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COMPUTER ENGINEERING

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MAT 102

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$$\vec{A} = 4\vec{i} + \vec{j} - 2\vec{k}, \quad \vec{B} = 3\vec{i} - 2\vec{j} + \vec{k}$$
$$\vec{C} = \vec{i} - 2\vec{k}$$

a) $(\vec{A} - 2\vec{B}) \times \vec{C}$

$$2\vec{B} = 2(3\vec{i} - 2\vec{j} + \vec{k}) = 6\vec{i} - 4\vec{j} + 2\vec{k}$$
$$\vec{A} - 2\vec{B} = 4\vec{i} + \vec{j} - 2\vec{k} - (6\vec{i} - 4\vec{j} + 2\vec{k}) = -2\vec{i} + 5\vec{j} - 4\vec{k}$$

$(\vec{A} - 2\vec{B}) \times \vec{C}$

$$\begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -2 & 5 & -4 \\ 1 & 0 & -2 \end{vmatrix}$$
$$\vec{i} \begin{vmatrix} 5 & -4 \\ 0 & -2 \end{vmatrix} - \vec{j} \begin{vmatrix} -2 & -4 \\ 1 & -2 \end{vmatrix} + \vec{k} \begin{vmatrix} -2 & 5 \\ 1 & 0 \end{vmatrix}$$
$$\vec{i}(10 - 0) - \vec{j}(4 - 4) + \vec{k}(0 - 5)$$
$$10\vec{i} - 5\vec{k}$$

$$6\vec{i} - 5\vec{k} + (-2\vec{k})$$
$$(\vec{A} - 2\vec{B}) \times \vec{C} = 6\vec{i} - 5\vec{k}$$

b) $\vec{A} \times (\vec{C} \times \vec{B})$

$$2\vec{C} = 2\vec{i} - 4\vec{k}$$
$$3\vec{B} = 9\vec{i} - 6\vec{j} + 3\vec{k}$$
$$2\vec{C} \times 3\vec{B} =$$
$$\begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 2 & 0 & -4 \\ 9 & -6 & 3 \end{vmatrix}$$
$$\vec{i} \begin{vmatrix} 0 & -4 \\ -6 & 3 \end{vmatrix} - \vec{j} \begin{vmatrix} 2 & -4 \\ 9 & 3 \end{vmatrix} + \vec{k} \begin{vmatrix} 2 & 0 \\ 9 & -6 \end{vmatrix}$$
$$\vec{i}(0 - 24) - \vec{j}(6 + 36) + \vec{k}(-12 - 0)$$
$$-24\vec{i} - 42\vec{j} - 12\vec{k} = 2\vec{C} \times 3\vec{B}$$

$\vec{A} \times (2\vec{C} \times 3\vec{B})$

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

$$\begin{aligned}
 & i \begin{vmatrix} 1 & -2 \\ -42 & -12 \end{vmatrix} - j \begin{vmatrix} 4 & -2 \\ -24 & -12 \end{vmatrix} + k \begin{vmatrix} 1 & 4 \\ -42 & -24 \end{vmatrix} \\
 & i(-12 - 84) - j(-48 + 48) + k(144 - 168) \\
 & i(-96) - j(0) + k(-24) \\
 & = -96i - 24k //
 \end{aligned}$$

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

For co-planer,

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

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

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

$$\begin{aligned}
 & P(6 - 3) + 6(8 - 1) - 3(-12 - 3) \\
 & 3P + 42 + 45 = 0 \\
 & 3P + 87 = 0 \\
 & 3P = -87 \\
 & P = -29 //
 \end{aligned}$$

$$\begin{aligned}
 & -3 \begin{vmatrix} 4 & 3 \\ 1 & -3 \end{vmatrix} = 0 \\
 & P(6 - 3) + 6(8 - 1) - 3(-12 - 3) \\
 & 3P + 42 + 45 = 0 \\
 & 3P + 87 = 0 \\
 & 3P = -87 \\
 & P = -29 //
 \end{aligned}$$