Oluwademilade Adeyemo
Mechatronics
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$x = \cos t + t\sin t$

$dx/dt = -\sin t + t\cos t + \sin t$

$dx/dt = t\cos t$

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

$dy/dt = \cos t + t\sin t - \cos t$

$dy/dt = t\sin t$

$dy/dx = dy/dt \times dt/dx$

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

$= \frac{\sin t}{\cos t}$

$\therefore d^2y/dx^2 = \frac{d}{dt}\left(\frac{\sin t}{\cos t}\right) \times \frac{dt}{dx}$

$d^2y/dx^2 = \frac{(\cos t)(\cos t) - (\sin t)(-\sin t)}{\cos^2 t} \times \frac{1}{t\cos t}$

$\frac{d^2y}{dx^2} = \frac{\cos^2 t + \sin^2 t}{\cos^2 t} \times \frac{1}{t\cos t}$

From trigonometric functions $\cos^2 t + \sin^2 t = 1$

$\therefore d^2y/dx^2 = \frac{1}{t\cos^3 t}$

I. Radius of curvature (R)

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

$R = \left(1 + \left(\frac{dy}{dx}\right)^2\right)^{3/2} \times \frac{dx^2}{dy}$

$= \left(1 + \left(\frac{dy}{dy}\right)^2\right)^{3/2} \times t\cos^3 t$

$= \left(1 + \left(\frac{\sin t}{\cos^2 t}\right)^{3/2} \times t\cos^3 t$