Finamo Ungwanyi Abraham [illegible]
[illegible] Elect/Elect

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Maths Assignment

(a) $x = \cos t + t\sin t$

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

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

$$\frac{dx}{dt} = -\sin t + (t\cos t + (1)\sin t)$$

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

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

$$\frac{dy}{dt} = \cos t + (-t\sin t + (1)\cos t)$$

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

$$\frac{dy}{dt} = 2\cos t - t\sin t$$

$$\frac{dy}{dx} = \frac{2\cos t - t\sin t}{t\cos t} = \frac{2\cos t}{t\cos t} - \frac{t\sin t}{t\cos t}$$

$$\frac{dy}{dx} = \frac{2}{t} - \frac{\sin t}{\cos t} = \frac{2}{t} - \tan t$$

$$2t^{-1} - \tan t$$

(b)

$$\frac{d^2y}{dx^2} = -2t^{-2} - \sec^2 t$$

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

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

Since $\sec t = \frac{1}{\cos t}$ $\therefore$ $\sec^2 t = \left(\frac{1}{\cos t}\right)^2$

$$\frac{d^2y}{dx^2} = \frac{-2t^{-3} - \left(\frac{1}{\cos t}\right)'}{t\cos t}$$

$$\frac{d^2y}{dx^2} = \frac{-2t^{-3}}{t\cos t} - \frac{[illegible]}{t\cos t}$$

$$\frac{d^2y}{dx^2} = -2t^{[illegible]} - \frac{[illegible]}{t\cos t}$$

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

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

[illegible]

$$R = \frac{\left[\left(1 + \frac{2}{t} - [illegible]\right)^2\right]^{3/2}}{\left(\frac{-2t^{-3}}{\cos t} - \frac{1}{t\cos t}\right)}$$

(ii) $x - R\sin\theta = H$

$y + R\cos\theta = K$

$\cos t + t\sin t - R\sin\theta = H$

$\sin t + t\cos t - R\cos\theta = K$

$h = \cos t + t\sin t - \left[\frac{[illegible]^{3/2}}{\frac{-2t^{-3}}{\cos t} - \frac{1}{t\cos t}}\right] \sin\theta - [illegible]$