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DEPARTMENT: COMPUTER SCIENCE

MATRIC NO: 19/SCIO1/015

### ASSIGNMENT

- (1) A particle moves along a curve  $x = 7t^2$ ,  $y = 6t^2 - 4t$ ,  $z = t - 5$ , where  $t$  is time. Find its velocity.

Solution.

$$x = 7t^2, y = 6t^2 - 4t \text{ and } z = t - 5$$

$$r = xi + yj + zk$$

$$r = (7t^2)i + (6t^2 - 4t)j + (t - 5)k$$

$$\text{Velocity} = \frac{dr}{dt}$$

$$\frac{dr}{dt} = 14ti + (12t - 4)j + k$$

$$\frac{dr}{dt} = 14ti + (12t - 4)j + k$$

- (2) If  $A = i + 2j - 4k$ ,  $B = 2i - 3j + k$ ,  $C = 4j - 3k$ . Find  $A \times (B \times C)$

Solution

$$A = i + 2j - 4k$$

$$B = 2i - 3j + k$$

$$C = 4j - 3k$$

$$(B \times C) = \begin{vmatrix} i & j & k \\ 2 & -3 & 1 \\ 0 & 4 & -3 \end{vmatrix}$$

$$(B \times C) = i \begin{vmatrix} -3 & 1 \\ 4 & -3 \end{vmatrix} - j \begin{vmatrix} 2 & 1 \\ 0 & -3 \end{vmatrix} + k \begin{vmatrix} 2 & -3 \\ 0 & 4 \end{vmatrix}$$

$$= i(9 - 4) - j(-6 - 0) + k(8 - 0)$$

$$= 5i + 6j + 8k$$

$$A \times (B \times C) = \begin{vmatrix} i & j & k \\ 1 & 2 & -4 \\ 5 & 6 & 8 \end{vmatrix}$$

$$A \times (B \times C) = i \begin{vmatrix} 2 & -4 \\ 6 & 8 \end{vmatrix} - j \begin{vmatrix} 1 & -4 \\ 5 & 8 \end{vmatrix} + k \begin{vmatrix} 1 & 2 \\ 5 & 6 \end{vmatrix}$$

$$A \times (B \times C) = i(16+24) - j(8+20) + k(10-6)$$

$$= 40i - 28j + 4k$$

h

3. Given  $R = 4\sin 3t i + 4e^{3t} j + 7t^3 k$ , find the integral of  $R$  with respect to  $t$ .

Solution

$$R = 4\sin 3t i + 4e^{3t} j + 7t^3 k$$

$$\int R = \int 4\sin 3t i + \int 4e^{3t} j + \int 7t^3 k$$

$$\int R = 4i \int \sin 3t + 4j \int e^{3t} + 7k \int t^3$$

$$\int R = \frac{4i}{3} (-\cos(3t)) + \frac{4j}{3} e^{3t} + \frac{7k}{4} t^4$$

$$\int R = \frac{-4\cos(3t)}{3} i + \frac{4e^{3t}}{3} j + \frac{7t^4}{4} k$$

4. If  $A = 7i + 2j - k$ ,  $B = 2i + j + 4k$ ,  $C = i + j + k$ , find  $(A+C) \cdot (B-A)$

Solution

$$A = 7i + 2j - k$$

$$B = 2i + j + 4k$$

$$C = i + j + k$$

$$(A+C) \cdot (B-A) = [(7i + 2j - k) + (i + j + k)] \cdot [(2i + j + 4k) - (7i + 2j - k)]$$

$$= [8i + 3j + 0k] \cdot [-5i - j + 5k]$$

$$= -40 - 3 + 0$$

$$= -43$$

h

5. Find a unit vector tangent to the space curve  $x=t$ ,  $y=t^2$ ,  $z=t^3$  at the point where  $t=1$ .

Solution

$$\underline{T} = \frac{dr}{dt}$$
$$\left| \frac{dr}{dt} \right|$$

$$r = xi + yj + zk$$

$$r = ti + t^2j + t^3k$$

$$\frac{dr}{dt} = i + 2tj + 3t^2k$$

$$\text{at } t=1, \frac{dr}{dt} = i + 2j + 3k$$

$$\underline{\frac{dr}{dt}} = i + 2(1)j + 3(1)^2k$$

$$= i + 2j + 3k$$

$$\left| \frac{dr}{dt} \right| = \sqrt{(1)^2 + (2j)^2 + (3k)^2}$$

$$\left| \frac{dr}{dt} \right|_{t=1} = \sqrt{1^2 + 2^2 + 3^2}$$

$$= \sqrt{1+4+9}$$

$$= \sqrt{14} = 3.74$$

$$\text{Hence } \underline{T} = \frac{i + 2j + 3k}{3.74}$$