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

$F \cdot F = x^4 + (9x^2 + 12x + 4) + \sin^2 x$

$\frac{d(F \cdot F)}{dx} = 4x^3 + (18x + 12) +$

Using product rule to differentiate $\sin^2 x$

$\sin^2 x = \sin x \cdot \sin x$

$\frac{du}{dx} = \cos x$

$\frac{dv}{dx} = \cos x$

$\frac{d}{dx}uv = u\frac{dv}{dx} + v\frac{du}{dx}$

$\frac{dy}{dx} = \sin x \cdot \cos x + \sin x \cdot \cos x$

$= 2\sin x \cos x.$

$\frac{d(F \cdot F)}{dt} = 4x^3 + (18x + 12) + 2\sin x \cos x.$

at $x = 1$ $= 4(1)^3 + (18(1) + 12) + 2\sin(1)\cos(1)$

$= 4 + 18 + 12 + 2(0.017 \times 0.99)$

$= 34 + 0.03366$

$= 34.03_{11}$

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

determine.

a) $\frac{dr}{dt}$

b) $\frac{d^2r}{dt^2}$ and

c) the value of $\left|\frac{d^2r}{dt^2}\right|$ at $t = 0$

a) $\frac{dr}{dt}$

b) $\frac{d^2r}{dt^2}$

c) at

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ENG 282 Assignment 2.

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

Find

a) $\frac{dF}{dx}$

b) $\frac{d^2F}{dx^2}$

c) $\left|\frac{dF}{dx}\right|$, and

d) $\frac{d}{dx}(F \cdot F)$ at $x = 1$.

Solution:

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

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

c) $\left|dF/dx\right|$ at $x = 1$

$dF/dx = 2(1)i + 3j + \cos(1) k$.

$= 2i + 3j + 0.99k$

$|dF/dx| = \sqrt{(2)^2 + (3)^2 + (0.99)^2}$

$= \sqrt{4+9+0.99}$

$= \sqrt{10.99}$

$= 3.32$.

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

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

c $at\ t=0 \quad = 2i + 18\sin 3(0)\, j + 12e^{2(0)} k$

$= 2i + 12k.$

$\left|\frac{d^2r}{dt^2}\right| at\ t=0 = \sqrt{2^2 + 12^2}$

$= \sqrt{4+144}$

$= \sqrt{148}$

$= 12.17_{(2)}$