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Matric No: 19/EN601/010

Course: MAT 102

Assignment

1 If $A = 2i - j$, $B = 3i + j - 11k$ and $C = 4i + 4j - 5k$, find the following:

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

$$\begin{aligned} &= -3(2i - j) + 7(3i + j - 11k) - 8(4i + 4j - 5k) \\ &= -6i + 3j + 21i + 7j - 77k - 32i - 32j + 40k \\ &= -17i - 29j - 37k \end{aligned}$$

ii If $k = 2A + 4B - C$, find the direction cosine of k

$$\begin{aligned} k &= 2(2i - j) + 4(3i + j - 11k) - (4i + 4j - 5k) \\ &= 4i - 2j + 12i + 4j - 44k - 4i - 4j + 5k \\ &= 12i - 2j - 39k \end{aligned}$$

$$\begin{aligned} |k| &= \sqrt{(12)^2 + (-2)^2 + (-39)^2} \\ &= \sqrt{144 + 4 + 1521} \\ &= \sqrt{1669} \\ &= 40.85 \end{aligned}$$

Direction

$$l = \cos \alpha = \frac{12}{40.85}$$

$$m = \cos \beta = \frac{-2}{40.85}$$

$$n = \cos \gamma = \frac{-39}{40.85}$$

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

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

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

$$= i(-5 + 44) - j(-15 + 44) + k(12 - 4)$$

$$= 39i - 29j + 9k$$

$$A \times (B \times C) = (2i - j) \times (39i - 29j + 9k)$$

$$= \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 39 & -29 & 9 \end{vmatrix}$$

$$= i \begin{vmatrix} -1 & 0 \\ -29 & 9 \end{vmatrix} - j \begin{vmatrix} 2 & 0 \\ 39 & 9 \end{vmatrix} + k \begin{vmatrix} 2 & -1 \\ 39 & -29 \end{vmatrix}$$

$$= i(-9 + 0) - j(18 - 0) + k(58 + 39)$$

$$= -9i - 18j + 97k$$

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

$$3A \times B = (6i - 3j) \times (3i + j - 11k)$$

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

$$= i \begin{vmatrix} -3 & 0 \\ 1 & -11 \end{vmatrix} - j \begin{vmatrix} 6 & 0 \\ 3 & -11 \end{vmatrix} + k \begin{vmatrix} 6 & -3 \\ 3 & 1 \end{vmatrix}$$

$$= i(-33 - 0) - j(-66 - 0) + k(6 + 9)$$

$$= -33i + 66j + 15k$$

$$\neq$$

$$A \times 2B = (2i - j) \times (6i + 2j - 22k)$$

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

$$= i \begin{vmatrix} -1 & 0 \\ 2 & -22 \end{vmatrix} - j \begin{vmatrix} 2 & 0 \\ 6 & -22 \end{vmatrix} + k \begin{vmatrix} 2 & -1 \\ 6 & 2 \end{vmatrix}$$

$$= i(22 - 0) - j(-44 - 0) + k(4 + 6)$$

$$= 22i + 44j + 10k$$

$$(3A \times B) \cdot (A + 2B) = (-33i + 66j + 15k) \cdot (22i + 44j + 10k)$$

$$= -726 + 2904 + 150$$

$$= 2328$$

(v) $A - 2B - C$

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

$$= 2i - j - 6i - 2j + 22k - 4i - 4j + 5k$$

$$= -8i - 7j + 27k$$

(2) A perpendicular vector is a vector such that a and a' form a right angle

A co-planar vectors are vectors parallel to the same plane or vectors which lie in the same plane.