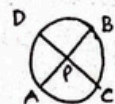


CIRCLES

*)

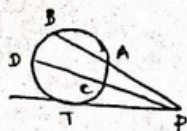


*)



$$PA \cdot PB = PC \cdot PD$$

*)



$$PT^2 = PA \cdot PB = PC \cdot PD$$

*)

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

$$\rightarrow \text{x-intercept} : 2\sqrt{g^2 - c}$$

$$\text{y-intercept} : 2\sqrt{f^2 - c}$$

$$\text{*) Diameter form : } (x-x_1)(x-x_2) + (y-y_1)(y-y_2) = 0$$

$$\text{*) Tgt : } x^2 + y^2 = a^2$$

$$\Rightarrow y = mx \pm a\sqrt{1+m^2} \quad \left(\frac{\pm am}{\sqrt{1+m^2}}, \frac{\pm a}{\sqrt{1+m^2}} \right)$$

$$\Rightarrow xx_1 + yy_1 = a^2$$

$$\text{*) Director circle} \rightarrow \text{1}^{\text{st}} \text{ tgl}$$

$$x^2 + y^2 = 2a^2$$

Normal,

$$\frac{x-x_1}{x_1+g} = \frac{y-y_1}{y_1+f}$$

$$\text{*) chord of contact} \rightarrow S_1 = 0$$

$$\text{*) } DCT = \sqrt{d^2 - (r_2 - r_1)^2}$$

$$\text{*) } TCT = \sqrt{d^2 - (r_2 + r_1)^2}$$

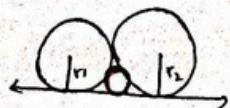


$$\text{*) Eq of chord of contact } S_1 = 0$$

$$\text{*) Eq of chord through midpoint } S_1 = S_{11}$$

$$\text{*) Combined Eq of pair of tgts } S_1^2 = SS_{11}$$

*)



$$\frac{1}{\sqrt{d}} = \frac{1}{\sqrt{r_1}} + \frac{1}{\sqrt{r_2}}$$

$$\text{*) Angle b/w two circles}$$

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

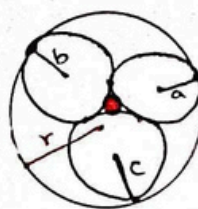
$$\text{*) Orthogonal}$$

$$2(g_1g_2 + f_1f_2) = c_1 + c_2$$

$$\text{*) Eq of common chord } S_1 - S_2 = 0$$

$$\text{*) If length of common chord} = \text{zero, } \begin{matrix} c < c \\ \downarrow \\ c < \text{tgt} \end{matrix}$$

*)



$$r = \frac{abc}{2\sqrt{abc(a+b+c)} \pm (ab+bc+ca)}$$

$$\begin{matrix} (+) \rightarrow \text{inner circle (r}_{\min}) \\ (-) \rightarrow \text{outer circle (r}_{\max}) \end{matrix}$$

Family of circles :

$$\text{*) } \odot \text{ of } S_1 = 0 \text{ \& } S_2 = 0 \Rightarrow S_1 + \lambda S_2 = 0 \quad \odot$$

*)



$$\rightarrow L_1L_2 + \lambda L_2L_3 + \mu L_3L_1 = 0$$

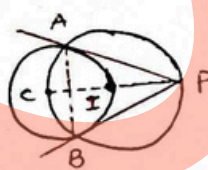
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$$\rightarrow S + \lambda L = 0$$

$$\rightarrow \text{make coeff of } x^2 = \text{coeff of } y^2 = 1, \quad xy = 0$$

*)

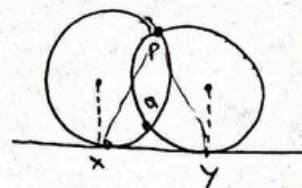


$$\text{Circumcentre} \rightarrow \text{midpoint of PC}$$

$$\text{Orthocentre} \rightarrow \text{Image of c w.r.t AB}$$

$$\text{Incentre} \rightarrow \text{P.O.I of circle \& PC (I)}$$

*)



Sine rule

$$R \text{ of } \Delta \times PY = 2\sqrt{r_1r_2}$$