# Analytical Geometry of two dimensions

## Parabola :-

Q.) Find the equation of normal at any point $(x_1, y_1)$ to the parabola.

Sol:- We know that equation of tangent at the point $P(x_1, y_1)$ to the parabola $y^2 = 4ax$ is

$$yy_1 = 2a(x + x_1) \quad \text{——— (i)}$$

$$y = \frac{2a}{y_1}x + \frac{2ax_1}{y_1}$$

Again equation of the line through the point $P(x_1, y_1)$ is

$$y - y_1 = m(x - x_1) \quad \text{——— (ii)}$$

Now equation (ii) be the required equation of normal if it is $\perp$ to (i)

So, by the Condition of perpendicularity of the lines

$$m \cdot \frac{2a}{y_1} = -1$$

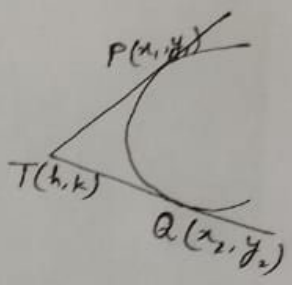
$$\text{or, } m = \frac{-y}{2a}$$

$\therefore$ from (ii), the required equation of the normal is

$$y - y_1 = \frac{1}{dy/dx}(x - x_1)$$

Q.) Find the equation of chord of contact at the tangents drawn from an external point $(h,k)$ to the parabola $y^2 = 4ax$.

Sol:- Let TP and TQ be two tangents drawn from an internal point $T(h,k)$ to the parabola $y^2 = 4ax$.




Equation of tangents are

$$yy_1 = 2a(x + x_1) \quad \text{——(i)}$$

$$y = \frac{2a}{y_1}x + \frac{2ax_1}{y_1} \quad \text{—(ii)}$$

Since both the tangents pass through $T(h,k)$ so its coordinates must satisfy equation (i) and (ii)

$\therefore$ we have

$$ky_1 = 2a(h + x_1) \quad \text{——(iii)}$$

$$ky_2 = 2a(h + x_2) \quad \text{——(iv)}$$

Generalising equation (iii) and (iv) we have

$$ky = 2a(h + x)$$

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This is required equation of the chord of Contact.