

MAT 102

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MECHANICS ENGINEERING

$$\textcircled{1} \quad A = 5i - 7j - 6k \quad B = j + 4k \quad C = 9i + 4j + k$$

$$\text{find } -8(A \times B) \cdot (C - A)$$

$$A \times B = 5i - 6j - 2k$$

$$(C - A) = 4i + 3j + 5k$$

$$-8(A \times B) \cdot (C - A) = -8(20 - 18 - 10)$$

$$= -8(-12)$$

$$= 96$$

$$\textcircled{2} \quad x = -3ti \quad y = t^2 \quad z = 4t^3 \quad @ \quad t = 1$$

$$\vec{r} = -3i + j + 4k$$

$$|\vec{r}| = \sqrt{3^2 + 1^2 + 4^2}$$

$$= \sqrt{9 + 16 + 1}$$

$$= \sqrt{26}$$

$$\text{Unit tangent vector} = \frac{-3i + j + 4k}{\sqrt{26}}$$

$$\textcircled{3} \quad A = i + 2j - 4k \quad B = 2i - 3j + k \quad C = 4j - 3k \quad \text{find } (A \times B) \times C$$

$$(A \times B) \times C = \begin{vmatrix} i & j & k \\ 1 & 2 & -4 \\ 2 & -3 & 1 \end{vmatrix} = i(2 - 12) - j(1 + 8) + k(-3 - 4)$$

$$= -10i - 9j - 7k$$

$$(A \times B) \times C = \begin{vmatrix} i & j & k \\ -10 & -9 & -7 \\ 0 & 4 & -3 \end{vmatrix} = i(-27 + 28) + j(-40 - 0) + k(30 - 0)$$

$$= i - 40j - 40k$$

$$\textcircled{4} \quad R = \frac{4}{3} \sin 3t i + t e^{2t} j + 7t^3 k$$

$$\int_0^1 (t \sin 3t i + t e^{2t} j + 7t^3 k) dt = \left[ \left( \frac{t}{3} \cos 3t \right) i + \left( \frac{t}{3} e^{2t} \right) j + \left( \frac{7}{4} t^4 \right) k \right]_0^1$$

$$= \left[ \frac{1}{3} \cos 3 + \frac{1}{3} e^2 + \frac{7}{4} \right] - 0$$

$$= \frac{1}{3} \cos 3 + \frac{1}{3} e^2 + \frac{7}{4} k$$