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19/ENG04/002

Electrical Electronics

Mat 102

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

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

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

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

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

$$\hat{T} = \frac{dr/dt}{\left| dr/dt \right|} \approx \hat{i}$$

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

$$2) A = 4t^3j + 5k \quad B = 2t^2i + 4tj$$

$$G = A \times B$$

$$G = \begin{vmatrix} i & j & k \\ 0 & 4t^3 & 5 \\ 2t^2 & 4t & 0 \end{vmatrix}$$

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

$$G = -20ti + 10t^2j - 8t^5k$$

$$\int_0^1 (-20ti + 10t^2j - 8t^5k) dt = \left[\left(\frac{-20t^2}{2} \right) i + \left(\frac{10t^3}{3} \right) j - \left(\frac{8t^6}{6} \right) k \right]_0^1$$

$$= \frac{-20(1)^2}{2} i + \frac{10(1)^3}{3} j - \frac{8(1)^6}{6} k$$

$$\int_0^1 (-20t)i + (10t^2)j + (-8t^5)k \cong -10i + \frac{10}{3}j - \frac{4}{3}k$$