Lecture : 01

B. Sc. (Hon.) Part-I

Paper - II

Curvature

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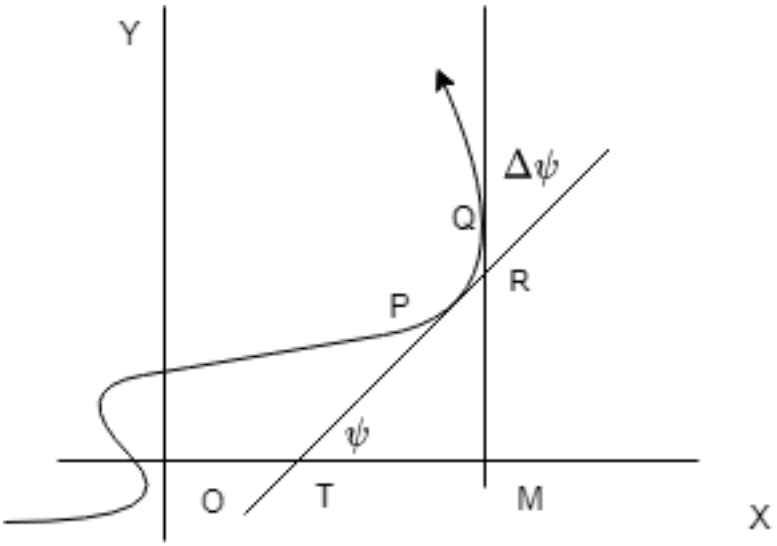


I. DEFINITION

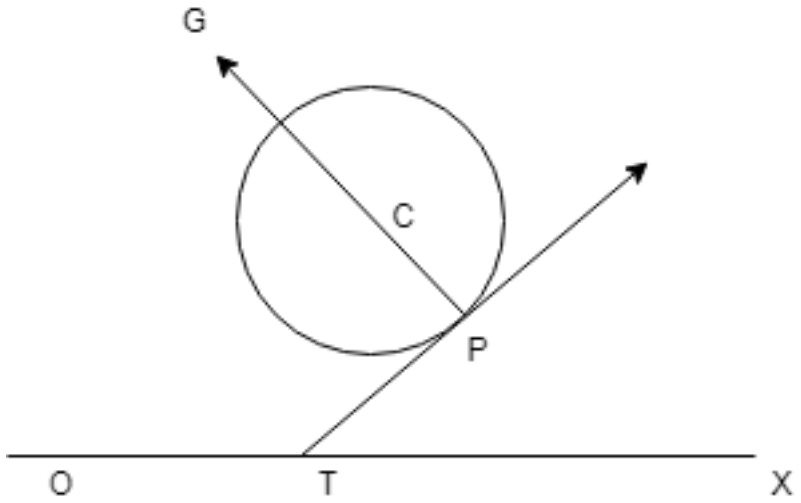
Let P be a given point on a curve, and Q be a point on the curve near P. Let the arc AP measured from a fixed point A on the curve be s, and AQ is $s+\Delta s$. Let $T\bar{P}L$ and $M\bar{R}Q$ be the tangent at P and Q respectively. Also let $m\angle PTM = \psi$ and $m\angle RMX = \psi + \Delta\psi$. Thus $\Delta\psi = m\angle QRL$ is the change in the inclination of the tangent line describes the arc $PQ(= \Delta s)$.

$\frac{\Delta\psi}{\Delta s}$is called the average curvature of the arc PQ.

The curvature at P is the limiting value when it exist, of the average curvature when $Q \to P$ along the curve, i.e., curvature at P

$$\chi = \lim_{\Delta s \to 0} \frac{\Delta\psi}{\Delta s} = \frac{d\psi}{ds}$$

Thus, *the curvature is the rate of change of direction of the curve with respect to the arc, or roughly speaking, the curvature is "the rate at which curve curves."* **Radius of curvature: The reciprocal of the curvature at any point is called *radius of curvature* at P and it is denoted by** ρ. Thus, $\rho = \frac{ds}{d\psi}$.



If a length PC equal to ρ is measured from P along the positive direction of the normal, the point C is called the *centre of curvature* at P, and the circle with centre C and radius CP is called the *circle of curvature* at P.

Any chord of this through the point of contact is called a *chord of curvature*.