NAME: AWALA DIVINE PAUL

MATRIC N0: 19/ENG05/016

DEPARTMENT: MECHATRONICS ENGINEERING.

COURSE: MAT 102

COVID-19 HOLIDAY 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

   $\vec{r} = \text{x}i + \text{y}j + \text{z}k$

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

   $\frac{d\vec{r}}{dt}$ = velocity = v

   $\frac{d\vec{r}}{dt}$ = (14t)i + (12t – 4)j + k

   ∴ Velocity = (14t)i + (12t – 4)j + k

2. If A = i + 2j – 4k, B = 2i – 3j + k, C = 4j – 3k. Find A × (B × C).

   SOLUTION

   A × (B × C)

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

   (B × C) = [(– 3 × – 3) – 4]i – [(– 3 × 2) – 0]j + [(2 × 4) – 0]k

   = 5i + 6j + 8k

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

   A × (B × C) = [16 – (– 24)]i – [8 – (– 20)]j + [6 – 10]k

   ∴ A × (B × C) = 40i – 28j – 4k

3. Given

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

   SOLUTION

   $\int Rdq = \int[\,(4\sin 3t)i + (4e^{3t})j + (7t^3)k]dt$

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

   = $(4 \times \frac{-1}{3}\cos 3t)i$ + $(4 \times \frac{1}{3}e^{3t})j$ + $(\frac{7t^4}{4})k$

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

4. If A = $7i + 2j - k$, B = $2i + j + 4k$, C = $i + j + k$. Find (A + C) . (B – A)

SOLUTION

(A + C) . (B – A)

$= [(7i + 2j - k) + (i + j + k)] . [(2i + j + 4k) - (7i + 2j - k)]$

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

(A + C) . (B – A) $= [8i + 3j + 0k] . [-5i - j + 5k]$

$= -40 - 3 + 0$

$= -43$

$\therefore$ (A + C) . (B – A) = – 43

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

$\vec{r} = \mathrm{x}i + \mathrm{y}j + \mathrm{z}k$

$\vec{r} = \mathrm{t}i + \mathrm{t}^2 j + \mathrm{t}^3 k$

$\mathrm{T} = \frac{dr/dt}{|dr/dt|}$

$\frac{d\vec{r}}{dt} = i + 2\mathrm{t}j + 3\mathrm{t}^2 k$ where t = 1

$\frac{d\vec{r}}{dt_{t=1}} = i + 2j + 3k$

$\left|\frac{dr}{dt}\right|_{t=1} = \sqrt{1^2 + 2^2 + 3^2} = \sqrt{1 + 4 + 9} = \sqrt{14} = 3.74$

Hence, $\mathrm{T} = \frac{dr/dt}{|dr/dt|} = \frac{i + 2\mathrm{t}j + 3\mathrm{t}^2 k}{3.74}$

$\therefore \mathrm{T} = \frac{i + 2\mathrm{t}j + 3\mathrm{t}^2 k}{3.74}$