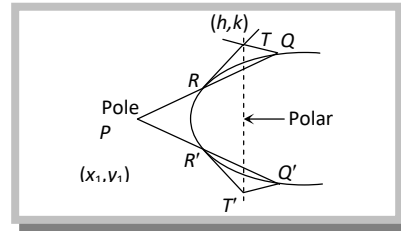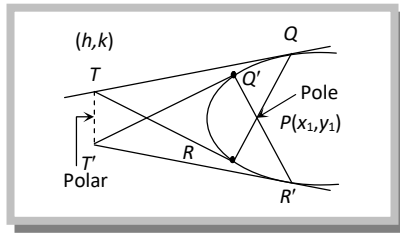# Pole and Polar.

The locus of the point of intersection of the tangents to the parabola at the ends of a chord drawn from a fixed point P is called the polar of point P and the point P is called the pole of the polar.

Equation of polar: Equation of polar of the point (x_1, y_1) with respect to parabola $y^2 = 4ax$ is same as chord of contact and is given by $yy_1 = 2a(x + x_1)$


(1) **Polar of the focus is directrix:** Since the focus is $(a, 0)$

$\therefore$ Equation of polar of $y^2 = 4ax$ is $y.0 = 2a(x + a) \Rightarrow x + a = 0$, which is the directrix of the parabola $y^2 = 4ax$.

(2) **Any tangent is the polar of its point of contact:** If the point $P(x_1 y_1)$ be on the parabola. Its polar and tangent at P are identical. Hence the tangent is the polar of its own point of contact.

Coordinates of pole: The pole of the line $lx + my + n = 0$ with respect to the parabola $y^2 = 4ax$ is $\left(\dfrac{n}{l}, \dfrac{-2am}{l}\right)$.
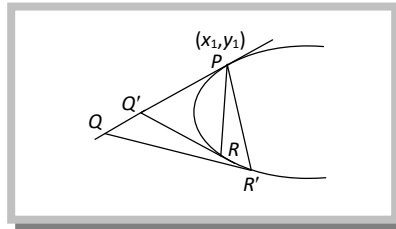
(i) Pole of the chord joining (x_1, y_1) and (x_2, y_2) is $\left(\dfrac{y_1 y_2}{4a}, \dfrac{y_1 + y_2}{2}\right)$ which is the same as the point of intersection of tangents at (x_1, y_1) and (x_2, y_2).

(ii) The point of intersection of the polar of two points Q and R is the pole of QR.