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Assignment:

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

$r = xi + yj + zk$

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

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

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

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

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

$R = i - 4j - 3k$

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

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

$i(-54 - (12)) - j(6 - (-32)) + k(-3 - (-72))$

$i(-66) - j(38) + k(69)$

$= -66i - 38j + 69k$

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

$+k\begin{vmatrix} 1 & -4 \\ 1 & -9 \end{vmatrix}$

$= i(16-27) - j(-4-(-3)) + k(-9-(-4))$

$= i(-11) - j(-1) + k(-5)$

$= -11i + j - 5k$

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

$= 726 - 38 - 345$

$= 343$

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

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

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

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

$$\int F = \frac{5i}{7}\int \cos 4u\, du - \frac{2j}{3}\int e^{u}\, du - 4k\int \frac{t^3+1}{3+1}$$

$$\int F = \frac{5i}{7}(\sin 4u) - \frac{2j}{3}(e^{u}) - 4k\left(\frac{t^4}{4}\right) =$$

$$\int F = \frac{5\sin 7ti}{7} - \frac{2e^{3t}}{3}j - t^4 k + C$$