Tangent & Normal.

The value of derivative at $P(x_1, y_1)$ gives the slope of the tangent to the curve at P.

$$f'(x_1) = \left.\frac{dy}{dx}\right|_{x_1, y_1} = m \quad (\text{slope})$$

Equation of tangent at (x_1, y_1) is $y - y_1 = \left.\frac{dy}{dx}\right]_{x_1, y_1} (x - x_1)$

Equation of Normal at (x_1, y_1) is $y - y_1 = \frac{-1}{\left.\frac{dy}{dx}\right]_{x_1, y_1}} (x - x_1)$

The point $P(x_1, y_1)$ will satisfy the equation of curve & the equation of tangent & normal line.

$$dy = f'(x)\, dx$$

For independant variable x, increment Δx & differential dx are equal but this is not the case with the dependant variable y, i.e. $\Delta y \neq dy$.

if

$$y = f(x).$$

$$y + \Delta y = f(x + \Delta x) = f(x) + \frac{dy}{dx} \Delta x.$$

$$\frac{dy}{dx} = f'(x).$$