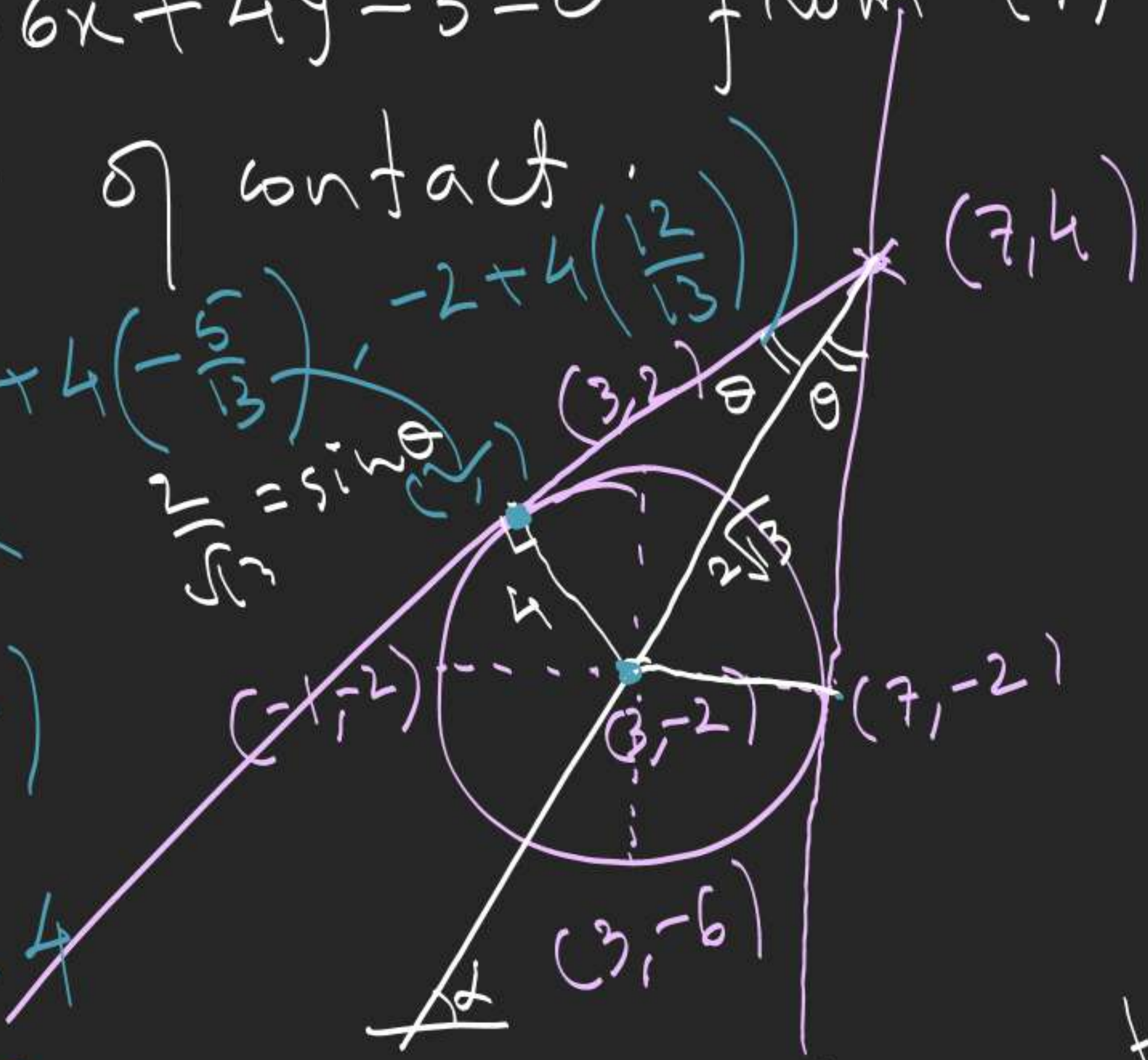
$$= (\alpha x+\beta y+g(x+\alpha)+f(y+\beta)+c)^2$$

1. Find the eqn of tangents drawn to circle $x^2+y^2-6x+4y-3=0$ from $(7,4)$. Also find the point of contact.

$12y$

$\left(3+4\left(-\frac{5}{13}\right), -2+4\left(\frac{12}{13}\right)\right)$

$\frac{2}{\sqrt{13}}=\sin\theta$



$y-4=m(x-7)$

$$\frac{|-6+4m|}{\sqrt{1+m^2}}=4$$

$m=\frac{5}{12}$

$\tan\alpha=\frac{6}{4}=\frac{3}{2}$

$\tan\theta=\frac{2}{3}$

$$\tan(\alpha\pm\theta)=\frac{\frac{3}{2}+\frac{2}{3}}{1-\frac{3}{2}\times\frac{2}{3}}, \frac{\frac{3}{2}-\frac{2}{3}}{1+\frac{3}{2}\times\frac{2}{3}}$$

$\infty \quad , \quad \frac{5}{12}$

$\boxed{x=7}$

$\boxed{y-4=\frac{5}{12}(x-7)}$

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2. Find the eqn. of tangents to circle $x^2+y^2-2x-4y-4=0$ which is perpendicular to line $3x-4y-7=0$.

$(1,2)$, $r=3$

$$4x+3y=C$$

$$\frac{|4+6-C|}{5}=3$$

$$C-10=\pm 15$$

$$C=25, -5$$

$$\boxed{\begin{aligned} 4x+3y&=25 \\ 4x+3y&=-5 \end{aligned}}$$

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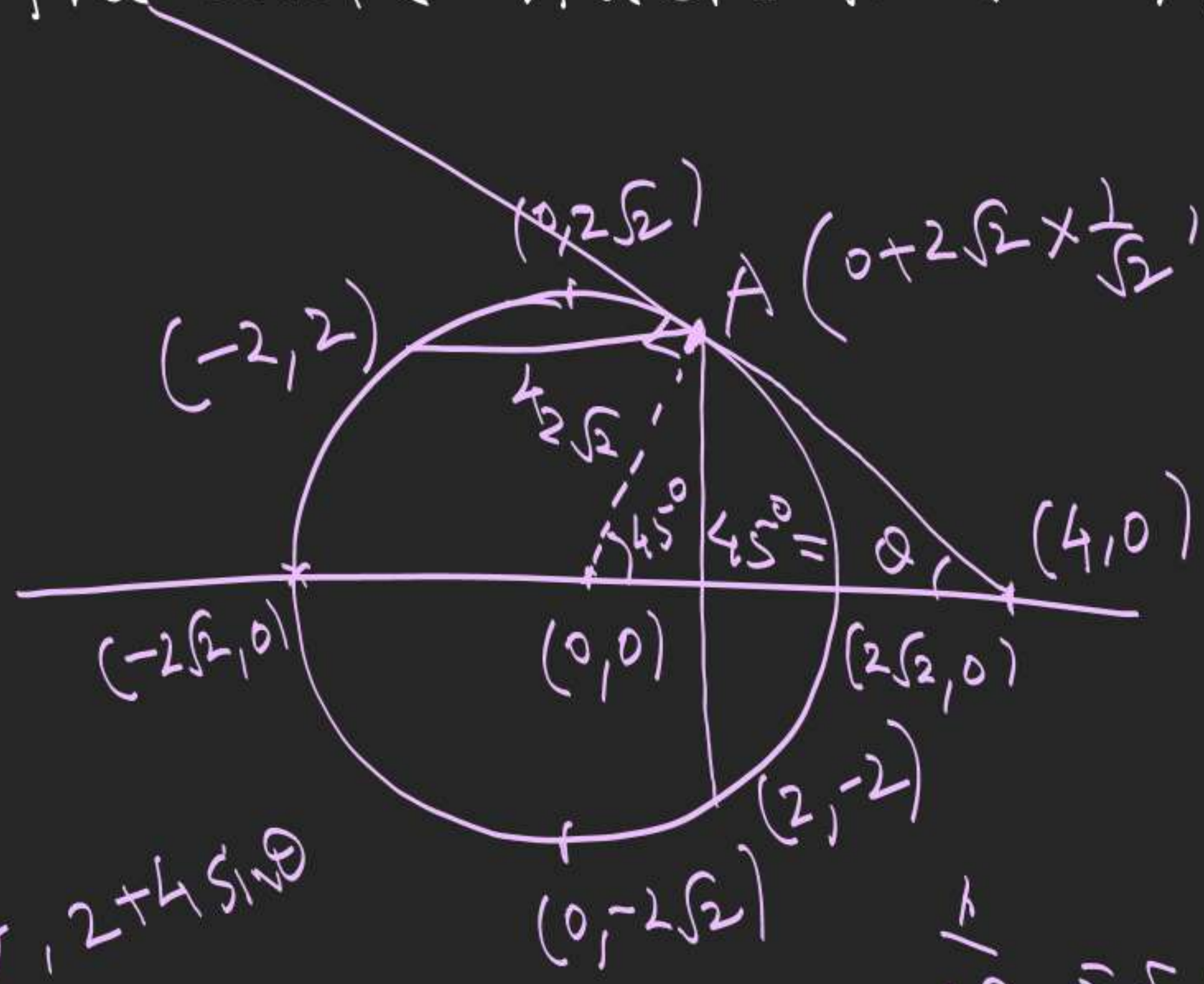
3. Tangent is drawn from point $P(4,0)$ to the circle $x^2+y^2=8$ touches it at A in first quadrant. Find the coordinates of point B on the circle such that $AB = 4$.



$A\left(0+2\sqrt{2}\times\frac{1}{\sqrt{2}},\ 2\sqrt{2}\times\frac{1}{\sqrt{2}}\right) = (2,2)$

$$\boxed{B = (-2,2),\ (2,-2)}$$

$2+4\cos\theta,\ 2+4\sin\theta$

$\frac{1}{\sqrt{2}} = \sin\theta$

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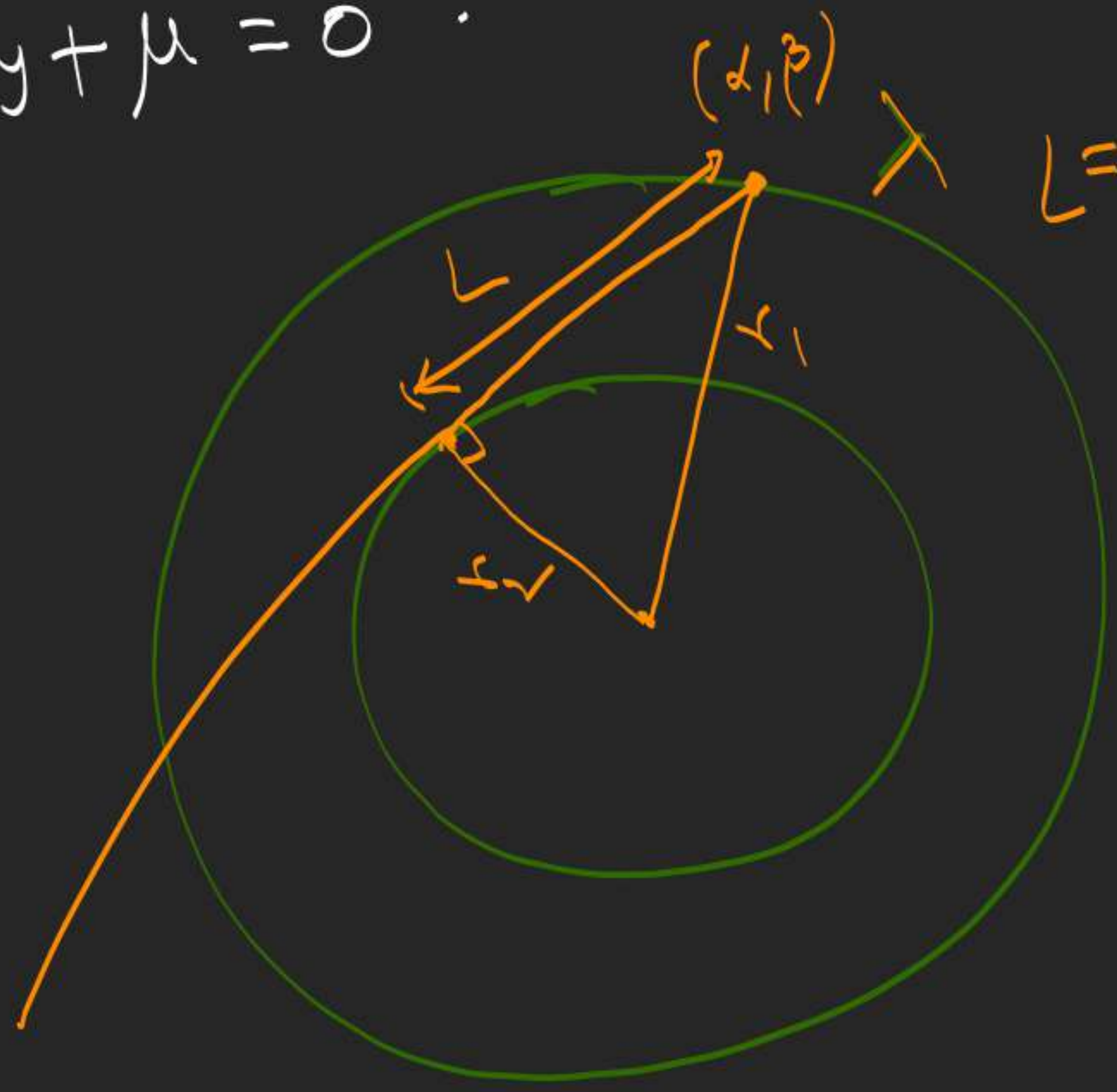
4. Find the length of the tangent from any point on the circle $x^2+y^2+2gx+2fy+\lambda=0$ to the circle $x^2+y^2+2gx+2fy+\mu=0$.



$$L=\sqrt{\underbrace{\alpha^2+\beta^2+2g\alpha+2f\beta}+\mu}$$

$$=\sqrt{-\lambda+\mu}$$

$$L=\sqrt{r_1^2-r_2^2}$$

$$=\sqrt{(g^2+f^2-\lambda)-(g^2+f^2-\mu)}$$

$$=\sqrt{\mu-\lambda}$$