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Electrical Electronics Engineering

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

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

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

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

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

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

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

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

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

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

$|K| = 40.85$

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

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

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

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

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

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

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

$= -39i - 39j - 29j + 8K$

$A \times (B \times C)$

$A = 2i - j$

$A \times (B \times C) = \begin{vmatrix} i & j & K \\ 2 & -1 & 0 \\ +34 & -29 & \end{vmatrix}$

$i\begin{vmatrix} -1 & 0 \\ -29 & 8 \end{vmatrix} - j\begin{vmatrix} 2 & 0 \\ -39 & 8 \end{vmatrix} + K\begin{vmatrix} 2 & -1 \\ +34 & -29 \end{vmatrix}$

$i(-8-(-29)) - j(16-(-39)) + K(-58+34)$

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

iv) $3A = 3(2i - j) = 6i - 3j$

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

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

$3A \times B = i(33-0) - j(-66-0) + K(6+9)$

$3A \times B = 33i + 66j + 15K$

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

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

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

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

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

vi) ~~A~~ $(3A \times B) \cdot (A \times 2B)$

$$3A \times B = \begin{vmatrix} i & j & k \\ 33 & 66 & 15 \\ 22 & 44 & 10 \end{vmatrix}$$

$$3A \times B \quad i\begin{vmatrix}66 & 15\\ 44 & 10\end{vmatrix} - j\begin{vmatrix}33 & 15\\ 22 & 10\end{vmatrix} + k\begin{vmatrix}33 & 66\\ 22 & 44\end{vmatrix}$$

$$i(660-660) - j(330-330) + k(1452-1452)$$

$$= 0$$

$$(3A \times B) \cdot (A \times 2B) = 0$$

vii) $A - 2B - C$

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

$$2B = 6i + 2j - 22k$$

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

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

$$A - 2B - C = -8i - 7j + 27k$$

$$A - 2B - C = -8i - 7j + 27k$$

2 i) Two vectors are said to be perpendicular when the dot product is equal to zero

ii) Vectors are said to be coplanar if their scalar type product is equal to zero