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1) $x = t^2$, $y = 5t^2 + t$, $z = t + 7$ find a

$$r = xi + yj + zk$$

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

$$v = \frac{dr}{dt} = (2t)i + (10t + 1)j + (1)k$$

$$a = \frac{dv}{dt} = \frac{d^2r}{dt^2} = 2i + 10j + (0)k$$

2) $P = i + 9j - 4k$, $Q = 8i + 3j + 6k$, $R = i - 4j - 3k$
Find $(P \times Q) \cdot (R \times P)$

soln

$$|P \times Q| = \begin{vmatrix} i & j & k \\ 1 & 9 & -4 \\ 8 & 3 & 6 \end{vmatrix} = i \begin{vmatrix} 9 & -4 \\ 3 & 6 \end{vmatrix} - j \begin{vmatrix} 1 & -4 \\ 8 & 6 \end{vmatrix} + k \begin{vmatrix} 1 & 9 \\ 8 & 3 \end{vmatrix}$$

$$= i \begin{vmatrix} 9 & -4 \\ 3 & 6 \end{vmatrix} - j \begin{vmatrix} 1 & -4 \\ 8 & 6 \end{vmatrix} + k \begin{vmatrix} 1 & 9 \\ 8 & 3 \end{vmatrix}$$

$$= i(54 - (-12)) - j(6 - (-32)) + k(3 - 72)$$
$$= 66i - 38j - 69k$$

$$|R \times P| = \begin{vmatrix} i & j & k \\ -4 & -3 \\ 1 & 9 & -4 \end{vmatrix} = i \begin{vmatrix} -4 & -3 \\ 1 & -4 \end{vmatrix} - j \begin{vmatrix} 1 & -3 \\ 1 & -4 \end{vmatrix} + k \begin{vmatrix} 1 & -4 \\ 1 & 9 \end{vmatrix}$$

$$= i(16 - (-12)) - j(-4 - (-3)) + k(9 - (-4))$$
$$= 28i + j + 13k$$

$$\begin{aligned}
 |P \times Q| \cdot |R \times P| &= (66i - 38j - 69k) \cdot (43i + j + 13k) \\
 &= 2838 - 38 - 897 \\
 &= 1903
 \end{aligned}$$

3) $F = 5\cos 7ti - 2e^{3t}j - 4t^3k$. Find integral with respect to t .

Solution.

$$\int_0^1 F dt = \int_0^1 [(5\cos 7t)i - (2e^{3t})j - (4t^3)k]$$

$$= \left. \frac{-5}{7} \sin 7ti - \frac{2}{3} e^{3t} j - \frac{4t^4}{4} k \right|_0^1$$

$$= \left. \frac{-5}{7} \sin 7i - \frac{2}{3} e^{3t} j - t^4 k \right|_0^1$$

$$= -\frac{5}{7} \sin 7(1)i - \frac{2}{3} e^{3(1)} j - (1)^4 k$$

$$= -0.087 - 13.39j - k$$

$$= -0.0$$

$$\leftarrow -0.09 - 13.39j - k$$