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Mechanical Engineering
EMLA 281 Assignment

The parametric equations of a curve are as given in the Equations

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

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

In terms of t , determine

- i an expression for the radius of curvature (R), and
- ii expressions for the coordinates (h, k) of the centre of curvature.

Solution

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

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

$$\frac{dx}{dt} = -\sin t + t \cos t + \sin t$$

$$\frac{dx}{dt} = t \cos t$$

$$\frac{dy}{dt} = \cos t - [-t \sin t + \cos t]$$

$$\frac{dy}{dt} = \cos t + t \sin t - \cos t$$

$$\frac{dy}{dt} = t \sin t$$

$$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$$

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

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

$$\frac{d^2y}{dx^2} = \frac{d}{dx} \left[\frac{dy}{dx} \right] \times \frac{dt}{dx}$$