Exercise: ML estimator $\hat{\sigma}^2_{\mathrm{mle}}$ is biased

Show that $\hat{\sigma}^2_{MLE} = \frac{1}{N}\sum_{n=1}^{N}(x_n - \hat{\mu})^2$ is a biased estimator of σ^2, i.e., show

$$\mathbf{E}_{\mathrm{X}_1,\ldots,\mathrm{X}_\mathrm{n}\sim\mathcal{N}(\mu,\sigma)}[\hat{\sigma}^2(\mathrm{X}_1,\ldots,\mathrm{X}_\mathrm{n})] \neq \sigma^2$$

Hint: note that $X_1, \ldots, X_N$ are independent, and use the fact that the expectation of a product of independent random variables is the product of the expectations.