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ELECT/ELECT

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

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

$dy/dt = \cos t - (-t\sin t + \cos t)$

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

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

$dy/dt = \underline{t\sin t}$

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

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

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

$dx/dt = t\cos t$

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

$d^2y/dx^2 = \frac{d}{dt}\frac{(\tan t)}{} \times dt/dx$

$d^2y/dx^2 = \sec^2 t \times 1/t\cos t$

$= t^{-1}\sec^3 t$

$= 1/t \times 1/\cos^2 t$

$\therefore \frac{d^2y}{dx^2} = t^{-1}\sec^3 t$

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

$d^2y/dx^2 = \frac{d}{dt}(\tan t) \times dt/dx$

$d^2y/dx^2 = \sec^2 t \times 1/t\cos t$

$= t^{-1}\sec^3 t$

$= 1/t \times 1/\cos^2 t$

$\therefore \frac{d^2y}{dx^2} = t^{-1}\sec^3 t$

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

$$\frac{\left(1 + (\tan t)^2\right)^{3/2}}{t^{-1}\sec^3 t}$$

$$R = \frac{(1+\tan^2 t)^{3/2}}{t^{-1}\sec^3 t}$$

$$R = \frac{(\sec t)^{2 \times 3/2}}{t^{-1}\sec^3 t}$$

$$R = \frac{(\sec t)^3}{t^{-1}(\sec t)^3} = t^1 = \underline{\underline{t \text{ units}}}$$

Centre of Curvature

$x_1 = h + R\sin\theta$

$h = x_1 - R\sin\theta$

$k = y_1 + R\cos\theta$

$\theta = \tan^{-1}\left[\frac{dy}{dx}\right]$

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

$\theta = t$

$x_1 = \cos t + t\sin t$

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

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

$\underline{h = \cos t}$

$k = y_1 + R\cos\theta$

$y_1 = \sin t - t\cos t$

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

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

$k = \sin t$

Centre of curvature =

$\underline{\cos t, \sin t}$