LECTURER'S NAME: MR OKUNADOLA

DATE SUBMITTED: 16/04/2020.

NAME OF STUDENT: ABE OLUWATOMISIN THADDEUS.

DEPARTMENT: MECHATRONICS.

MATRIC NO. 19/ENG05/001.

Assignment

1. If $A = 5i - 7j - 6k$, $B = j + 4k$, $C = 9i - 4j + k$ find $-8(A+B)\cdot(C-A)$.

Solution

$A = 5i - 7j - 6k \quad B = j + 4k \quad C = 9i - 4j + k.$

$-8(A+B)$

$A+B = [5i - 7j - 6k] + [j + 4k]$

$= [5i + 0i] + [-7j + j] + [-6k + 4k]$

$= 5i - 6j - 2k$

$-8[5i - 6j - 2k]$

$= -40i + 48j + 16k.$

$C-A = [9i - 4j + k] - [5i - 7j - 6k]$

$= [9i - 5i] + [-4j - (-7j)] + [k - (-6k)]$

$= 4i + [-4j + 7j] + k + 6k$

$= 4i + 3j + 7k.$

$[-40i + 48j + 16k]\cdot[4i + 3j + 7k].$

$= -160i + 144j + 112k = \underline{\underline{96}}$

2. Find the unit vector tangent to the space curve $x=-3t$, $y=t^2$, $z=4t^3$ at the point where $t=1$.

<u>Solution</u>

$x=-3t \quad y=t^2 \quad z=4t^3.$

$r = a_x i + a_y j + a_z k.$

$$\frac{dr}{dt} = -3t\,i + t^2 j + 4t^3 k$$

$$= -3i + 2t\,j + 12t^2 k.$$

at $t=1$ $\frac{dr}{dt} = -3i + 2j + 12k.$

$$\left|\frac{dr}{dt}\right|_{t=1} = \sqrt{(-3)^2 + 2^2 + 12^2} = 12.53.$$

Hence, $T = \dfrac{\frac{dr}{dt}}{\left|\frac{dr}{dt}\right|} = \dfrac{-3i + 2j + 12k}{12.53}.$

3. A particle moves along a curve, $x = -8t^2$ $y = t^2 - 4t$ $z = t + 1$, where t is time. find its acceleration

Solution.

$x = -8t^2$ $\quad y = t^2 - 4t$ $\quad z = t + 1$

Acceleration $= \dfrac{d^2r}{dt^2}$

$$\frac{d^2r}{dt^2} = -8t^2 i + [t^2 - 4t] j + [t+1] k$$

$$\frac{dr}{dt} = -16t i + [2t - 4] j + [1] k$$

$$\frac{d^2r}{dt^2} = -16 i + [2t] j$$

$$= -16 i + 2t j$$

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

<u>Solution</u>

$A = i+2j-4k$ $B = 2i-3j+k$ $C = 4i-3k$.

$(A\times B)\times C$

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

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

$i(2-(12)) - j(1-(-8)) + k(-3-4)$

$= i(-10) - j(9) + k(-7)$

$= -10i - 9j - 7k$

$$(\bar{A}\times\bar{B})\times\bar{C} = \begin{vmatrix} i & j & k \\ -10 & -9 & -7 \\ 0 & 4 & -3 \end{vmatrix}$$

$$i\begin{vmatrix} -9 & -7 \\ 4 & -3 \end{vmatrix} - j\begin{vmatrix} -10 & -7 \\ 0 & -3 \end{vmatrix} + k\begin{vmatrix} -10 & -9 \\ 0 & 4 \end{vmatrix}$$

$i(27-(-28)) - j(30-0) + k(-40-0)$

$i(27+28) - j(30) + k(40)$

$= 55i - 30j + 40k$.

5. Given

$R = 4\sin 3t\,i + 4e^{3t}j + 7t^3k$. find the integral of R with respect to t from 0 to 1

solution

$$\int_0^1 4\sin 3t\,i + 4e^{3t}j + 7t^3k$$

$$\int_0^1 4\sin 3t\,i + \int_0^1 4e^{3t}j + \int_0^1 7t^3k.$$

$$\int_0^1 \frac{-4\cos 3t}{3} + \int_0^1 \frac{4e^{3t}}{3} + \int_0^1 \frac{7t^4}{4}$$

$$i\left[\frac{-4\cos 3(1)}{3} - \left[-\frac{4\cos 3(0)}{3}\right]\right]_0^1 + j\left[\frac{4e^{3(1)}}{3} - \frac{4e^{3(0)}}{3}\right]_0^1 + k\left[\frac{7(1)^4}{4} - \frac{7(0)^4}{4}\right]_0^1$$

$$= i[-1.3315 + 1.33] + j[26.78 - 1.33] + k[1.75 - 0k]$$

$$= -0.0051i + 25.45j + 1.75k$$