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Department: Mechanics Engineering

1 $x = t^2, y = -5t^2 + t, z = t + 7$

$r = xi + yj + zk$

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

velocity = $\frac{dr}{dt} = 2ti + (-10t)j + (1)k$

$= 2ti - 10tj + k$

acceleration = $\frac{d^2r}{dt^2} = 2i - 10j$

2 If $P = i - 9j - 4k$

$Q = 8i - 3j + 6k$

$R = i - 4j - 3k$

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

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

$= i((-9 \times 6) - (-3 \times -4)) - j((1 \times 6) - (-4 \times 8)) + k((1 \times -3) - (-9 \times 8))$

$= -66i - 38j + 75k$

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

$= i((-4 \times -4) - (-3 \times -9)) - j((1 \times -4) - (-3 \times 1)) + k((1 \times -9) - (-4 \times 1))$

$= -11i + j - 5k$

$\therefore (P \times Q) \cdot (R \times P) = (-66i - 38j + 75k) \cdot (-11i + j - 5k)$

$= 726 + -38 - 375$

$= 313$

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

$$= -\frac{5}{7} \sin 7t i - \frac{2}{3} e^{3t} j - t^4 k$$

