

NAME :- EMTIAWUFEH ELTORBE  
 DEPARTMENT: COMPUTER ENG  
 MATRIC NO: 17/ENG02/020  
 COURSE: ENG 282

Question 1

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

$$dF = 2x i + 3j + \cos x k$$

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

c.  $\left| \frac{dF}{dx} \right|$

Recall  $\frac{dF}{dx} = 2i + 3j + \cos x k$

when  $x=1$   $\frac{dF}{dx} = 2i + 3j + k$

$$\begin{aligned} \left| \frac{dF}{dx} \right| &= \sqrt{(2)^2 + (3)^2 + (1)^2} \\ &= \sqrt{4+9+1} \\ &= \sqrt{14} \\ &= 3.74 \end{aligned}$$

d.  $\frac{d}{dx}(F \cdot F)$  at  $x=1$

$$\begin{aligned} F \cdot F &= (x^2 i + (3x+2)j + \sin x k) \cdot (x^2 i + (3x+2)j + \sin x k) \\ &= (x^2 - x^2)i + (3x+2)(3x+2)j + (\sin x)(\sin x)k \\ &= x^4 i + (9x^2 + 6x + 4)j + (\sin^2 x)k \end{aligned}$$

$$F \cdot F = x^4 i + (9x^2 + 6x + 4)j + (\sin^2 x)k$$

$$\frac{d}{dx}(F \cdot F) = 4x^3 + 18x + 12 + \sin(2x)$$

$$\begin{aligned} \frac{d}{dx}(F \cdot F) &= 4x^3 + 18 + 12 + 0.035 \\ &= 34.035 \end{aligned}$$

$$\frac{d}{dx}(F \cdot F) = 34.035$$

Question 2

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

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

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

$$\begin{aligned} \frac{d}{dt} \left[ (2t+3)i + (-6\cos t)j + 6e^{2t}k \right] \\ = \frac{d^2 r}{dt^2} = 2i + (18\sin t)j + 12e^{2t}k \end{aligned}$$

$$\left| \frac{d^2 r}{dt^2} \right| = \sqrt{(2)^2 + (18 \sin^2(0))^2 + (120^{2(0)})^2}$$

$$\text{at } t=0$$

$$= \sqrt{2^2 + (18 \sin(0))^2 + (120^0)^2}$$

$$= \sqrt{4 + 44}$$

$$= \sqrt{148}$$

$$= 2\sqrt{37}$$

$$= 12.17$$