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Assignment 2

1A1EAC021012

Computer Engineering

① Given that

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

Find

②  $\frac{df}{dx} = 2xi + 3j + \cos x k$

At  $x = 1$

$$\frac{df}{dx}(dx) = 2(1)i + 3j + \cos(1)k$$

$$= 2i + 3j + 0.9998k$$

b.  $\frac{d^2f}{dx^2} = \frac{d}{dx} \left[ \frac{df}{dx} \right] = 2i - \sin x k$

at  $x = 1$

$$\frac{d^2f}{dx^2}(dx^2) = 2i - \sin(1)k$$

$$= 2i - 0.0175k$$

c.  $\left| \frac{d^2f}{dx^2} \right| = \sqrt{2^2 + 3^2 + 0.9998^2}$   
 $= \sqrt{2^2 + 3^2 + 0.9998^2}^{1/2}$   
 $= 3.74$

$$d. \quad \frac{d}{du}(F \cdot F)$$

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

$$= x^4 + (9x^2 + 12x + 4) + (\sin^2 x)$$

Remember

$$i \cdot i = j \cdot j = k \cdot k = 1$$

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

$$u = x = 1$$

$$\frac{d}{du}(F \cdot F) = 4 + 18 + 12 + 2 \sin(1) \cos(1)$$

$$= 4 + 30 + 0.035$$

$$= 34.035$$

$$\textcircled{2} \quad \vec{r}(t)$$

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

derivative

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

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

$$\frac{dr}{dt} = (2(0) + 3)i - 6 \cos 3(0)j + 6e^{2(0)} k$$

$$= 2i - 6j + 6k$$

$$\textcircled{b} \quad \frac{d}{dt} \left( \frac{dr}{dt} \right) = 2i + 18 \sin 3t j + 12e^{2t} k$$

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

$$\frac{d^2 r}{dt^2} = 2i + 18 \sin 3(0)j + 12e^{2(0)} k$$

$$= 2i + 12k$$

①

$$\left| \frac{2^2}{2^2} \right| = 2^2 + 12^2$$

$$= [2^2 + 12^2]^{1/2}$$

$$= [4 + 144]^{1/2}$$

$$= [148]^{1/2}$$

$$= \sqrt{148}$$

$$= \sqrt{4 \times 37}$$

$$= \sqrt{4} \times \sqrt{37}$$

$$= 2\sqrt{37}$$