

NAME: OGUNLATTA OMOLARA ABIODUN

COURSE: MATH 102

MATRIC NO: 19/ENG09/013

DEPARTMENT: AERONAUTICAL ENGINEERING (100 LEVEL)

ASSIGNMENT

1. The position vector (r)

$$r = xi + yj + zk$$

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

$$\text{velocity} = \frac{dr}{dt} = (14t)i + (12t - 4)j + k$$

$$\text{Velocity} = \underline{\underline{(14t)i + (12t - 4)j + k}}$$

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

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

$$R_{11} = i(9 - 4) = 5i$$

$$R_{12} = -j(-6 - 0) = 6j$$

$$R_{13} = k(8 - (+0)) = 8k$$

$$(B \times C) = 5i + 6j + 8k$$

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

$$R_{11} = i(16 - (-24)) = 40i$$

$$R_{12} = -j(8 - (-20)) = -28j$$

$$R_{13} = k(6 - (10)) = -4k$$

$$A \times (B \times C) = \underline{\underline{40i - 28j - 4k}}$$

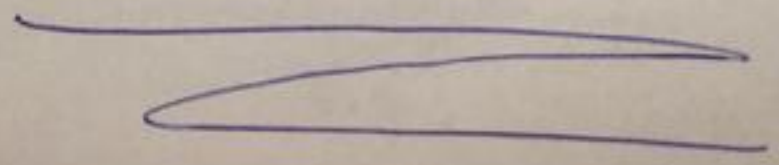
3. $R = 4 \sin 3t i + 4e^{3t} j + 7t^3 k$ (Integrate)

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

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

$$= 4i \left[-\frac{1}{3} \cos 3t \right] + 4j \left[\frac{1}{3} e^{3t} \right] + 7k \left[\frac{t^4}{4} \right]$$

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



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$$\begin{aligned} 4. (A+C) &= (7i+2j-k) + (i+j+k) \\ &= 7i+i+2j+j-k+k \\ &= 8i+3j \end{aligned}$$

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

$$\begin{aligned} (A+C) \cdot (B-A) &= (8i+3j+0k) \cdot (-5i-j+5k) \\ &= -40 - 3 \\ &= -43 \\ &\quad \underline{\quad} \end{aligned}$$

$$5. T = \frac{dr/dt}{|dr/dt|_{t=?}}$$

$$r = xi + yj + zk$$

$$r = ti + t^2j + t^3k$$

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

$$\text{at } t=1 = i + 2j + 3k$$

$$\text{magnitude} = \sqrt{1^2 + 2^2 + 3^2} = \sqrt{14}$$

$$T = \frac{i + 2j + 3k}{\sqrt{14}}$$