DARE BENEDICT OLUBUKOLA
MECHANICAL ENGINEERING
19/ENG06/016 SERIAL NO.; 111
MAT 102 ASSIGNMENT (Mrs. Saka Funmilayo)

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

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

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

Solution

a. $A - 2B = (4i + j - 2k) - 2(3i - 2j + k)$

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

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

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

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

$i[(-2 \times 5) - (-4 \times 0)] - j[(-2 \times -2) - (-4 \times 1)] + k[(-2 \times 0) - (1 \times 5)]$

$i[-10 - 0] - j[4 + 4] + k[0 - 5]$

$\Rightarrow (A-2B) \times C = -10i - 8j - 5k$

b. $2C = 2(i - 2k)$

$= 2i - 4k$

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

$= 9i - 6j + 3k$

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

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

$i[(3 \times 0) - (-6 \times -4)] - j[(2 \times 3) - (-4 \times 9)] + k[(-6 \times 2) - (9 \times 0)]$

$i[0 - 24] - j[6 + 36] + k[-12 - 0]$

$\Rightarrow 2C \times 3B = -24i - 42j - 12k$

$\therefore$ For,

$$A \times (2C \times 2B) = \begin{vmatrix} i & j & k \\ 4 & 1 & -2 \\ -24 & -42 & -12 \end{vmatrix}$$

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

$i[-12 - 84] - j[-48 - 48] + k[-168 + 24]$

$\Rightarrow A \times (2C \times 2B) = -96i + 96k - 144k$

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.

Solution

$$A \cdot (B \times C) = \begin{vmatrix} P & -6 & -3 \\ 4 & 3 & -1 \\ 1 & -3 & 2 \end{vmatrix} = 0$$

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

$$P[6 - 3] + 6[8 + 1] - 3[-12 - 3] = 0$$

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

$$3P = -99$$

$$P = -33$$