$$R = \frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\frac{d^2y}{dx^2}}$$

$$R = \frac{\left[1 + (\tan t)^2\right]^{3/2}}{\frac{\sec^2 t}{t\cos t}} = (1 + \tan^2 t)^{3/2} \times \frac{t\cos t}{\sec^2 t}$$

$$R = (\sec^2 t)^{3/2} \times \frac{t\cos t}{\sec^2 t}$$

$$R = \sec^3 t \times \frac{t\cos t}{\sec^2 t}$$

$$R = \sec t \times t\cos t$$

$$R = \frac{1}{\cos t} \times t\cos t$$

$$\therefore R = t$$

ii) $h = x - R\sin t$

$K = y + R\cos t$

$\therefore h = \cos t + t\sin t - t\sin t$

$h = \cos t$

$k = \sin t - t\cos t + t\cos t$

$k = \sin t$

$\therefore$ the coordinates for the radius of curvature are $(\cos t, \sin t)$

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Assignment 2 Solution

1.) i)

$x = \cos t + t\sin t$

$y = \sin t - t\cos t$

$\therefore R = \dfrac{\left[1 + \left(\dfrac{dy}{dx}\right)^2\right]^{3/2}}{\dfrac{d^2y}{dx^2}}$

$\dfrac{dx}{dt}$, $\dfrac{dy}{dx} = \dfrac{dy}{dt} \times \dfrac{dt}{dx}$

$\dfrac{dx}{dt} = -\sin t + t\cos t + \sin t(1)$

$\dfrac{dx}{dt} = t\cos t \quad \therefore \dfrac{dt}{dx} = \dfrac{1}{t\cos t}$

$\dfrac{dy}{dt} = \cos t - (-t\sin t + \cos t) = \cos t + t\sin t - \cos t$

$\therefore \dfrac{dy}{dt} = t\sin t$

$\therefore \dfrac{dy}{dx} = t\sin t \times \dfrac{1}{t\cos t} = \tan t$

$\dfrac{dy}{dx} = \tan t$

$\therefore \dfrac{d^2y}{dx^2} = \sec^2 t \times \dfrac{dt}{dx} = \sec^2 t \times \dfrac{1}{t\cos t}$

$\therefore \dfrac{d^2y}{dx^2} = \dfrac{\sec^2 t}{t\cos t}$