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

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

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

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

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

$$\therefore \text{Acceleration} = 2i - 10j$$

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

$$\text{Find } (P \times Q) \cdot (R \times P)$$

Soln

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

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

$$= -66i + 26j + 69k$$

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

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

$$= -11i + j - 5k$$

$$\begin{aligned}
 (P \times Q) \cdot (R \times P) &= (-66i + 26j + 69k) \cdot (-11i + j - 5k) \\
 &= 726 + 26 - 345 \\
 &= 407
 \end{aligned}$$

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

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

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

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