$$\frac{L_n^2}{n!} \cdot \binom{n}{k} \cdot D_{n-k} = \frac{L_n^2}{n!} \cdot \binom{n}{k} \cdot \left(\sum_{i=0}^{n-k} (-1)^i \frac{(n-k)!}{i!} \right)$$