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

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

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

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

$= \sqrt{13}$

d. $F \cdot F = \left[x^2 i + (3x+2) j + \sin x\, k\right] \cdot \left[x^2 i + (3x+2) j + \sin x\, k\right)$

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

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

at $x = 1$

$= 4 + 4(5) + 2(1) = 36$ //

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

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

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

c. at $t = 0$;

$= 2i + 0 + 27k$

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

$= 27.07$ //