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19/ENG03/019 NO 188
CIVIL ENGINEERING

MAT 102

Given that

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

find

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

2 $A = Pi - 6j - 3k$
$B = 4i + 3j - k$
$C = i - 3j + 2k$

find the value of P for which A, B & C are co-planar.

Solution

i) $4i + j - 2k - (6i - 4j + 2k) \times i + 0j - 2k$

$4i + j - 2k - 6i + 4j - 2k \times i - 2k$

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

+	−	+
i	j	k
-2	5	-4
1	0	-2

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

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

$$-10i - 8j - 5k = -23 //$$

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

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

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

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

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

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

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

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

$-96i + 96j - 144k$

Answer $= -144$.

2) Coplanar vectors are vectors whose ~~scalar~~ product amounts to zero multiplied

Given

$$A = Pi - 6j - 3k$$
$$B = 4i + 3j - k$$
$$C = i - 3j + 2k$$

+	-	+
i	j	k
P	-6	-3
4	3	-1
1	-3	2

$$P\begin{pmatrix} 3 & -1 \\ -3 & 2 \end{pmatrix} \quad -6\begin{pmatrix} 4 & -1 \\ 1 & 2 \end{pmatrix} \quad -3\begin{pmatrix} 4 & 3 \\ 1 & -3 \end{pmatrix}$$

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

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

$$3p = 54 + 45$$

$$3p = 99$$

$$p = 99/3$$

$$P = 11$$