Name: Okuntade Olatunde George
Department: Aeronautical and Astronautical Engineering
Matric No.: 19/ENG 09/018
Assignment Title: MR OKUNLOLA AND DR OYELAMI 3 GROUPS

Questions:

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

Solution

The position velocity $r = x_i + y_j + zk$

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

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

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

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

Solution

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

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

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

$\bar{B} \times \bar{C} = 5i + 5j + 8k$

Hence:

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

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

$= 1(16-(-20)) - j(8-(-20)) + k(5-10)$
$= 1(16+20) - j(8+20) + k(-5)$
$= 36i - 28j - 5k$

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

Solution

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

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

Solution

$(A+C) = (-7i + 2j - k) + (i + j + k)$
$= -6i + 3j$
$(B-A) = (2i + j + 4k) - (7i + 2j - k)$
$= 7i + j + 4k - 7i - 2j + k$
$= 5i - j + 5k$
$\therefore (A+C) * (B-A) = (-6i + 3j)(-5i - j + 5k)$
$= 30 - 3$
$= 27$

5. find a unit vector tangent to the Space Curve $x = t$, $y = t^2$, $z = t^3$ at the point where $t = 1$.

$r = t_i + t^2_j + t^3 k$

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

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

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

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

$= \sqrt{14}$

$= 3.7$

Hence $T = \frac{i + 2j + 4k}{3.7}$