

Dragt 7b cont.

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$$= - \sum_{ijklm} \epsilon_{ijk} b_i c_j a_k \epsilon_{ilm} \hat{e}_m$$

$$= - \sum_{ijklm} b_i c_j a_k \hat{e}_m \epsilon_{ijk} \epsilon_{ilm}$$

$$= - \sum_{\substack{ij \\ lm}} b_i c_j a_k \hat{e}_m (\delta_{il} \delta_{jm} - \delta_{im} \delta_{jl})$$

$$= - \sum_{ij} [b_i c_j a_k \hat{e}_j - b_i c_j a_j \hat{e}_i]$$

$$= - \sum_j c_j \hat{e}_j \underbrace{\sum_i b_i a_i}_{\vec{a} \cdot \vec{b}} + \sum_i b_i \hat{e}_i \underbrace{\sum_j c_j a_j}_{\vec{a} \cdot \vec{c}}$$

$$= \vec{b} (\vec{a} \cdot \vec{c}) - \vec{c} (\vec{a} \cdot \vec{b})$$

f) $(J_i)_{jk} = -\epsilon_{ijk}$

$$J_1 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{pmatrix} \Rightarrow (J_1)_{23} = -1 = -\epsilon_{123}$$

$$(J_1)_{32} = +1 = -\epsilon_{321}$$

$$\therefore (J_i)_{jk} = -\epsilon_{ijk}, \text{ etc.}$$