Name : Prince · A · Brown

Course : MAT 102

matric : 19/ENG05/1002

Department : Mechatronic Engr.

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

$c = 9i - 4j + 1k$

$8(A+B) = 8(5i - 6j - 2k) = -40i + 48j + 16k$

$(C-A) = 9i - 4j + 1k - (5i - 7j - 6k) =$

$4i + 3j + 7k.$

$-8(A+B)\cdot(C-A) = (-40i + 48j + 16k)\cdot$

$(4i + 3j + 7k)$

$= -160i + 144j + 112k$

2) Position vector $(r) = (-3t)i + (t^2)j + (4t^3)k$

Tangent vector i.e

$r^{-1}(t) = -3i + 2tj + 12t^2k$

$r^{-1}(1) = -3i + 2(1)j + 12(1)^2k$

$= -3i + 2j + 12k$

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Unit tangent Vector

magnitude $\sqrt{(-3)^2 + 2^2 + 1^2} = \sqrt{167}$

$$= \frac{-3}{\sqrt{157}}, \frac{2}{\sqrt{157}}, \frac{12}{\sqrt{157}}$$

$$= \langle 0.24, 0.16, 0.96 \rangle$$

3.) $r = (-8t^2)i + (t^2 - 4t)j + (t+1)k$

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

Acceleration Vector $= \dfrac{d^2r}{dt^2} = -16i + (2t)$

4.) $((A \times B) \times C)$

$$(A \times B) = \begin{array}{ccc} + & - & + \\ \left| \begin{array}{ccc} i & j & K \\ 1 & 2 & -4 \\ 2 & -3 & 1 \end{array} \right| \end{array}$$

$$= i \begin{vmatrix} 2 & -4 \\ -3 & 1 \end{vmatrix} - j \begin{vmatrix} 1 & -4 \\ 2 & 1 \end{vmatrix} \; K \begin{vmatrix} 1 & 2 \\ 2 & -3 \end{vmatrix}$$

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

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

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

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

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

$= i(27-(-28)) - j(-10-0) + k(-40-0)$

$= \underline{55i + 10j} - 40k$

5.) $R = \int (4\sin 3t)\,i + \int 4e^{3t}\,j + \int (7t^3)\,k$

$$= \int \left(-\frac{4}{3}\cos 3t\right) i + \left(\frac{4}{3}e^{3t} + c\right) j + \left(\frac{7t^4}{4} + c\right)$$

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