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1) $x = 7t^2, y = 6t^2 - 4t, z = t - 5$
 $\frac{dx}{dt} = 14t + 12t + 1 \quad \therefore \frac{dA}{dt} = 14i + 12j + k$

2) $A = i + 2j - 4k, B = 2i - 3j + k, C = 2j - 3k$

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

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

$$= i \begin{vmatrix} -3 & 1 \\ 4 & -3 \end{vmatrix} - j \begin{vmatrix} 2 & 1 \\ 0 & -3 \end{vmatrix} + k \begin{vmatrix} 2 & -3 \\ 0 & 4 \end{vmatrix}$$

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

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

$$= 5i + 6j + 8k$$

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

$$= i \begin{vmatrix} 2 & -4 \\ 6 & 8 \end{vmatrix} - j \begin{vmatrix} 1 & -4 \\ 5 & 8 \end{vmatrix} + k \begin{vmatrix} 1 & 2 \\ 5 & 6 \end{vmatrix}$$

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

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

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

3) Given that $R = 4 \sin 3t i + 4e^{3t} j + 7t^3 k$. Find $\int R dt$

$$\therefore \int R dt = \left| 4(-3 \cos 3t) i + 4 \left(\frac{1}{3} e^{3t} \right) j + 7 \left(\frac{t^4}{4} \right) k \right| + C$$

$$= -12 \cos 3t i + \frac{4}{3} e^{3t} j + \frac{7}{4} t^4 k + C$$

4) $A = 7i + 2j - k, B = 2i + j + k, C = i + j + k$

$$(A + C) = (7i + 2j - k) + (i + j + k)$$

$$(A + C) = 8i + 3j$$

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$$4 \text{ cont'd)} \quad (B-A) = (2i + j + 4k) - (7i + 2j - k) \\ = 2i + j + 4k - 7i - 2j + k \\ = -5i - j + 5k$$

$$(A+C) \cdot (B-A) = (8i + 3j) \cdot (-5i - j + 5k) \\ = -40i^2 - 3j^2 = -40 - 3$$

$$(A+C) \cdot (B-A) = -40 - 3$$

$$5) \quad x = t \quad y = t^2 \quad , \quad z = t^3$$

where $t = 1$

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

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

$$\text{at } t = 1 \quad \frac{dr}{dt} = 1i + 2j + 3k$$

$$\left| \frac{dr}{dt} \right|_{t=1} = \sqrt{1^2 + 2^2 + 3^2} \\ = \sqrt{1 + 4 + 9} \\ = \sqrt{14} \\ = 3.74$$

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