$$E[\log L(\vec{x}, \vec{z} \mid \theta)] = \sum_{i=1}^{n} \left(\log \tau - \frac{1}{2} \log(2\pi\sigma^2) - \sum_{j=1}^{n} E[z_{ij}] \frac{(x_i - u_j)^2}{2\sigma^2} \right)$$

$$\frac{dE[\log L(\vec{x}, \vec{z} \mid \theta)}{d\theta} = \frac{\partial}{\partial \theta} \left(\sum_{i=1}^{n} \log \tau - \frac{1}{2} \log(2\pi\sigma^2) - \sum_{j=1}^{n} E[z_{ij}] \frac{(x_i - u_j)^2}{2\sigma^2} \right)$$

$$= \sum_{j=1}^{n} \frac{E[z_{ij}] (x_i - u_j)}{2} \qquad (\sigma^2 = 1)$$

$$= \frac{1}{2} \left(\sum_{j=1}^{n} E[z_{ij}] x_i - \sum_{j=1}^{n} E[z_{ij}] u_j \right) = 0$$

$$\Rightarrow \sum_{j=1}^{n} E[z_{ij}] x_i = \sum_{j=1}^{n} E[z_{ij}] u_j$$

$$u_j = \frac{\sum_{j=1}^{n} E[z_{ij}] x_i}{\sum_{j=1}^{n} E[z_{ij}]}$$