1. **(5 points)** Let $X_1, X_2, ..., X_n$ be a random sample from $N(\mu, \sigma^2)$ distribution. Show that

$$W = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{\sigma^2} \sim \mathcal{X}^2_{(n-1)}$$