1. **Slope** (i) The slope of a tangent to the curve $y = f(x)$ at the point (x_1, y_1) is given by

$$\left(\frac{dy}{dx}\right)_{(x_1, y_1)} \text{ or } f'(x_1).$$

(ii) The slope of a normal to the curve $y = f(x)$ at the point (x_1, y_1) is given by

$$\frac{-1}{\left(\frac{dy}{dx}\right)_{(x_1, y_1)}}.$$

NOTE If a tangent line to the curve $y = f(x)$ makes an angle θ with X-axis in the positive direction, then $\frac{dy}{dx}$ = Slope of the tangent $= \tan\theta$.

2. **Equations of Tangent and Normal**

(i) The equation of tangent to the curve $y = f(x)$ at the point $P(x_1, y_1)$ is given by

$$y - y_1 = m(x - x_1), \text{ where } m = \frac{dy}{dx} \text{ at point } (x_1, y_1).$$

(ii) The equation of normal to the curve $y = f(x)$ at the point $Q(x_1, y_1)$ is given by

$$y - y_1 = \frac{-1}{m}(x - x_1), \text{ where } m = \frac{dy}{dx} \text{ at point } (x_1, y_1).$$

3. If slope of the tangent line is zero, then $\tan\theta = 0$, so $\theta = 0$, which means that tangent line is parallel to the X-axis and then equation of tangent at the point (x_1, y_1) is $y = y_1$.

4. If $\theta \to \frac{\pi}{2}$, then $\tan\theta \to \infty$, which means that tangent line is perpendicular to the X-axis, i.e. parallel to the Y-axis and then equation of the tangent at the point (x_1, y_1) is $x = x_0$.