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Civil Engineering

MAT 102 Assignment

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

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

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

$= 6i - 4j + 2k$

$\therefore (A - 2B) \times C = [4i + j - 2k - (6i - 4j + 2k)] \times (i - 2k)$

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

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

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

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

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

~~$\therefore (A - 2B) \times C = -10i - 5k$~~

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

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

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

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

$\therefore$ ~~$A \times (2C \times 3B) = i - j$~~

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

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

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

$$= -24i - 42j - 12k$$

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

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

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

$$= -96i - 192k$$

$\therefore A \times (2C \times 3B) = -96i - 192k$

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

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

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

$$6p - 3p + 54 + 45 = 0$$

$$3p + 99 = 0$$

$$3p = -99$$

$$p = -\frac{99}{3}$$

$$p = 33$$