MAT 102

ANULUNKO CHUKWUEBUKA OLIVER

MECHATRONICS ENGINEERING

~~A = 5i − 7j − 6k B = Oi~~

19/ENG05/014

1 $A = 5i - 7j - 6k \quad B = Oi + j + 4k$

$C = 9i - 4j + k$

i $-8(A+B)$

$(A+B) = (5i - 7j - 6k) + (Oi + j + 4k)$

$(A+B) = 5i - 6j - 2k$

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

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

ii $(C - A)$

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

$(C - A) = 4i + 3j + 7k$

$-8(A+B) \cdot (C-A) = (-40 + 48j + 16k) \cdot (4i + 3j + 7k)$

$= -160 + 144 + 112 = 96$

2 $T = \dfrac{dr/dt}{|dr/dt|}$

$r = -3ti + t^2 j + 4t^3 k$

$\dfrac{dr}{dt} = -3i + 2tj + 12t^2 k$

at $t = 1$

$\dfrac{dr}{dt} = -3i + 2(1)j + 12(1)^2 k$

$\dfrac{dr}{dt} = -3i + 2j + 12k$

$\left|\dfrac{dr}{dt}\right| = \sqrt{(-3)^2 + (2)^2 + (12)^2} = \sqrt{9 + 4 + 144}$

$= \sqrt{157} = 12.52996$

$T = \dfrac{-3i + 2j + 12k}{12.52996}$

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

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

$a = \frac{dv}{dt} = \frac{d^2 r}{dt^2} = -16 i + 2 j$

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

$(A \times B) \times C$

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

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

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

$(A \times B) = -10i - 9j - 7k$

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

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

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

$55i - 30j - 40k$

5 $R = 4\sin 3t\, i + 4e^{3t} + 7t^3 k$

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

$\frac{-4\cos 3t}{3} i + \frac{4e^{3t}}{3} j + \frac{7t^4}{4} k \Big|_0^1$

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

$(-1.3315 i + 26.78 j + 1.75k) - (-1.33 i + 1.33 j + 0k)$

$-0.0015 i + 25.45 j + 1.75 k$