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

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

$i(-1\times-22-(2\times0)) - j(2\times-22-6\times0)+k(2\times2-6\times-1)$

$22i + 44j + 10k$

$(5A\times B)\cdot(A\times 2B) =$

$(33i + 66j + 15k)\cdot(22i + 44j + 10k)$

$726 + 2904 + 150$

$= 3508$ 3780

v) $A - 2B - C$

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

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

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

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

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

Perpendicular vectors are vectors that ~~when~~ ~~a·b~~ their dot product equals zero e.g $a \cdot b = 0$

Coplanar vectors are three vectors that their dot and vector product equals zero e.g $A \cdot (B \times C) = 0$

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

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

$-3(2i - j) + 7(3i + j - 11k) - 8(4i + 4j - 5k)$
$-6i + 3j + 21i + 7j - 77k - 32i - 32j + 40k$
$= -6i + 21i - 32i + 3j + 7j - 32j - 77k + 40k$
$= -17i - 22j - 37k$

ii) $k = 2A + 4B - C$
$2(2i - j) + 4(3i + j - 11k) - (4i + 4j - 5k)$
$4i - 2j + 12i + 4j - 44k - 4i - 4j + 5k$
$= 4i + 12i - 4i - 2j + 4j - 4j - 44k + 5k$
$= 12i - 2j - 39k$
$k = 12i - 2j - 39k$

$|K| = \sqrt{(12)^2 + (-2)^2 + (-39)^2}$
$= \sqrt{144 + 4 + 1521}$
$|K| = \sqrt{1669}$
$|k| = 40.9$

$l = \cos\alpha = \frac{12}{40.9}$

$m = \cos\beta = \frac{-2}{40.9}$

$n = \cos\gamma = \frac{-39}{40.9}$

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

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

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

$i[(1\times-5)-(4\times-11)] - j[(3\times-5)-(4\times-11)] + k[(3\times4)-(4\times1)]$

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

$39i - 29j + 8k$

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

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

$i[(-1\times8)-(-29\times0)] - j[(2\times8)-(39\times0)] + k[2\times-29-(39\times-1)]$

$i(-8) - j(18) + k(-19)$

$-8i - 18j - 19k$

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

$3A = 6i + 3j$

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

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

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

$i(-3\times-11)-(1\times0) + j(6\times-11-3\times0) + k(6\times1-3\times3)$

$33i + 66j + 15k$