

NUMERIK PASCAL CITTAMANI

MECHATRONICS ENGINEERING

19/EMG051043

$$1) \quad X = t^2, \quad Y = -5t^2 + t, \quad Z = t + 7$$

$$\frac{dA}{dt} = 2t\mathbf{i} + (-10t + 1)\mathbf{j} + \mathbf{k}$$

$$\frac{d^2A}{dt^2} = 2\mathbf{i} - 10\mathbf{j} + \mathbf{k}$$

$$2) \quad P = \mathbf{i} - 9\mathbf{j} - 4\mathbf{k}, \quad Q = 8\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}, \quad R = \mathbf{i} - 4\mathbf{j} - 3\mathbf{k}$$

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

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

$$= \mathbf{i} \begin{vmatrix} -9 & -4 \\ -3 & 6 \end{vmatrix} - \mathbf{j} \begin{vmatrix} 1 & -4 \\ 8 & 6 \end{vmatrix} + \mathbf{k} \begin{vmatrix} 1 & -9 \\ 8 & -3 \end{vmatrix}$$

$$= \mathbf{i}(-54 - 12) - \mathbf{j}(6 + 32) + \mathbf{k}(-3 + 72)$$

$$= -66\mathbf{i} - 38\mathbf{j} + 69\mathbf{k}$$

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

$$= \mathbf{i} \begin{vmatrix} -4 & -3 \\ -9 & -4 \end{vmatrix} - \mathbf{j} \begin{vmatrix} 1 & -3 \\ 1 & -4 \end{vmatrix} + \mathbf{k} \begin{vmatrix} 1 & -4 \\ 1 & -9 \end{vmatrix}$$

$$= \mathbf{i}(16 - 27) - \mathbf{j}(-4 + 3) + \mathbf{k}(-9 + 4)$$

$$= -11\mathbf{i} + \mathbf{j} - 5\mathbf{k}$$

$$= -11\mathbf{i} + \mathbf{j} - 5\mathbf{k}$$

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

$$= (-66\mathbf{i} - 38\mathbf{j} + 69\mathbf{k}) \cdot (-11\mathbf{i} + \mathbf{j} - 5\mathbf{k})$$

$$= 726\mathbf{i} - 38\mathbf{j} - 345\mathbf{k}$$

$$(P \times Q)(R \times P) = 343$$

$$3) \int \mathbf{r} dt = \int (5 \sin 7t \mathbf{i} + 5 \cos 7t \mathbf{j} - 2e^{3t} \mathbf{j} - 4t^3 \mathbf{k}) dt$$

$$\int \mathbf{r} dt = \left[\frac{5}{7} \sin 7t \mathbf{i} - \frac{2}{3} e^{3t} \mathbf{j} - t^4 \mathbf{k} + \mathbf{C} \right]$$

$$\int \mathbf{r} dt = \frac{5}{7} \sin 7t \mathbf{i} - \frac{2}{3} e^{3t} \mathbf{j} - t^4 \mathbf{k} + \mathbf{C}$$