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DEPARTMENT: PETROLEUM ENGINEERING

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(1) $x = 7t^2$, $y = 6t^2 - 4t$, $z = t - 5$, find its velocity

$$\text{Velocity} = \frac{\text{distance}}{\text{time}} = \frac{dy}{dt}$$

(i) Velocity of x, $\frac{dx}{dx} = 14t$

(ii) Velocity of y, $\frac{dy}{dt} = 12t - 4$

(iii) Velocity of z, $\frac{dz}{dt} = 1$

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

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

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

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

$= 5i + 6j + 8k$

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

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

$= 40i - 28j - 4k$

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

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

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

$= -4\cos 3t\,i + \frac{1}{3}4e^{3t}\,j + \frac{7t^4}{4}k$

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

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

$= (8i + 3j)$

then

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

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

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

$(A + C) \cdot (B - A) = (-40i + 15k)$

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

(i) $\frac{dx}{dt} = 1$

(ii) $\frac{dy}{dt} = 2t^2$

$\left.\frac{dy}{dt}\right|_{t=t} = 2(1) = 2$

(iii) $\frac{dz}{dt} = 3t^2$

$\left.\frac{dz}{dt}\right|_{t=t} = 3(1)^2 = 3$