

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

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

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

c. $\left| \frac{dF}{dx} \right| = \sqrt{2^2 + 3^2 + 1^2}$ at $x = \left| \frac{dF}{dx} \right| = 2i + 3j + k$
 $= \sqrt{13}$

$F \cdot F = [x^2 i + (3x+2) j + \sin x k] \cdot [x^2 i + (3x+2) j + \sin x k]$
 $= x^4 + (3x+2)^2 + \sin^2 x$ [i.i = j.j = k.k = 1]

$\frac{d(F \cdot F)}{dx} = 4x^3 + 2(3)(3x+2) + 2 \cos x$
 $= 4x^3 + 6(3x+2) + 2 \cos x$ at $x=1$
 $= 4 + 6(5) + 2(1) = 36$

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

a. $\frac{dr}{dt} = (2t+3) i - 6 \cos 3t j + 9e^{3t} k$

$$b. \frac{d^2 r}{dt^2} = 2i + 18\sin 3t j + 27e^{3t} k$$

$$c \text{ at } t = 0.$$

$$\left. \frac{d^2 r}{dt^2} \right|_{t=0} = 2i + 0 + 27k$$

$$\left| \frac{d^2 r}{dt^2} \right| = \sqrt{2^2 + 27^2}$$
$$= \underline{27.07}$$