VI derivation (non-intuitive)

Write marginal log-lik. as a sum

$$\ln p(x) = \mathcal{L}(q(z)) + KL(q(z) \| p(z|x))$$

(our approx)

where

$$\mathcal{L}(q(z)) = \int q(z) \ln \frac{p(x,z)}{q(z)} \, dz$$

$$KL(q(z) \| p(z|x)) = \int q(z) \ln \frac{q(z)}{p(z|x)} \, dz$$

Verification (as for EM)

$$\mathcal{L} + KL$$

$$= \int q(z) \ln \frac{p(x,z)}{p(z|x)} \, dz$$

$$= \int q(z) \ln p(x) \, dz$$

$$= \ln p(x)$$

We minimize $KL(q(z) \| p(z|x))$ by maximizing $\mathcal{L}(q(z))$ (easier, often possible).