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19|ENG05|048
MECHATRONICS ENGINEERING
MAT 102 ASSIGNMENT
~~Elijah~~

(1) A particle moves along a curve, $x = t^2$, $y = 5t^2 + t$ and $z = t + 7$ where t is time. Find Acceleration.

$r = xi + yj + zk$

$\therefore r = (t^2)i + (-5t^2 + t)j + (t+7)K$

Velocity $= \frac{dr}{dt} = (2t)i + (-10t + 1)j + K$

Acceleration $= \frac{dV}{dt} = \frac{d^2r}{dt^2} = 2i - 10j + K_4$

$\therefore$ Acceleration $= 2i - 10j + K_4$

(2) $P = i - 9j - 4K$, $Q = 8i - 3j + 6K$, $R = i - 4j - 3k$

find $(P \times Q) \cdot (R \times P)$

$$(P \times Q) = \begin{vmatrix} i & j & K \\ 1 & -9 & -4 \\ 8 & -3 & 6 \end{vmatrix} = i\begin{bmatrix} -9 & -4 \\ -3 & 6 \end{bmatrix} - j\begin{bmatrix} 1 & -4 \\ 8 & 6 \end{bmatrix} + K\begin{bmatrix} 1 & -9 \\ 8 & -3 \end{bmatrix}$$

$$= i[-54 - 12] - j[6 - (-32)] + K[-3 - (-72)]$$

$$(P \times Q) = -66i - 38j + 69K_4$$

$$(R \times P) = \begin{vmatrix} i & j & K \\ 1 & -4 & -3 \\ 1 & -9 & -4 \end{vmatrix} = i\begin{bmatrix} -4 & -3 \\ -9 & -4 \end{bmatrix} - j\begin{bmatrix} 1 & -3 \\ 1 & -4 \end{bmatrix} + K\begin{bmatrix} 1 & -4 \\ 1 & -9 \end{bmatrix}$$

$$= i[16 - 27] - j[-4 - (-3)] + K[-9 - (-4)]$$

$$(R \times P) = -11i + j - 5K$$

$$\therefore (P \times Q) \cdot (R \times P) = (-66i - 38j + 69k) \cdot (-11i + j - 5k)$$

$$= [-66 \times -11] + [-38 \times 1] + [69 \times -5]$$

$$= 726 - 38 - 345$$

$$= 726 - [38 + 345]$$

$$= 726 - 383$$

$$\therefore (P \times Q) \cdot (R \times P) = 343_4$$

(3) $F = (5\cos 7t)i + (-2e^{3t})j + (-4t^3)k$

$$\int F dt = \int 5\cos 7t\,(i) + \int -2e^{3t}\,(j) + \int -4t^3\,(k) + c$$

$$= [5(7\sin 7t)]i + [-2[\tfrac{1}{3}e^{3t}]]j + [-4(\tfrac{t^{3+1}}{4})]k + c$$

$$\therefore \int F dt = 35\sin 7t\,(i) - \tfrac{2}{3}e^{3t}\,(j) - t^4\,(k) + c_4$$