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PETROLEUM ENGINEERING

17/ENG09/006

ENG 282 Assignment 2.

① Given that

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

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

③ $\frac{d^2F}{dx^2} = 2i + (-\sin x)k$
 $= 2i - \sin x k //$

④ $\frac{dF}{dx}$ at $x=1$

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

$$\left| \frac{dF}{dx} \right| = \sqrt{(2)^2 + (3)^2 + (0.9998)^2}$$

$$= \sqrt{4+9+0.9996}$$

$$= \sqrt{13.9996}$$

$$= 3.74 \text{ units} //$$

⑤ $\frac{d(F \cdot F)}{dx}$

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

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

NB, $i \cdot i = 1$

$j \cdot j = 1$

$k \cdot k = 1$

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

at $x=1$

$$= 4(1)^3 + 18(1) + 12 + 2 \sin(1) \cos(1)$$

$$= 4 + 18 + 12 + 0.035 = 34.035 //$$

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

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

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

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

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

$$\left| \frac{d^2r}{dt^2} \right| = \sqrt{(2)^2 + (0)^2 + (12)^2}$$

$$= \sqrt{4 + 0 + 144}$$

$$= \sqrt{148}$$

$$= 12.17 \text{ units/s}^2$$