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Mechatronics

19) Entcos 1065

1)  $r_0 = 7t^3$ ,  $y = 6t^2 - 4t$ ,  $z = t - 5$ .

$r = 7t^3 i + (6t^2 - 4t) j + (t - 5) k$

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

$\frac{dr}{dt} = 21t^2 i + (12t - 4) j + k$

2)  $\vec{A} = 12j - 4k$ ,  $\vec{B} = 2i - 3j + k$ ,  $\vec{C} = 4j - 3k$ . Find  $\vec{A} \times (\vec{B} \times \vec{C})$

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

$= i(-9 - 4) - j(-6 - 0) + k(8 + 0)$   
 $= -13i + 6j + 8k$

$$\vec{A} \times (\vec{B} \times \vec{C}) = \begin{vmatrix} i & j & k \\ 12 & -4 & 0 \\ -13 & 6 & 8 \end{vmatrix}$$

$= i(16 + 24) - j(8 + 20) + k(6 - 10)$   
 $= 40i - 28j - 4k$

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

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

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

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

$$4 \quad A = 7i + 2j - k, \quad B = 2i + k + 4k, \quad C = 1 + j + k.$$

$$(A+C) \cdot (B-A)$$

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

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

$$(A+C) \cdot (B-A) = (8i + 3j) \cdot (-5i - j + 5k) \\ = -40 + 310 \\ = -37$$

$$5 \quad x = t, \quad y = t^2, \quad z = t^3 \quad \text{at } t=1$$

$$r = xi + yj + zk$$

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

$$|r| = \sqrt{t^2 + t^4 + t^6}$$

$$\text{When } t=1$$

$$r = i + j + k$$

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

$$l_r = \frac{i + j + k}{\sqrt{3}}$$

$$l_r = \frac{i}{\sqrt{3}} + \frac{j}{\sqrt{3}} + \frac{k}{\sqrt{3}}$$