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17/ENQ02/019

Computer Engineering

ENQ 282: ENGINEERING MATHEMATICS II (ASSIGNMENT III)

ASSIGNMENT II

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

$$a) \frac{\partial F}{\partial x} = 2xi + 3j + \cos xk$$

$$b) \frac{\partial^2 F}{\partial x^2} = 2j - \sin xk$$

$$\begin{aligned} c) \left| \frac{dF}{dx} \right| &= \text{at } x=1 = 2(1)i + 3j + \cos(1)k \\ &= 2i + 3j + 0.999k \\ &= \sqrt{2^2 + 3^2 + (0.999)^2} \\ &= \sqrt{4 + 9 + 0.998} \\ &= \sqrt{13.998} \\ &= 3.74 \end{aligned}$$

$$d) \frac{\partial}{\partial x} (F \cdot F)$$

$$\begin{aligned} (F \cdot F) &= (x^2 + (3x+2)j + \sin xk) \cdot (x^2 + (3x+2)j + \sin xk) \\ &= x^4 + 9x^2 + 12x + 4 + \sin^2 x \end{aligned}$$

$$\frac{d(\sin^2 x)}{dx} = \sin^2 x = \sin x$$

$$u = \sin x, \quad v = \sin x$$

$$\frac{du}{dx} = \cos x, \quad \frac{dv}{dx} = \cos x$$

Using product rule.

$$u \frac{dv}{dx} + v \frac{du}{dx}$$

$$= \sin(\cos x) + \sin$$

$$= \sin x (\cos x) + \sin x (\cos x)$$

$$= \sin x \cos x + \sin x \cos x$$

$$\sin^2 x = 2 \sin x \cos x$$

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

$$\text{at } x=1 = 4(1) + 18(1) + 12 + 2 \sin(1) \cos(1)$$

$$4 + 18 + 12 + 0.034$$

$$= 34.06$$

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

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

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

$$c) \quad \left. \frac{d^2r}{dt^2} \right|_{at \ t=0} = 2\mathbf{i} + 18\sin 3(0)\mathbf{j} + 12e^{2(0)}\mathbf{k}$$

$$= 2\mathbf{i} + 0 + 12\mathbf{k}$$

$$= \sqrt{2^2 + 12^2} = \sqrt{4 + 144} = \sqrt{148} = 12.16$$