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$$A = 3i + 4j - 6k \quad B = 5i - 11j + 2k \quad C = 7i - 7j + k$$

1) $A \cdot C + B \cdot C$

$$\begin{aligned} A \cdot C &= (3i + 4j - 6k) \cdot (7i - 7j + k) \\ &= 21 + (-28) - 6 \\ &= 21 - 28 - 6 \\ &= 43 \end{aligned}$$

$$\begin{aligned} B \cdot C &= (5i - 11j + 2k) \cdot (7i - 7j + k) \\ &= 35 + 77 + 2 \\ &= 114 \end{aligned}$$

$$\therefore A \cdot C + B \cdot C = 43 + 114 = \underline{\underline{157}}$$

2) $(A - B) \cdot C$

$$\begin{aligned} A - B &= (3i + 4j - 6k) - (5i - 11j + 2k) \\ &= -2i + 15j - 8k \end{aligned}$$

$$\begin{aligned} (A - B) \cdot C &= (-2i + 15j - 8k) \cdot (7i - 7j + k) \\ &= -14 - 105 - 8 \\ &= \underline{\underline{-127}} \end{aligned}$$

3) $A \cdot (B \times C)$

$$B \times C = \begin{vmatrix} i & j & k \\ 5 & -11 & 2 \\ 7 & -7 & 1 \end{vmatrix}$$

$$B \times C = i(-11 + 14) - j(5 - 14) + k(-35 + 77)$$

$$\therefore B \times C = 3i + 9j + 42k$$

$$\begin{aligned} \therefore A \cdot (B \times C) &= 3i + 4j - 6k \cdot (3i + 9j + 42k) \\ &= 9 + 36 - 252 \\ &= \underline{\underline{-207}} \end{aligned}$$