1 $x = 7t^2$, $y = 6t^2 - 4t$ and $z = t - 5$

$r = xi + yj + zk$

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

$$\text{velocity} = \frac{dr}{dt}$$

$$\frac{dr}{dt} = 14ti + (12t - 4)j + \frac{k}{Z}$$

2 ~~If~~ $A = i + 2j - 4k$

$B = 2i - 3j + k$

$C = 4j - 3k$

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

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

$= i(9 - 4) - j(-6 - 0) + k(8 - 0)$

$= 5i + 6j + 8k$

FASOIRO VICTOR OLADAPO
COMPUTER SCIENCE
19/SCI01/046

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

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

$$= i(16+24)-j(8+20)+k(10-6)$$

$$=40i-28j+4k$$

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

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

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

$$=\frac{4i}{3}(-\cos(3t))+\frac{4je^{3t}}{3}+\frac{7kt^4}{4}$$

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

4 $A=7i+2j-k$

$B=2i+j+4k$

$C=i+j+k$

$$(A+C)\cdot(B-A)=[(7i+2j-k)+(i+j+k)]\cdot[(2i+j+4k)-(7i+2j-k)]$$

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

$$=-40-3+0$$

$$=-43$$

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$$T = \frac{\frac{dr}{dt}}{\left|\frac{dr}{dt}\right|}$$

$r = xi + yj + zk$

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

$dr/dt = i + 2tj + 3t^2 k$

at $t = 1$, $\frac{dr}{dt} = i + 2tj + 3t^2 k$

$= i + 2(1)j + 3(1)^2 k$

$= i + 2j + 3k$

$= \sqrt{1^2 + 2^2 + 3^2}$

$= \sqrt{1 + 4 + 9}$

$= \sqrt{14} = 3.74$

Hence $T = \frac{i + 2j + 3k}{3.74}$