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18/ENG02/065
Computer ENG.
Maths 102.

1) $A = 2i - j$

$B = 3i + j - 11k$

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

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

$-6i + 3j + 21i + 7j - 77k - 32i - 32j + 4k$

$-6i + 21i - 32i + 3j + 7j - 32j - 77k + 4k$

$-17i - 22j - 37k$

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

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

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

$k = 4i + 6i - 4i - 2j + 4j - 4j - 44k + 5k$

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

$= \sqrt{144 + 4 + 1521}$

$\sqrt{1669}$

$= 40.85$

$l = \cos\alpha = \frac{12}{40.85} = 0.2938$

$m = \cos\beta = \frac{-2}{40.85} \; 0.0490$

$N = \cos\alpha = \frac{-39}{40.85} \; 0.9547$

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

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

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

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

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

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

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

$$= -8i - 16j - 19k$$

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

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

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

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

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

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

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

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

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

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

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

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

$$= -2028$$

2) i) Perpendicular vectors are two vectors A and B where the are parallel $A - B = 0$

Coplanar Vectors are said to be coplanar when three vectors A B C will equal to zero at $A \cdot (B \times C)$