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Subject: MAT 102

$$A = 2i - j, B = 3i + j - 11k, C = 4i + 4j - 5k$$

i) $-3A + 7B - 8C$

$$-3(2i - j) + 7(3i + j - 11k) - 8(4i + 4j - 5k)$$

$$-6i + 3j + 21i + 7j - 77k - 32i - 32j + 40k$$

$$= -17i - 22j - 37k$$

ii) $2A + 4B - C$

$$2(2i - j) + 4(3i + j - 11k) - 4i + 4j - 5k$$

$$4i - 2j + 12i + 4j - 44k - 4i + 4j - 5k$$

$$12i + 6j - 49k$$

Direction Cosine

$$|r| = \sqrt{(12)^2 + (6)^2 + (-49)^2}$$

$$= \sqrt{144 + 36 + 2401}$$

$$|r| = \sqrt{2581}$$

$$\cos \alpha = \frac{12}{\sqrt{2581}}$$

$$\cos \beta = \frac{6}{\sqrt{2581}}$$

$$\cos \gamma = \frac{-49}{\sqrt{2581}}$$

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

$$B \times C \begin{vmatrix} i & j & k \\ 3 & 1 & -11 \\ 4 & 4 & -5 \end{vmatrix}$$

$$i \begin{bmatrix} 1 & -11 \\ 4 & -5 \end{bmatrix} - j \begin{bmatrix} 3 & -11 \\ 4 & 5 \end{bmatrix} + k \begin{bmatrix} 3 & 1 \\ 4 & 4 \end{bmatrix}$$

$$i [-5 + 44] - j [15 + 44] + k [12 - 4]$$

$$i [39] - j [59] + k [8]$$

$$39i - 59j + 8k$$

Then,

$$A \times (B \times C) \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 39 & -59 & 8 \end{vmatrix}$$

$$i \begin{bmatrix} -1 & 0 \\ 59 & 8 \end{bmatrix} - j \begin{bmatrix} 2 & 0 \\ 39 & 8 \end{bmatrix} + k \begin{bmatrix} 2 & -1 \\ 39 & -59 \end{bmatrix}$$

$$i [-8 - 0] - j [16 - 0] + k [-118 - (-39)]$$

$$i (-8) - j (16) + k (-79)$$

$$-8i - 16j - 79k$$

iv) $(3A \times B) \cdot (A \times 2B)$

$$3A \times B \begin{vmatrix} i & j & k \\ 6 & -3 & 0 \\ 3 & 1 & -11 \end{vmatrix}$$

$$A \times 2B \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 6 & 2 & -22 \end{vmatrix}$$

$$i \begin{bmatrix} -3 & 0 \\ 1 & -11 \end{bmatrix} - j \begin{bmatrix} 6 & 0 \\ 3 & -11 \end{bmatrix} + k \begin{bmatrix} 6 & -3 \\ 3 & 1 \end{bmatrix} \cdot i \begin{bmatrix} -1 & 0 \\ 2 & -22 \end{bmatrix} + j \begin{bmatrix} 2 & 0 \\ 6 & -22 \end{bmatrix} + k \begin{bmatrix} 2 & -1 \\ 0 & 2 \end{bmatrix}$$

$$i(33 - 0) - j(-66 - 0) + k(6 + 1) \cdot i(22 - 0) - j(-44 - 0) + k(4 + 6)$$

$$i(33) - j(-66) + k(15) \cdot i(22) - j(-44) + k(10)$$

$$33i + 66j + 15k \cdot 22i + 44j + 10k$$

$$3A \times B \cdot A \times 2B = 726 + 2904 + 150$$

$$= 3780$$

V) $A - 2B - C$

$$2\mathbf{i} - \mathbf{j} - 3\mathbf{i} - 2\mathbf{j} + 22\mathbf{k} - 4\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$$

$$= -5\mathbf{i} + \mathbf{j} + 17\mathbf{k}$$

2) Co-planar vectors are vectors which lie in the same plane formed by only 2 axes in the Co-ordinate geometry

Perpendicular vectors ~~are~~ 2 vectors \vec{A} and \vec{B} are perpendicular if and only if their scalar product is $= 0$