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DEPARTMENT: MECHATRONICS

MATRICE NO: 191ENIGOS1001

Assignment

1. A particle moves along a curve  $x=2t^2$ ,  $y=-5t^2+t$ ,  $z=t+7$  where  $t$  is time find its acceleration.

Solution

$$x=2t^2 \quad y=-5t^2+t \quad z=t+7$$

Acceleration is  $\frac{d^2r}{dt^2}$

$$\begin{aligned} \frac{dr}{dt} &= [2t]i + [-10t + 1]j + [1]k \\ &= [2t]i + [-10t + 1]j + 1k \\ &= 2ti + [-10t + 1]j + 1k. \end{aligned}$$

$$\begin{aligned} \frac{d^2r}{dt^2} &= 2i + [-10]j + 0k \\ &= 2i - 10j + 0k. \end{aligned}$$

2. If  $P = i - 9j - 4k$ ,  $Q = 8i - 3j + 6k$ ,  $R = i - 4j - 3k$  - find  $(P \times Q) \cdot (R \times P)$

Solution

$$P = i - 9j - 4k \quad Q = 8i - 3j + 6k \quad R = i - 4j - 3k$$

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

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

$$i(-66) - j(6 + 32) + k(69)$$

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

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

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

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

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

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

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$[P \times Q], [R \times P]$

$$= [-66i - 38j + 69k] \cdot [-14i + j - 5k]$$

$$= 726 - 38 - 345 = \underline{\underline{343}}$$

3 Given  $f = 5\cos 7t \mathbf{i} - 2e^{3t} \mathbf{j} - 4t^3 \mathbf{k}$ , find the integral of  $f$  with respect to  $t$ .

Solution

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

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

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

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