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Maths 102

① $A = 2i - j$, $B = 3i + j - 11k$ $C = 4i + 4j - 5k$

$-3A + 7B - 8C$

$-3A = -3(2i - j = -6i + 3j$
$7B = 7(3i + j - 11k) = 21i + 7j - 77k$
$-8C = -8(4i + 4j - 5k) = -32i - 32j + 40k$

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

ii) $K = 2A + 4B - C$
$2A = 2(2i - j) = 4i - 2j$
$4B = 4(3i + j - 11k) = 12i + 4j - 44k$
$2A + 4B - C = 12i - 2j - 39k$

$|K| = \sqrt{(12)^2 + (-2)^2 + (-39)^2} = \sqrt{1659} = 40.85$

The direction cosines of K are

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

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

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

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

$= 1(11 - 0) - j(-22 - 0) + k(2 + 3)$

$= 11i + 22j + 5k$

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

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

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

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

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

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

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

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

$= 33i + 66j + 15k$

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

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

$= 22i + 44j + 10k$

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

$= (33 \times 22) + (66 \times 44 + (5 \times 10) = 3780$

v $A - 2B - C$

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

$= -8i - 7j + 27k$

(2) (i) Two vectors A and B are said to be perpendicular if their scalar product is equal to zero

(ii) Three vectors A, B and C are said to be coplanar if their triple scalar product is equal to zero $[A \cdot (B \times C)]$