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

$$\frac{1}{t\cos^3 t}$$

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

$$\frac{1}{t\cos^3 t}$$

$$\left[\frac{1}{(\cos t)^2}\right]^{3/2} \div \frac{1}{t(\cos t)^3}$$

$$\frac{1^{3/2}}{(\cos t)^{2 \times 3/2}} \times \frac{t(\cos t)^3}{1}$$

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

$R = t$.

Recall θ is also $= t$; $R = t$

(h, k)

$h = x - R\sin\theta$

$k = y + R\cos\theta$

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

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

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

$k = \sin t - t\cos t\ (t\cos t)$

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

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

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

NAME: IORMEE MCDAVIS SAMUEL
MATRIC NO.: 16/ENG07/013
DEPT.: PETROLEUM ENGINEERING

1) Parametric equation of a curve is given as eqn 1 & 2

$x = \cos t + \sin t$ --- eqn 1

$y = \sin t - t\cos t$ --- eqn (2)

determine radius R.
determine coordinates (h, k) at centre of curvature.

Soln

$x = \cos t + \sin t$

$\frac{dx}{dt} = \frac{du}{dt} + \frac{dv}{dt}$

$= -\sin t$

$\frac{dv}{dt}$ - using product rule $t = p$, $\sin t = q$

$\frac{dv}{dt} = p\frac{dq}{dt} + q\frac{dp}{dt}$

$= t\cos t + \sin t \cdot 1$

$= t\cos t + \sin t$

$\frac{dv}{dt} = \sin t + \cos t$

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

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

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

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

$\frac{dy}{dt} = \frac{du}{dt} - \frac{dv}{dt}$

$v = t\cos t$, i.e. t, $\cos t$

$\frac{dq}{dt} = -\sin t$, $\frac{dp}{dt} = 1$

$\frac{dv}{dt} = p\frac{dq}{dt} + q\frac{dp}{dt}$

$= t \cdot -\sin t + \cos t \cdot 1$

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

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

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

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

but $\frac{dt}{dx} = \left(\frac{dx}{dt}\right)^{-1}$

$\frac{dy}{dx} = t\sin t \times (t\cos t)^{-1}$

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

$\theta = \tan^{-1}\tan t$

$\theta = t$

$\frac{d^2y}{dx^2} = \frac{d\left(\frac{dy}{dx}\right)}{dt} \div \frac{dx}{dt}$

$= \sec^2 t \div t\cos t$

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

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

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