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19/SCI01/034

Computer Science

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

solution

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

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

$$\frac{dr}{dt} = 2ti - 10tj + k$$

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

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

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

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

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

$$R = i - 4j - 3k$$

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

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

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

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

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

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

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

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

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

$$(-66i - 38j + 69k) \cdot (-11i + j - 5k)$$

$$= 726 - 38 - 345$$

$$= 343$$

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

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

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

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

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