$K = 2A + 4B - C$

$K = 4i - 2j + 12i + 4j - 44K - 4i - 4j - 15K$

$= 4i + 12i - 4i - 2j + 4j - 44K + 15K - 4j$

$= 12i - 2j - 29K$

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

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

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

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

$= 39i - 29j + 8K$

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

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

$= 6i - 3j$

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

$= 6i + 2j - 22K$

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

$= i[(-3 \times -11) - (1 \times 0)] - j[(6 \times -11) - (3 \times 0)] + K[(6 \times 1) - (-3 \times 3)]$

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

$= 33i + 66j + 15K$

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

$= i[(-1 \times -22) - (2 \times 0)] - j[(2 \times -22) - (6 \times 0)] + k[(2 \times 2) - (-1 \times 6)]$

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

$= 22i + 44j + 10k$

$(3A \times B) \cdot (A \times 2B) = 33i + 66j + 15k \cdot 22i + 44j + 10k$

$= 726 + 2904 + 150$

$= 3780$

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

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

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

2 Perpendicular vectors:

Two vectors are said to be perpendicular if their dot product is equal to zero i.e $A \cdot B = 0$

Coplanar vectors

Three vectors are said to be coplanar if $A \cdot (B \times C) = 0$

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

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

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

$= -6i + 3j$

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

$= 21i + 7j - 77k$

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

$= -32i - 32j + 40k$

~~$-3A$~~ $-3A + 7B - 8C = -6i + 3j + (21i + 7j - 77k) +$

$-3A + 7B - 8C = -6i + 3j + 21i + 7j - 77k - 32i - 32j + 40k$

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

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

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

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

$= 4i - 2j$

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

$= 12i + 4j - 44k$

$-C = -1(4i + 4j - 5k)$

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