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$$1.) F = x^2 i + (3x+2)j + \sin x k$$

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

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

$$c) \left(\frac{dF}{dx} \right)_{\text{at } x=1} = \sqrt{2} \quad \frac{dF}{dx} = 2(1)i + 3j + \cos 1 k$$

$$\left| \frac{dF}{dx} \right| = \sqrt{2^2 + 3^2 + (\cos 1)^2} = \sqrt{4 + 9 + 0.9996} \\ = \sqrt{14}$$

$$d) \frac{d^2 F}{dx^2} \text{ at } x=1 \Rightarrow 2i + j + (-\sin 1)k$$

d(F.F)

$$x \quad F \cdot F = x^2 i + (3x+2)j + \sin x k \cdot F \\ = x^4 i + (9x^2 + 12x + 4)j + \sin^2 x k$$

$$\frac{d(F \cdot F)}{dx} = 4x^3 + (18x + 12)j + 2 \cos 2x \\ = 4(1) + 18(1) + 12 + 2 \cos 2(1) \\ = 4 + 18 + 12 + 2 \cos 2 \\ = 35.998$$

$$2. \quad r = (t^2 + 3t)i - 26 \sin 3t j + 3e^{2t} k$$

$$\frac{dr}{dt} = 2t + 3i - 6 \sin 6 \cos t + 6e^{2t} k$$

$$\frac{d^2r}{dt^2} = 2i - (36 \sin^2 t + 36 \cos^2 t)j + 12e^{2t} k$$

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

$$= 2i + 36j + 12k$$

$$= \sqrt{2^2 + 36^2 + 12^2} = \sqrt{1444}$$

$$= 38$$