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C ENG 281
D Elect Elect
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Question and Answers

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

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

An expression for the radius of Curvature (R) in terms of t

Answer

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

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

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

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

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

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

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

$\frac{d^2y}{dx^2} = u = \sin t \quad v = \cos t$

$\frac{du}{dt} = \cos t \quad \frac{dv}{dt} = -\sin t$

$\frac{v\,du/dt - u\,dv/dt}{v^2}$

$\frac{\cos t(\cos t) - (\sin t)(-\sin t)}{(\cos t)^2} \times \frac{1}{t\cos t}$

$\frac{\cos^2 t + \sin^2 t}{\cos^2 t} \times \frac{1}{t \cos t}$

$\therefore \theta = \frac{1}{t_{on}} \times t_{on}t$

$\theta = t$

$h = x_1 - t\sin t$

$k = y_1 + t\cos t$

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

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

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

$h = \cos t$

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

$k = \sin t$

Expressions for the coordinates ~~h and~~ (h, k) or the centre of curvature in terms of t.

answer

$$h = x_1 - R\sin\theta$$
$$k = y_1 + R\cos\theta$$

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

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

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

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