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DEPT: MECHANICAL ENGINEERING.

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ASSIGNMENT TITLE: MR OKUNOLA AND DR OYEJAMI

QUESTION:

1. A particle moves along a curve $x = 2t^3$, $y = 6t^2 - 4t$, $z = t - 5$, where t is time find velocity.

Soln

The position velocity $v = x, y, z$

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

$$\text{velocity} = \frac{dv}{dt}$$

$$\frac{dv}{dt} = 14t + (2t - 4)j + k.$$

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

Soln

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

$$= i \begin{vmatrix} -3 & 1 \\ 4 & -3 \end{vmatrix} - j \begin{vmatrix} 2 & 1 \\ 0 & -3 \end{vmatrix} + k \begin{vmatrix} 2 & -3 \\ 0 & 4 \end{vmatrix}$$

$$\vec{B} \times \vec{C} = i(9 - 4) - j(-6 - 0) + k(5 - 0)$$

$$\vec{B} \times \vec{C} = 5i + 6j + 5k$$

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

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

solve

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

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

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

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

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

$$= \sqrt{14}$$

$$= 3.7$$

$$\text{hence } T = \frac{1 + 2j + 3k}{3.7}$$

$$= i \begin{vmatrix} 2 & -4 \\ 5 & 8 \end{vmatrix} - j \begin{vmatrix} 1 & -4 \\ 5 & 8 \end{vmatrix} + k \begin{vmatrix} 1 & 2 \\ 5 & 5 \end{vmatrix}$$

$$= i(16 - (-20)) - j(8 - (-20)) + k(5 - 10)$$

$$= i(16 + 20) - j(8 + 20) + k(-5)$$

$$= 36i - 28j - 5k$$

③ Given $P = 4\sin 3t i + 4e^{2t} j + 2t^3 k$

find the integral of P with respect to t .

Solu

$$\frac{dV}{dt} = 12\cos 3t i + 3e^{2t} j + 2t^2 k$$

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

Solu

$$(A + C) = (2i + 2j - k) + (i + j + k)$$

$$= 3i + 3j$$

$$(B - A) = (2i + j + 4k) - (2i + 2j - k)$$

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

$$= -j + 5k$$

$$\therefore (A + C) \times (B - A) = (3i + 3j) \times (-j + 5k)$$

$$= 30 - 3$$

$$= 27$$