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Assignment

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

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

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

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

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

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

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

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

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

$4i - 2j + 0k + 12i + 4j - 44k - 4i - 4j + 5k$

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

$= 12i - 2j - 39k$

$$|k| = \frac{12i - 2j - 39k}{\sqrt{(12)^2 + (-2)^2 + (39)^2}}$$

$(k) = 40.85$

$\therefore \cos\alpha = \frac{12}{40.85}$, $\cos\beta = \frac{2}{40.85}$ $\cos\gamma = \frac{39}{40.85}$

iii - $A \times (B \times C)$ Solution:

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

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

$i[(-5 \times 1) - (-11 \times 4)] - j[(3 \times -5) - (-11 \times 4)] + k[(3 \times 4) - (1 \times 4)]$

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

$39i - 29j + 8k$

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

$i\begin{bmatrix}1&0\\-2&8\end{bmatrix} - j\begin{bmatrix}2&0\\3&8\end{bmatrix} + k\begin{bmatrix}2&-1\\3&-2\end{bmatrix}$

$i[8-0] - [16-0] + k[-5 8 + 3 9]$

$8i - 16j - 19k$

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

$A = 3(2i - j) - (6i - 3j)$; $B = (3i + j - 11k)$

$2B = 2(3i + j - 11k) = 6i + 2j - 22k$

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

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

$i[-33] - j[-66] + k[(6 \times 1) - (-3 \times 3)]$

$-33i + 66j + [6 + 9]$

$-33i + 66j + 15k$

$\therefore (A \times 2B)$

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

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

$i[22]\ j[-44] + k[10]$

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

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

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

$726 + 2904 + 150 = 3,780$

v.) $A - 2B - C$ Solution.

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

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

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

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

$-8i - 7j + 27k_{11}$

2.) Define Perpendicular and Co-planar vectors

a.) Perpendicular Vectors are vectors that their scalar product is equal to zero. Therefore,
$\bar{A} \cdot \bar{B} = 0$.

b.) Co-planar vectors are vectors that their scalar triple product of any of the three vectors is zero.