

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

$$c) \left| \frac{d^2r}{dt^2} \right| \text{ at } t=0 = 2i + [18 \sin(3) \cos]j + 12e^{2 \cdot 0}k$$
$$= 2i + 18 \sin 0j + 12e^0k$$

$$\left| \frac{d^2r}{dt^2} \right| = \frac{2i + 12k}{\sqrt{2^2 + 12^2}}$$
$$= \sqrt{148} = 12.17$$

1) Given that  $F = x^2 i + (3x+2) j + \sin x k$ . find a)  $dF/dx$   
(b)  $d^2F/dx^2$  (c)  $d(F \cdot F)/dx$  (d)  $d/dx(F \cdot F)$  at  $x=1$ .

Soln

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

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

$$c) \left| \frac{dF}{dx} \right| = \sqrt{2x^2 + 3^2 \cos^2 x}$$

$$= \sqrt{4x^2 + 9 + \cos^2 x}$$

$$\text{at } x=1 \sqrt{4(1)^2 + 9 + \cos^2(1)} = \sqrt{13.99} = 3.74$$

$$d) \frac{d(F \cdot F)}{dx} = (F \cdot F)' = [x^2 i + (3x+2) j + \sin x k] \cdot [2xi + (3x+2)j + \sin x k]$$

$$= x^4 + (9x^2 + (3x+2)) + \sin^2 x$$

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

$$d/dx(F \cdot F) = 4x^3 + 18x + 12 + 2\sin x \cos x$$

$$d/dx(F \cdot F) = 4(1)^3 + 18(1) + 12 + 2\sin(1) \cos(1)$$

$$\text{at } x=1$$

$$= 4 + 18 + 12 + 0.635$$

$$= 34.635$$

2) If  $r = (t^2 + 3t)i - 2\sin 3t j + 3e^{2t} k$  find (a)  $dr/dt$  (b)  $d^2r/dt^2$   
(c)  $\left| \frac{d^2r}{dt^2} \right|$  at  $t=0$

Soln

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