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DEPARTMENT: COMPUTER SCIENCE

MATRIC NUMBER: 19/SCI01/015

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i.  $A = 3i + 7j - 2k$   
 $B = i + 3j + 7k$   
 $C = 9i - 4j + 6k$

(i) Angle between A and C

$$\begin{aligned}\overline{A \cdot C} &= (3i + 7j - 2k) \cdot (9i - 4j + 6k) \\ &= 27 - 28 - 12 \\ &= -13\end{aligned}$$
$$\begin{aligned}|A| &= \sqrt{(3)^2 + (7)^2 + (-2)^2} \\ &= \sqrt{9 + 49 + 4} \\ &= \sqrt{62}\end{aligned}$$
$$\begin{aligned}|C| &= \sqrt{(9)^2 + (-4)^2 + (6)^2} \\ &= \sqrt{81 + 16 + 36} \\ &= \sqrt{133}\end{aligned}$$
$$\cos \theta = \frac{-13}{\sqrt{62} \times \sqrt{133}} = \frac{-13}{90.808}$$
$$\theta = \cos^{-1} \left( \frac{-13}{90.808} \right)$$
$$\theta = 98.23^\circ$$

(ii) Angle between B and C

$$\begin{aligned}\overline{B \cdot C} &= (i + 3j + 7k) \cdot (9i - 4j + 6k) \\ &= 9 - 12 + 42 \\ &= 39\end{aligned}$$
$$\begin{aligned}|B| &= \sqrt{(1)^2 + (3)^2 + (7)^2} \\ &= \sqrt{1 + 9 + 49} \\ &= \sqrt{59}\end{aligned}$$

$$|C| = \sqrt{9^2 + (-4)^2 + (6)^2}$$

$$= \sqrt{81 + 16 + 36}$$

$$= \sqrt{133}$$

$$\cos \theta = \frac{39}{\sqrt{59} \times \sqrt{133}}$$

$$\cos \theta = \frac{39}{88.583}$$

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

$$\theta = 63.88^\circ$$

$$(ii) \quad e_{A+B+C} = \frac{A+B+C}{|A+B+C|}$$

$$A+B+C = (3i + 7j - 2k) + (1i + 3j + 7k) + (9i - 4j + 6k)$$

$$= 13i + 6j + 11k$$

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

$$= \sqrt{169 + 36 + 121}$$

$$= \sqrt{326}$$

$$e_{A+B+C} = \frac{13i + 6j + 11k}{\sqrt{326}}$$



2.  $x = -8t^2$ ,  $y = t^2 - 4t$  and  $z = t + 1$ , find modulus of acceleration

Soln.

$$r = xi + yj + zk$$

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

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

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

$$\begin{aligned} \left| \frac{d^2r}{dt^2} \right| &= \sqrt{(-16)^2 + (2)^2} \\ &= \sqrt{256 + 4} \\ &= \sqrt{260} \text{ or } 16.13 \end{aligned}$$

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

$$B = 8i - 2j + k$$

$$C = i + 4j - 3k$$

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

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

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

$$= i(2 - 8) - j(4 - (-32)) + k(-8 - 16)$$

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

$$(A \times B) \times C = \begin{vmatrix} i & j & k \\ -6 & -36 & -24 \\ 1 & 4 & -3 \end{vmatrix}$$

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

$$= i(108 - (-96)) - j(18 - (-24)) + k(-24 - (-36))$$

$$= i(108 + 96) - j(18 + 24) + k(-24 + 36)$$

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