

NOTE:

DEPT: ARCHITECTURE, COLLEGE: SCIENCES

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MAT-NO: 19/SCI181004

MAT 102

$$\begin{aligned} 1. (A+B) &= 5i - 7j - 6k + j + 4k \\ &= 5i - 6j - 2k \end{aligned}$$

$$\begin{aligned} (C-A) &= 9i - 4j + k - 5i - 7j - 6k \\ &= 4i + 3j + 7k \end{aligned}$$

$$\begin{aligned} -8(A+B) &= -8(5i - 6j - 2k) \\ &= -40i + 48j + 16k \end{aligned}$$

$$\begin{aligned} -8(A+B) \cdot (C-A) &= -40(4) + 48(3) + 16(7) \\ &= -160 + 144 + 112 \\ &= 96 \end{aligned}$$

2. Tangent vector

$$\frac{dx}{dt} = -3 \rightarrow -3 = -3$$

$$\frac{dy}{dt} = 2t \rightarrow 2(1) = 2$$

$$\frac{dz}{dt} = 12t^2 \rightarrow 12(1)^2 = 12$$

$$\text{tangent vector} = \langle -3, 2, 12 \rangle$$

constd.

$$\text{Unit tangent vector} = \frac{v}{|v|}$$

$$|v| = \sqrt{(-3)^2 + (2)^2 + (12)^2}$$

$$= \sqrt{9 + 4 + 144}$$

$$= \sqrt{157}$$

$$= 12.53$$

$$\frac{v}{|v|} = \frac{\langle -3, 2, 12 \rangle}{12.53}$$

$$= \left\langle \frac{-3}{12.53}, \frac{2}{12.53}, \frac{12}{12.53} \right\rangle$$

3. Let  $P(x, y, z)$  be any point on the given curve and  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$  be the position vector of  $P$  relative to  $O$  as origin.

Then ~~THE POSITION VECTOR~~

$$\vec{r} = 8t^2\hat{i} + t^2 - 4t\hat{j} + t + 1\hat{k}$$

$$\text{velocity} = \frac{d\vec{r}}{dt} = 16t\hat{i} + 2t - 4\hat{j} + \hat{k}$$

$$\text{acceleration} = \frac{d^2\vec{r}}{dt^2} = \frac{d}{dt}(16t\hat{i} + 2t - 4\hat{j} + \hat{k})$$

$$\text{acceleration} = 16\hat{i} + (2-0)\hat{j} + 0$$

$$= 16\hat{i} + 2\hat{j}$$

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

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

$$= (2 - 12) + (1 - (-8)) + (-3 - 4)$$

$$A \times B = -10\hat{i} + 9\hat{j} + (-7)\hat{k}$$

$$= -10\hat{i} + 9\hat{j} - 7\hat{k}$$

$$\text{let } A \times B = D = -10\hat{i} + 9\hat{j} - 7\hat{k}$$

$$D \times C = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -10 & 9 & -7 \\ 0 & 4 & -3 \end{vmatrix}$$

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

$$= (-27 - (-28)) + (30 - 0) + (-40 - 0)$$

$$= 1\hat{i} + 30\hat{j} + (-40)\hat{k}$$

$$= 1\hat{i} + 30\hat{j} - 40\hat{k} //$$

$$b) \mathbf{r} = 4 \sin 3t \mathbf{i} + 4e^{3t} \mathbf{j} + 7t^3 \mathbf{k}$$

$$= \left\langle \int_0^1 4 \sin 3t \, dt, \int_0^1 4e^{3t} \, dt, \int_0^1 7t^3 \, dt \right\rangle$$

$$= \left\langle \frac{4 \cos(3t) + C}{3}, \frac{4e^{3t} + C}{3}, \frac{7t^4 + C}{4} \right\rangle$$