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MECHATRONICS ENGINEERING

MAT 102

- ① A particle move along a curve  $x = t^2$ ,  $y = -t^2 + t$ ,  $z = t + 7$   
 given  $t$  time find its acceleration

Ans

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

$$\frac{dr}{dt} = v = 2t i + (10t + 1) j + k$$

$$\frac{dv}{dt} = a = 2i + 10j + 0k$$

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

$$(P \times Q) = \begin{vmatrix} i & j & k \\ 1 & -9 & -4 \\ 8 & -3 & 6 \end{vmatrix} = i(-54 - 12) - j(6 + 32) + k(-3 + 72)$$

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

$$(R \times P) = \begin{vmatrix} i & j & k \\ 1 & -4 & -3 \\ 1 & -9 & -4 \end{vmatrix} = i(16 - 27) - j(-4 + 3) + k(-9 + 4)$$

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

$$(P \times Q) \cdot (R \times P) = (-66 \times -11) + (38 \times 1) + (69 \times -5) = 726 + 38 - 345 = 419$$

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

Ans

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

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