

AGUDANIRU ROSEMARY
 17ENEC01/003
 CHEMICAL ENGINEERING
 ENG 282 ASSIGNMENT

11 Given that $F = x^2i + (3x+2)j + \sin xk$
 find a) $\frac{dF}{dx}$ b) $\frac{d^2F}{dx^2}$ (c) $\left| \frac{dF}{dx} \right|$ (d) $\frac{d(F \cdot F)}{dx}$ at $x=1$

SOLUTION

1) $\frac{dF}{dx} = 2xi + 3j + \cos xk$

2) $\frac{d^2F}{dx^2} = xi + (-\sin x)k = xi - \sin xk$

3) $\left| \frac{dF}{dx} \right| = \sqrt{2x^2 + 3^2 + (\cos x)^2} = \sqrt{4x + 9 + \sin^2 x}$

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

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

$$= x^4i + (3x+2)^2j + \sin^2 xk$$

at $x=1 = i + 25j + (3.045 \times 10^{-4})k$

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

$= 0$

$$3. \quad r = (t^2 + 3t)i - 2\sin 8tj + 3e^{2t}k$$

determine

a) $\frac{dr}{dt}$

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

c) $\left| \frac{d^2r}{dt^2} \right|$ at $t=0$

SOLUTION

a) $\frac{dr}{dt} = (2t + 3)i - 6\cos 8tj + 6e^{2t}k$

b) $\frac{d^2r}{dt^2} = 2i + 18\sin 8tj + 12e^{2t}k$

c) $\left| \frac{d^2r}{dt^2} \right|$ at $t=0$

$$= 2i + 0j + 12k$$

$$= \sqrt{2^2 + 12^2}$$

$$= \sqrt{4 + 144} = \sqrt{148} = 12.166$$