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Biotechnology

MAT102 starts: 14th ends: 19th

Assignment Answers

$$2 \quad r = -3ti + t^2j + 4t^3k$$
$$\frac{dr}{dt} = -3i + 2tj + 12t^2k$$

$$\frac{dr}{dt} = -3i + 2j + 12k$$

$$\left. \frac{dr}{dt} \right|_{t=1}$$

$$= \sqrt{-3^2 + 2^2 + 12^2}$$
$$= \sqrt{9 + 4 + 144}$$
$$= \sqrt{157}$$
$$= 12.5$$

$$\text{Hence } T = \frac{-3i + 2j + 12k}{12.5}$$

Where T is the unit tangent vector for the space curve

$$3 \quad \text{Acceleration} = \frac{d^2r}{dt^2}$$

$$\text{Position vector } (r) = -8t^2i + (t^2 - 4t)j + (t+1)k$$

$$\frac{dr}{dt} = -16ti + (2t - 4)j + tk$$

$$\frac{d^2r}{dt^2} (\text{Acceleration}) = -16i + 2j + k$$

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

$$= i \begin{vmatrix} 2 & -4 \\ -3 & 1 \end{vmatrix} - j \begin{vmatrix} 1 & -4 \\ 2 & 1 \end{vmatrix} + k \begin{vmatrix} 1 & 2 \\ 2 & -3 \end{vmatrix}$$

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$$= i(2-12) - j(1-(-8)) + k(-3-4)$$
$$= -10i - 9j - 7k$$

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

$$= i \begin{vmatrix} +9 & -7 \\ 4 & -3 \end{vmatrix} - j \begin{vmatrix} -10 & -7 \\ 0 & -3 \end{vmatrix} + k \begin{vmatrix} -10 & -9 \\ 0 & 4 \end{vmatrix}$$

$$= i(27 - (-28)) - j(30 - 0) + k(-40 - 0)$$

$$= 55i - 30j - 40k$$

$$\therefore (A \times B) \times C = 55i - 30j - 40k$$

1 $A = 5i - 7j - 6k$

$$B = j + 4k$$

$$C = 9i - 4j + k$$

$$= -8(5i - 7j - 6k + j + 4k) \cdot (9i - 4j + k) - (5i - 7j - 6k)$$

$$= -8(5i - 6j - 2k) \cdot (4i + 3j + 7k)$$

$$= (-40i + 48j + 16k) \cdot (4i + 3j + 7k)$$

$$= -160i + 144j + 122k$$