

## Assignment 11.

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

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

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

$$(c) \left. \frac{dF}{dx} \right|_{x=1}$$

when  $x=1$

Recall that  $2xi + 3j + \cos x k$ .

$$2(1)i + 3j + \cos(1)k.$$

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

$$= \sqrt{2^2 + 3^2 + 1^2}$$

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

$$= \sqrt{14}$$

$$= 3.74$$

$$(d) \left. \frac{d}{dx} (F \cdot F) \right|_{x=1}$$

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

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

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

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

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

$$= 4x^3 + 18x + 12 + \sin 2x.$$

when  $x=1$

$$4 + 18 + 12 + 0.0349$$

$$= 34.034$$

Question 2.

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

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

$$(b) \frac{d^2r}{dt^2} = \frac{d}{dt} \left( \frac{dr}{dt} \right)$$

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

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

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

$$= \sqrt{2^2 + (18\sin 0)^2 + (12e^0)^2}$$

$$= \sqrt{4 + 144}$$

$$= \sqrt{148}$$

$$= 2\sqrt{37}$$

$$= \underline{\underline{12.17}}$$