Triangle: ① Centeroid $\equiv \left(\frac{\Sigma x}{3}, \frac{\Sigma y}{3}\right)$, ② Circumcentre $\equiv \left(\frac{\Sigma x_1 \sin 2A}{\Sigma \sin 2A}, \frac{\Sigma y_1 \sin 2A}{\Sigma \sin 2A}\right)$

③ OrthoCentre $\equiv \left(\frac{\Sigma x_1 \tan A}{\Sigma \tan A}, \frac{\Sigma y_1 \tan A}{\Sigma \tan A}\right) \equiv \left(\frac{\Sigma x_1 \tan A}{\Pi \tan A}, \frac{\Sigma y_1 \tan A}{\Pi \tan A}\right)$

④ Incentre $\equiv \left(\frac{\Sigma a x_1}{\Sigma a}, \frac{\Sigma a y_1}{\Sigma a}\right)$

⑤ $\frac{HG}{GO} = \frac{2}{1}$ ⑥ $A(\Delta) = \frac{1}{2}\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$ ⑦ $A(\triangle) = \frac{\sqrt{3}}{4}a^2$

⑧ $A(\text{n-Sided Polygon}) = \frac{1}{2}\left[\begin{vmatrix} x_1 & x_2 \\ y_1 & y_2 \end{vmatrix} + \begin{vmatrix} x_2 & x_3 \\ y_2 & y_3 \end{vmatrix} + \begin{vmatrix} x_3 & x_4 \\ y_3 & y_4 \end{vmatrix} + \dots + \begin{vmatrix} x_n & x_1 \\ y_n & y_1 \end{vmatrix}\right]$

Straight lines: ① Slope $= \tan\theta = \frac{y_2 - y_1}{x_2 - x_1}$

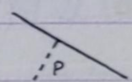
② Eqⁿ of line in various forms: ⓐ Point Slope form: $(y - y_1) = m(x - x_1)$

ⓑ 2-Point form: $y - y_2 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_2)$ OR $y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$

ⓒ Determinant form: $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = 0$ OR $A(\Delta) = 0$ ⓓ Slope-intercept form: $y = mx + c$

ⓔ Double intercept form: $\frac{x}{a} + \frac{y}{b} = 1$

ⓕ Perpendicular form (Normal form): $P = x\cos\alpha + y\sin\alpha$



ⓖ General form: → $ax + by + c = 0$: ⓘ Slope $= -\left(\frac{a}{b}\right)$ or $-\left[\frac{\text{Coeff of } x}{\text{Coeff of } y}\right]$

ⓘⓘ y-intercept $= -(c/b)$ ⓘⓘⓘ x-intercept $= -(c/a)$

③ Angle b/w 2 lines: $\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|$

④ Parallel Lines $(\theta = 0)$: ① $m_1 = m_2$ ② $L_1: y = mx + \underline{\underline{c}}$, $L_2: y = mx + \underline{\underline{k}}$

$\{L_1 \parallel L_2\}$

③ $L_1: ax + by + c = 0$, $L_2: ax + by + k = 0$

④ if $L_1 \parallel L_2 \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

⑤ $D(L_1, L_2) = \left|\frac{c_1 - c_2}{\sqrt{a^2 + b^2}}\right|$

⑤ Perpendicular Lines $(\theta = 90°) \Rightarrow \tan\theta =$ Undefined : ① $m_1 m_2 = -1$

⑥ Slope: $m_{new} = \tan(\alpha \pm \theta)$

⑦ $\left.\begin{array}{ll} L_1 = 0 ; & m_1 \\ L_2 = 0 ; & m_2 \\ L_3 = 0 ; & m_3 \end{array}\right\} m_1 > m_2 > m_3$

Tangents of interior angle formed are given by:

$\tan A = \frac{m_1 - m_2}{1 + m_1 m_2}$, $\tan B = \frac{m_2 - m_3}{1 + m_2 m_3}$, $\tan C = \frac{m_3 - m_1}{1 + m_1 m_3}$

POSL: $\begin{cases} \text{Point passing through origin (A)} \\ \text{Point passing through } P(\alpha, \beta) \text{ (B)} \end{cases}$

(A)

① eqⁿ of POSL: $(y - m_1 x)(y - m_2 x) = 0$

↳ Passing through origin: $ax^2 + 2hxy + by^2 = 0$

② $b\left(\frac{y}{x}\right)^2 + 2h\left(\frac{y}{x}\right) + a = 0 \begin{cases} \alpha = m_1 \\ \beta = m_2 \end{cases}$: ⓐ $m_1 + m_2 = \frac{-2h}{b}$ ⓑ $m_1 m_2 = \frac{a}{b}$

ⓒ $|m_1 - m_2| = \frac{2\sqrt{h^2 - ab}}{b}$ ⓓ $\tan\theta = \left|\frac{2\sqrt{h^2-ab}}{a+b}\right|$

d[ⓘ] if $a+b=0$, both lines Perpendicular.

d[ⓘⓘ] if $h=0$, lines are equally inclined with x-axis.

c[ⓘ] if $h^2 > ab$, 2-real & distinct lines

c[ⓘⓘ] if $h^2 = ab$, 2-real & coincide lines

c[ⓘⓘⓘ] if $h^2 < ab$, No-real lines

(B) ① eqⁿ of POSL $= (m_1 x + c_1)(m_2 x + c_2) = 0$

②

$\Delta = \begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}$; $\underbrace{\text{Eq}^n \text{ of POSL}}_{\text{when } \Delta = 0} = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$

$m_1 + m_2 = \frac{-2h}{b}$ $m_1 m_2 = \frac{a}{b}$ $\tan\theta = \left|\frac{2\sqrt{h^2-ab}}{a+b}\right|$

③ Eqⁿ of ang. bis. of $L_1 = 0$ & $L_2 = 0$: $\frac{(x-\alpha)^2 - (y-\beta)^2}{a-b} = \frac{(x-\alpha)(y-\beta)}{h}$

Point of intersection $\equiv (\alpha, \beta)$

- Rotation of Axes ⇒ $x = (x\cos\theta - y\sin\theta)$, $y = (x\sin\theta + y\cos\theta)$

- Shifting of origin ⇒ $(x, y) \equiv [(x+\alpha), (y+\beta)]$