(Q2.) b.) Given:- $F(q,\theta) = \sum_z q(z) \log \frac{P(x,z|\theta)}{q(z)}$

Explain the above approach using K-L divergence.

$$\therefore F(q,\theta) = \int q(z) \log \frac{P(x,z|\theta)}{q(z)} dz$$

~~$= \int q(z) \log P(z|x,\theta)$~~

$$= \int q(z) \log \frac{P(z|x,\theta)\, P(x|\theta)}{q(z)} dz$$

$$= \int q(z) \log P(x|\theta)\, dz + \int q(z) \log \frac{P(z|x,\theta)}{q(z)} dz \quad \text{—— (A)}$$

$$= L(\theta) - KL[q(z) \,||\, P(z|x,\theta)] \quad \text{—— (1)}$$

In equation (A)–

The first term is the log likelihood with respect to θ.

The second term is the KL divergence.