Course: Mat 102

Department: Computer Engineering

Matric No: 19/GnG02/056

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

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

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

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

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

$= -36i - 22j - 37k$

(ii) $K = 2A + 4B - C$

$2A = 2(2i - j) = 4i - 2j$

$4B = 4(3i + j - 11k) = 12i + 4j - 44k$

$C = 4i + 4j - 5k$

$2A + 4B - C = 4i - 2j + 12i + 4j - 44k - 4i - 4j + 5k$

$\Rightarrow (4i + 12i - 4i) + (-2j + 4j - 4j) + (-44k + 5k)$

$K = 12i - 2j - 39k$

$|K| = \sqrt{(12)^2 + (2)^2 + (-39)^2}$

$= \sqrt{1669}$

$= 40.85 \simeq 41$ to Nearest whole number

Direction cosine $\Rightarrow l = \cos\alpha = \frac{12}{41}$

$m = \cos\beta = \frac{-2}{41}$

$n = \cos\gamma = \frac{-39}{41}$

$\therefore$ Direction cosine $= \frac{12}{41}, \frac{-2}{41}, \frac{-39}{41}$

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

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

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

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

$$(B \times C) = 39i - 29j + 8k$$

$$A \times (B \times C) = \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 39 & -29 & 8 \end{vmatrix}$$

$$i \begin{vmatrix} -1 & 0 \\ -29 & 8 \end{vmatrix} - j \begin{vmatrix} 2 & 0 \\ 39 & 8 \end{vmatrix} + k \begin{vmatrix} 2 & -1 \\ 39 & -29 \end{vmatrix}$$

$$i(-8-0) - j(16-0) + k(-58+39)$$

$$A \times (B \times C) = -8i - 16j - 19k$$

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

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

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

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

$$(3A \times B) = 33i + 66j + 15k$$

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

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

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

$$(A \times 2B) = 22i + 44j + 10k$$

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

$$= 726 + 2904 + 150$$

$$(3A \times B) \cdot (A \times 2B) = 3780$$

(v) $A - 2B - C$

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

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

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

$$= -8i - 7j + 17k$$

2. Coplanar force: This is just forces on a plane. In a system in which all the forces lie in the same plane, it is known as coplanar force.