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17/ENG08/015

ENG 282 Assignment 2

1. Given that

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

(a)  $\frac{df}{dx} = 2xi + 3j + \cos xk$

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

(c)  $\frac{df}{dx}$  at  $x=1$

$$\frac{df}{dx} = 2i + 3j + 0.9998k$$

$$\left| \frac{df}{dx} \right| = \sqrt{2^2 + 3^2 + (0.9998)^2} = 3.74 \text{ units}$$

(d)  $\frac{d}{dx} (f \cdot f)$

$$f \cdot f = (x^2 i + (3x+2)j + \sin xk) \cdot (x^2 i + (3x+2)j + \sin xk)$$

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

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

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

at  $x=1$

$$\frac{d}{dx} (f \cdot f) = 4(1)^3 + 18(1) + 12 + 2 \sin(1) \cos(1)$$

$$= 4 + 18 + 12 + 0.035$$

$$= 34.035$$





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

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

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

$$(c) \quad \frac{d^2 r}{dt^2} \text{ at } t = 0$$

$$\frac{d^2 r}{dt^2}$$

$$\frac{d^2 r}{dt^2} = 2j + 12k$$

$$\frac{d^2 r}{dt^2}$$

$$\left| \frac{d^2 r}{dt^2} \right| = \sqrt{2^2 + 0^2 + 12^2} = \sqrt{148} \Rightarrow 12.17 \text{ unit}$$