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Chemical Engineering

MAT102 Assignment

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

$$\Rightarrow r = xi + yj + zK$$

$$= ti + t^2j + t^3K$$

$$r'(t) = i + 2tj + 3t^2K$$

@ $t = 1$

$$r' = i + 2(1)j + 3(1)^2K$$

$$r' = i + 2j + 3K$$

$$\text{Unit tangent vector} = \frac{i + 2j + 3K}{|i + 2j + 3K|} = \frac{i + 2j + 3K}{\sqrt{1^2 + 2^2 + 3^2}}$$

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

2 $A = 4t^3j + 5K$

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

$$G = A \times B$$

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

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

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

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

$$\int_0^1 (-20ti + 10t^2j - 8t^5K)$$

$$= \left(\int_0^1 -20t \right) i + \left(\int_0^1 10t^2 \right) j - \left(\int_0^1 8t^3 \right) k$$

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

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