

32

2, 8, 8, 18

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Mechanical Engineering

ENG 282

~~Ans~~

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

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

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

c) $\left| \frac{\partial F}{\partial x} \right| = \sqrt{2^2 + 3^2 + 1}$ i.e. at $x = \left| \frac{\partial F}{\partial x} \right| = 2i + 3j + k$
 $= \sqrt{13}$

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

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

at $x = 1$

$= 4 + 4(5) + 2(1) = \underline{\underline{36}}$

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

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

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

c) at $t = 0 = 2i + 0 + 27k$

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