

19/ENG06/042 Mechanical engineering  
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$$A = 4i + j - 2k, B = 3i - 2j + k \text{ and } C = i - 2k.$$

a)  $(A - 2B)$

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

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

$$\Rightarrow -2i + 5j - 4k$$

$$(A - 2B) \times C = \begin{vmatrix} + & - & + \\ i & j & k \\ -2 & 5 & -4 \\ 1 & 0 & -2 \end{vmatrix} \Rightarrow i(-10 - 0) - j(4 + 4) + k(0 - 5)$$

$$\Rightarrow -10i - 8j - 5k$$

b)  $(2C \times 3B) \Rightarrow 2(i - 2k) \times 3(3i - 2j + k)$   
 $\Rightarrow (2i - 4k) \times (9i - 6j + 3k)$

$$(2C \times 3B) \Rightarrow \begin{vmatrix} + & - & + \\ i & j & k \\ 2 & 0 & -4 \\ 9 & -6 & 3 \end{vmatrix} \Rightarrow i(3 - 24) - j(6 + 36) + k(-12)$$
$$\Rightarrow -21i - 42j - 12k$$

$$\therefore A \times (2C \times 3B) \Rightarrow \begin{vmatrix} + & - & + \\ i & j & k \\ 4 & 1 & -2 \\ -21 & -42 & -12 \end{vmatrix} \Rightarrow i(-12 - 84) - j(-48 - 42) + k(168 + 21)$$

$$\Rightarrow -96i + 90j - 177k$$

$$A = Pi - 6j - 3k, B = 4i + 3j - 1k \text{ and } C = i - 3j + 2k$$

$$\text{ii) } A \cdot (B \times C) = 0$$

$$\Rightarrow (B \times C) \begin{vmatrix} i & j & k \\ 4 & 3 & -1 \\ 1 & -3 & 2 \end{vmatrix} \Rightarrow i(6-3) + j(8+1) + 1k(-12-1)$$
$$\Rightarrow 3i - 9j - 15k$$

$$A \cdot (B \times C) \Rightarrow (Pi - 6j - 3k) \cdot (3i - 9j - 15k) = 0$$

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

$$\Rightarrow 3P = 99$$

$$\therefore P = 33$$