Now, using ② –

$$q(z) \propto P(x, z \mid \theta)$$

$$q(z) = \frac{P(x, z \mid \theta)}{\sum_z P(x, z \mid \theta)}$$ {Normalizing the sum to 1.}

$$= \frac{P(x, z \mid \theta)}{P(x \mid \theta)}$$

$$= P(z \mid x, \theta)$$ {By definition of conditional probability}.

(i.) <u>Now for the E step</u>:-

we will set $q(z) := P(z \mid x, \theta)$ ——— ④

~~Also~~ This E-step will create a lower bound on the log likelihood function which is tight at the current value of $\theta$.

(ii.) <u>For the M-step</u>:-

We will maximize the lower bound with respect to our parameters $\theta$.

$$\theta := \underset{\theta}{\operatorname{argmax}} \sum_z q(z) \log \frac{P(x, z \mid \theta)}{q(z)} \quad \text{———} \quad ⑤$$

Hence ④ & ⑤ gives the E & M step of the equation.