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$$A = 4i + j - 2k$$

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

$$C = i - 2k$$

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

$$2B = 6i - 4j + 2k$$

$$\begin{aligned} A - 2B &= 4i + j - 2k - (6i - 4j + 2k) \\ &= 4i + j - 2k - 6i + 4j - 2k \\ &= -2i + 5j - 4k \end{aligned}$$

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

$$\begin{aligned} (A - 2B) \times C &= i[(-10) - (0)] - j(4 + 4) + k(0 - 5) \\ &= -10i - 8j - 5k \end{aligned}$$

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

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

$$2C = 2i - 4k$$

$$3B = 9i - 6j + 3k$$

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

$$\begin{aligned} 2C \times 3B &= i(0 - 24) - j(6 + 36) + k(18 - 0) \\ &= -24i - 42j - 18k \end{aligned}$$

$$A \times (2C \times 3B) = \begin{vmatrix} i & -j & k \\ 4 & 1 & -2 \\ -24 & -42 & -18 \end{vmatrix}$$

$$A \times (2C \times 3B) = i(-18-84) - j(-72-48) + k(-168+24)$$

$$= -102i + 120j - 144k$$

$$\therefore A \times (2C \times 3B) = -102i + 120j - 144k$$

② $A = pi - 6j - 3k$, $B = 4i + 3j - k$, $C = i - 3j + 2k$
 Vectors A, B, C are coplanar if $a \cdot (b \times c) = 0$

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

$$A \cdot (B \times C) = p(6+3) - 6(8+1) - 3(-12-3) = 0$$

$$= 9p - 54 + 45 = 0$$

$$9p - 9 = 0$$

$$9p = 9$$

$$\frac{9p}{9} = \frac{9}{9}$$

$$p = 1$$

The value of p for which A, B and C are coplanar is 1