HALIM NOBERT UDOCHUKWUKA
ENG 281 (ASSIGNMENT 1) ENGINEERING MATHEMATICS
U/EN/S/62/021
COMPUTER ENGINEERING
200 LEVEL

1. $x = \cos t + t\sin t$
$y = \sin t - t\cos t$

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

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

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

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

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

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

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

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

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

$\frac{[\cos t][\cos t] - [\sin t][-\sin t]}{[\cos t]^2} \times \frac{1}{t\cos t}$

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

$= \frac{1}{\cos^2 t} \times \frac{1}{t\cos t} = \frac{1}{t\cos^3 t}$

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

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

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

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

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

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

$$= \frac{1}{\cos^3 t} \Big/ \frac{1}{t \cos^2 t}$$

$$R = \frac{1}{\cos^3 t} \times t \cos^2 t$$

$$\therefore R = t$$

b) $h = x_1 = R \sin\theta$

$k = y_1 = R \cos\theta$

$R = t$

$\theta = \tan^{-1}\left(\frac{dy}{dx}\right)$

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

$\theta = \frac{1}{\tan t} \times \tan t$

$\theta = t$

$h = x_1 - t \sin t$

$k = y_1 + t \cos t$

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

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

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

$h = \cos t$

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

$= \sin t$

$(h, k) = (\cos t, \sin t)$