

Name: Dhwuchi Avitus Chukwuebuka

Department: Chemical Engineering

Matric No: 19/ENGO1010

MAT 102

1. $A = 4i + j - 2k$, $B = 3i - 2j + k$, $C = i - 2k$. Find

(a) $(A - 2B) \times C$

$$\begin{aligned}(A - 2B) &= (4i + j - 2k) - 2(3i - 2j + k) \\ &= (4i + j - 2k) - (6i - 4j + 2k) \\ &= (-2i + 5j - 4k)\end{aligned}$$

$$\begin{aligned}(A - 2B) \times C &= (-2i + 5j - 4k) \times (i - 2k) \\ &= \begin{vmatrix} i & j & k \\ -2 & 5 & -4 \\ 1 & 0 & -2 \end{vmatrix}\end{aligned}$$

$$= i \begin{vmatrix} 5 & -4 \\ 0 & -2 \end{vmatrix} - j \begin{vmatrix} -2 & -4 \\ 1 & -2 \end{vmatrix} + k \begin{vmatrix} -2 & 5 \\ 1 & 0 \end{vmatrix}$$

$$= i(-10 + 0) - j(4 + 4) + k(0 - 5)$$

$$\underline{\underline{A - 2B \times C = -10i - 8j - 5k}}$$

b $A \times (2C \times 3B)$

$$(2C \times 3B) = (2(i - 2k) \times 3(3i - 2j + k))$$

$$= (2i - 4k) \times (9i - 6j + 3k)$$

$$= \begin{vmatrix} i & j & k \\ 2 & 0 & -4 \\ 9 & -6 & 3 \end{vmatrix}$$

$$= i \begin{vmatrix} 0 & -4 \\ -6 & 3 \end{vmatrix} - j \begin{vmatrix} 2 & -4 \\ 9 & 3 \end{vmatrix} + k \begin{vmatrix} 2 & 0 \\ 9 & -6 \end{vmatrix}$$

$$= i(0 - 24) - j(6 + 36) + k(-12 - 0)$$

$$\underline{\underline{= -24i - 42j - 12k}}$$

$$A \times (2C \times 3B) = (4i + j - 2k) \times (-24i - 42j - 12k)$$

$$= \begin{vmatrix} i & j & k \\ 4 & 1 & -2 \\ -24 & -42 & -12 \end{vmatrix}$$

$$= i \begin{vmatrix} 1 & -2 \\ -42 & -12 \end{vmatrix} - j \begin{vmatrix} 4 & -2 \\ -24 & -12 \end{vmatrix} + k \begin{vmatrix} 4 & 1 \\ -24 & -42 \end{vmatrix}$$

$$= i(-12 - 84) - j(-48 - 48) + k(-168 + 24)$$

$$= \underline{\underline{-96i + 96j - 144k}}$$

2. $A = Pi - 6j - 3k$, $B = 4i + 3j - k$ and $C = i - 3j + 2k$. Find the value of P for which A, B and C are co-planar.

$$\begin{vmatrix} P & -6 & -3 \\ 4 & 3 & -1 \\ 1 & -3 & 2 \end{vmatrix} = 0$$

$$P \begin{vmatrix} 3 & -1 \\ -3 & 2 \end{vmatrix} + 6 \begin{vmatrix} 4 & -1 \\ 1 & 2 \end{vmatrix} - 3 \begin{vmatrix} 4 & 3 \\ 1 & -3 \end{vmatrix} = 0$$

$$P(6 - 3) + 6(8 + 1) - 3(-12 - 3) = 0$$

$$3P + 54 + 45 = 0$$

$$3P + 99 = 0$$

$$k = -99/3$$

$$\underline{\underline{k = -33}}$$