③ $L \overset{det}{=} \log P(D|V)$ $\quad P(D|V) = \prod_{n=1}^{N} \prod_{K=1}^{k} P_K(V_K^T X^{(n)}) \, |\det(V)|$

$= N \log|\det(V)| + \sum_{K=1}^{K} \sum_{n=1}^{N} \log(P_K(V_K^T X^{(n)}))$

④ $\frac{\partial L}{\partial V_{ij}} = N \frac{V_{ij}}{\det(V)} + \sum_{n=1}^{N} \log \frac{\operatorname{sech}(V_i^T X_j^{(n)})}{\Pi}$

$= N V_{ij} + \sum_{n=1}^{n} \frac{}{\operatorname{sech}(V_i^T X_j^{(n)})} \cdot \tanh(V_i^T X_j^{(n)})(-\operatorname{sech}(V_i^T X_j^{(n)}) \cdot X_j^{(n)}$

$= N V_{ij} - \sum_{n=1}^{n} \tanh(V_i^T X^{(n)}) X_j^n$

③ $L \overset{det}{=} \log P(D|V)$ $\quad P(D|V) = \prod_{n=1}^{N} \prod_{K=1}^{k} P_K(V_K^T X^{(n)}) \, |\det(V)|$

$\Rightarrow L = N \log|\det(V)| + \sum_{K=1}^{K} \sum_{n=1}^{N} \log [P_K(V_K^T X^{(n)})]$

④ $\frac{\partial L}{\partial V_{ij}} = N \frac{V_{ij}}{|\det(V)|} + \frac{\partial \left(\sum_{n=1}^{n} \sum_{K=1}^{K} \log \frac{\operatorname{sech}(V_i^T X^n))}{\Pi} \right)}{\partial V_{ij}}$

$= N V_{ij} + \sum_{n=1}^{n} \frac{1}{\operatorname{sech}(V_i^T X^{(n)})} \cdot \tanh(V_i^T X^{(n)})(-\operatorname{sech}(V_i^T X^{(n)}) \cdot X_j^{(n)}$

$= N \cdot V_{ij} - \sum_{n=1}^{n} \tanh(V_i^T X^{(n)}) \cdot X_j^{(n)}$