Now, for the E-step —

for a fixed θ, $F(q, \theta)$ is bounded by L & achieves that bound when $KL[q(z) \| P(z|x, \theta)] = 0$

Now, $KL[q][p]$ is zero only if $q = p$.

∴ the value of $q(z)$ in E-step will be —

$$q^{(k)}(z) = P(z|x, \theta^{(k-1)})$$

and the KL term will turn to 0 to achieve the lower bound.