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ENG 282.

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

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

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

c.  $\left| \frac{dF}{dx} \right| = \sqrt{2^2 + 3^2 + 1} = \sqrt{14}$       i.e at  $x = \left| \frac{\partial F}{\partial x} \right| = 2i + 3j + k$

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

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

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

at  $x = 1.$

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

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

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

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

c. at  $t = 0 = 2i + 0j + 27k.$

$\left| \frac{d^2 v}{dt^2} \right| = \sqrt{2^2 + 27^2} = 27.074 //$