INYANG MARTIN VICTOR 19/SCI01/053

COMPUTER SCIENCE

1. $\bar{A} = 3i + 7j - 2k$

$B = 9i - 4j + 6k$

$\bar{A} \cdot \bar{C} = (27 - 28 - 12) = -13$

$\cos\theta = \frac{\bar{A} \cdot \bar{C}}{|A|\,|C|}$

$|A| = \sqrt{3^2 + 7^2 + 2^2} = \sqrt{62} = 7.87$

$|C| = \sqrt{9^2 + 4^2 + 6^2} = \sqrt{133} = 11.53$

$\cos\theta = \frac{\bar{A} \cdot \bar{C}}{|A||C|} = \frac{-13}{\sqrt{62} \times \sqrt{133}} = \frac{-13}{90.808} =$

$\theta = \cos^{-1}\left(\frac{-13}{90.808}\right) = 98.23^\circ$

ii. $\bar{B} \cdot \bar{C} = (i + 3j + 7k) \cdot (9i - 4j + 6k)$

$\bar{B} \cdot \bar{C} = (1 + 3j + 7k)(9i - 4j + 6k)$

$(9i - 12j + 42k)$

$(9 - 12 - 42) = 39$

$\cos\theta = \frac{\bar{B} \cdot \bar{C}}{|B|\,|C|}$

$|B| = \sqrt{1^2 + 3^2 + 7^2} = \sqrt{59} = 7.68$

$|C| = \sqrt{9^2 + 4^2 + 6^2} = \sqrt{133} = 11.53$

$\cos\theta = \frac{\bar{B} \cdot \bar{C}}{|B|\,|C|} = \frac{39}{\sqrt{59} \times \sqrt{133}} = \frac{39}{88.583}$

$\theta = \cos^{-1}\left(\frac{39}{88.583}\right)$

$\theta = 63.88^\circ$

iii. $\bar{A} + \bar{B} + \bar{C} = \frac{\bar{A} + \bar{B} + \bar{C}}{|A + B + C|} = (3i + 7j - 2k) + (i + 3j + 7k) + (9i - 4j + 6k)$

$= 13i + 6j + 11k$

$|A + B + C| = \sqrt{(13)^2 + (6)^2 + (11)^2}$

$= \sqrt{196 + 36 + 121}$

$= \sqrt{326}$

$\therefore = \frac{13i + 6j + 11k}{\sqrt{326}}$

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2. A particle moves along a curve $x = 8t^2$, $y = t^2 - 4t$, $z = t + 1$ where t is time. Find modulus of acceleration

Solution

$$r = (8t^2)i + (t^2 - 4t)j + (t+1)k$$

$$\frac{dr}{dt} = 16t\,i + 2t - 4\,j + (1)k$$

$$\text{acceleration} = \frac{d^2r}{dt} = -16i + 2j$$

$$d^2r = \sqrt{(16)^2 + (2)^2}$$

$$= \sqrt{256 + 4}$$

$$= \sqrt{260} = 16.3$$

3. If $A = 4i + 2j - 4k$

$B = 8i - 2j + k$

$C = i + 4j - 3k$, Find $(A \times B) \times C$

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

$$i\begin{vmatrix} 2 & -4 \\ -2 & 1 \end{vmatrix} - j\begin{vmatrix} 4 & -4 \\ 8 & 1 \end{vmatrix} + k\begin{vmatrix} 4 & 2 \\ 8 & -2 \end{vmatrix}$$

$$-6i - 36j - 24k$$

$$(A \times B) \times C$$

$$= \begin{vmatrix} i & j & k \\ -6 & -36 & -24 \\ 1 & 4 & -3 \end{vmatrix}$$

$$i\begin{vmatrix} -36 & -24 \\ 4 & -3 \end{vmatrix} - j\begin{vmatrix} -6 & -24 \\ 1 & 3 \end{vmatrix} + k\begin{vmatrix} -6 & -36 \\ 1 & 4 \end{vmatrix}$$

$$= 204i - 42j + 12k$$