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MATH 102

MECHANICAL ENG

$$1.) x = t, y = t^2, z = t^3$$

$$F = xi + yj + zk$$

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

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

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

$$\frac{dr}{dt} = i + 2j + 3k$$

$$\left| \frac{dr}{dt} \right| = \sqrt{(1)^2 + (2)^2 + (3)^2} = \sqrt{14}$$

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

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

$$T = \frac{i + 2j + 3k}{\sqrt{14}}$$

$$2.) A = 4t^3j + 5k$$

$$B = 2t^2i + 4tj$$

$$A \times B = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 4t^3 & 5 \\ 2t^2 & 4t & 0 \end{vmatrix}$$

$$t\hat{i} \begin{vmatrix} 4t^3 & 5 \\ 4t & 0 \end{vmatrix} - \hat{j} \begin{vmatrix} 0 & 5 \\ 2t^2 & 0 \end{vmatrix} + \hat{k} \begin{vmatrix} 0 & 4t^2 \\ 2t^2 & 4t \end{vmatrix}$$

$$+ i(0 - 20t) - j(0 - 10t^2) + k(0 - 8t^5)$$

$$= -20t\hat{i} + 10t^2\hat{j} - 8t^5\hat{k}$$

$$\int_0^1 \frac{-20t^2}{2}\hat{i} + \frac{10t^3}{3}\hat{j} - \frac{8t^6}{6}\hat{k}$$

$$\left[-10(1)^2\hat{i} + \frac{10(1)^3}{3}\hat{j} - \frac{8(1)^6}{6}\hat{k} \right] - \left[-10(0)^2 + \frac{10(0)^3}{3} - \frac{8(0)^6}{6} \right]$$

$$= -10\hat{i} + \frac{10}{3}\hat{j} - \frac{8}{6}\hat{k}$$