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MAT102 Assignment

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

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

$$2B = 2(3i - 2j + k) \Rightarrow 6i - 4j + 2k$$

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

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

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

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

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

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

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

$$2C = 2(i - 2k) \Rightarrow 2i - 4k$$

$$3B = 3(3i - 2j + k) \Rightarrow 9i - 6j + 3k$$

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

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

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

$$2C \times 3B = 24i + 30j - 12k$$

$$A \times (2C \times 3B) = \begin{vmatrix} i & j & k \\ 4 & 1 & -2 \\ 24 & 30 & -12 \end{vmatrix}$$

$$i \begin{vmatrix} 1 & -2 \\ 30 & -12 \end{vmatrix} - j \begin{vmatrix} 4 & -2 \\ 24 & -12 \end{vmatrix} + k \begin{vmatrix} 4 & 1 \\ 24 & 30 \end{vmatrix}$$

$$i(-12 + 60) - j(-48 + 48) + k(120 - 24)$$

$$\therefore A \times (2C \times 3B) = \underline{48i + 96k}$$

2) $A = p\mathbf{i} - 6\mathbf{j} - 3\mathbf{k}$, $B = 4\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ and $C = \mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$

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

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

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

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

$$3p = -99$$

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