Name : Udemba Prince Chinemerem
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Department: Computer Engineering
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1) $A = 2i - j$, $B = 3i + j - 11k$ and $C = 4i + 4j - 5k$

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

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

$7B = 7(3i + j - 11k) = 21i + 7j - 77k$

$-8C = -8(4i + 4j - 5k) = i - 2j + 40k$

$-3A + 7B - 8C = -17i - 22j - 37k$

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

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

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

$2A + 4B - C \Rightarrow 12i - 2j + 39k$

$|k| = \sqrt{(12)^2 + (-2)^2 + (-39)^2} = \sqrt{1669} \Rightarrow 40.85$

C - The direction cosines of k are:

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

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

$\cos\gamma = \frac{-39}{40.85} \Rightarrow 0.9547$

iii) $A \times B \times C \Rightarrow A \times B = \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 3 & 1 & -11 \end{vmatrix}$

$= i(11-0) - j(-22-0) + k(21-3)$

$= 11i + 22j + 5k$

$$A \times B \times C = \begin{vmatrix} i & j & k \\ 11 & 22 & 5 \\ 4 & 4 & -5 \end{vmatrix}$$

$= i(-110-20) - j(-55-20) + k(44-88)$

$= -130i + 75j - 44k$

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

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

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

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

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

$\Rightarrow 33i + 66j + 15k$

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

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

$= 22i + 44j + 10k$

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

$= (33 \times 22) + (66 \times 44) + (15 \times 10) = 3780$

v) $A - 2B - C$

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

$\Rightarrow -8i - 7j + 27k$

2) Two Vectors A and B are said to be perpendicular if their scalar product is equal to Zero

- Three Vectors A, B and C are said to be Coplanar if their triple scalar product $[A \cdot (B \times C)]$ is equal