1.13 given (1.56) $\sigma_{ML}^2 = \frac{1}{N}\sum_n (x_n - \mu_{ML})^2$

replace μ_{ML} with the true value μ of the mean, we have.

$$\sigma_{ML}^2 = \frac{1}{N}\sum_n (x_n - \mu)^2$$

$$E(\sigma_{ML}^2) = E\left[\frac{1}{N}\sum_n (x_n - \mu)^2\right]$$

$$= \frac{1}{N} E\left[\sum_n (x_n - \mu)^2\right]$$

$$= \frac{1}{N} E\left[\sum_n x_n^2 - 2\mu x_n + \mu^2\right]$$

$$= E[x_n^2] - 2\mu E[x_n] + E[\mu^2]$$

$$= \mu^2 + \sigma^2 - 2\mu^2 + \mu^2$$

$$= \sigma^2$$