

ILODIBE ANTHONY UDENNA

COMPUTER ENGINEERING

19/ENG02/026

MAT 102

SERIAL NO: 35

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

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

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

sol  $(+1i - 2j + 3k) \times (i - 2k) = (-2i - 5j) \times 2$

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

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

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

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

$$\therefore (A - 2B) = -2i + 5j - 4k$$

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

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

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

$$= -10i - 8j - 5k$$

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

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

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

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

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

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

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

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

$$\therefore A \times (2C \times 3B) = \begin{vmatrix} + & - & + \\ i & j & k \\ 4 & 1 & -2 \\ -24 & -42 & -12 \end{vmatrix}$$

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

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

$$= i(-96) - j(-96) + k(-144)$$

$$= -96i + 96j - 144k$$

$$\therefore A \times (2C \times 3B) = -96i + 96j - 144k$$

2.  $A = p\hat{i} - 6\hat{j} - 3\hat{k}$ ,  $B = 4\hat{i} + 3\hat{j} + \hat{k}$  and  $C = \hat{i} - 3\hat{j} + 2\hat{k}$ . Find the value of  $P$  for which  $A$ ,  $B$  and  $C$  are coplanar.

Sol

$$A \cdot (B \times C) = 0$$

$$(B \times C) = \begin{vmatrix} + & - & + \\ i & j & k \\ 4 & 3 & -1 \\ 1 & -3 & 2 \end{vmatrix} = \begin{vmatrix} p-5 & 1 & 1-3 \\ 5-1 & 1 & 5-0 \\ 1-(-3) & 1 & (1-p) - (0-0) \end{vmatrix}$$

$$= i \begin{vmatrix} 3 & -1 \\ -3 & 2 \end{vmatrix} - j \begin{vmatrix} 1 & 1 \\ 1 & 2 \end{vmatrix} + k \begin{vmatrix} p-5 & 1 \\ 1 & -3 \end{vmatrix}$$

$$= i(6 - (3)) - j(8 - 1) + k(-12 - 3)$$

$$= i(3) - j(9) + k(-15)$$

$$(B \times C) = 3i - 9j - 15k$$

$$\therefore A \cdot (B \times C) = p\hat{i} - 6\hat{j} - 3\hat{k} \cdot 3i - 9j - 15k = 0$$

$$3p + 54 + 45 = 0$$

$$3p + 99 = 0$$

$$3p = -99$$

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

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