UNAOGU CHINAGOROM . M.
17/ENG06/086.
MECHANICAL ENGR.

(2)

1) $F = x^2 i + (3x+2)j + \sin x\, k$.

(a) $\frac{dF}{dx} = 2xi + 3j + \cos x\, k$.

(b) $\frac{d^2F}{dx^2} = 2i - \sin x\, k$

c) $\left|\frac{dF}{dx}\right| = \sqrt{(2)^2 + (3)^2 + (1)^2}$; $2xi + 3j + \cos x\, k$ at $x = 1$.

$= \sqrt{4+9+1}$

$= \sqrt{14}$.

$= 3.74$.

(d) $d/dx\,(f \cdot f)$ at $x = 1$.

$f \cdot f = (x^2 i + 3x + 2)j + \sin x\, k \cdot (x^2 i + (3x+2)j + \sin x\, k)$.

$= x^4 i + (9x^2 + 12x + 4)j + (\sin^2 x)k$.

$d/dx\,(F \cdot F) = 4x^3 + 18x + 12 + \sin(2x)$.

$= 4 + 18 + 12 + 0.035$ at $x = 1$. $= 34.034$

$\therefore d/dx\,(F \cdot F) = 34.034$.

(2) $r = (t^2 + 3t)i - 2\sin 3t\, j + 3e^{2t}$

$\therefore dr/dt = (2t+3)i - 6\cos 3t\, j + 6e^{2t}k$.

$d^2r/dt = d/dt\left[\frac{dr}{dt}\right]$

$= d/dt\left[(2t+3)i + (-6\cos 3t)j + 6e^{2t}k\right]$

$\frac{d^2r}{dt^2} = 2i + (18\sin 3t)j + 12e^{2t}k$.

$\left|\frac{d^2r}{dt^2}\right| = \sqrt{(2)^2 + (18\sin 3(0))^2 + (12e^{2(0)})^2}$

$= \sqrt{4 + 144}$

$= 2\sqrt{37}$

$= 12.17$ u.