Exercise 1:

Consider a case of binary classification, i.e., $y \in \{0, 1\}$, where you only have a one-dimensional feature $\mathbf{x}$.

(a) Derive the decision regions for LDA, i.e., assuming that $\mathbf{x}|y = k \sim \mathcal{N}(\mu_k, \sigma^2)$ for $k \in \{0, 1\}$

(b) Derive the decision regions for QDA, i.e., assuming that $\mathbf{x}|y = k \sim \mathcal{N}(\mu_k, \sigma_k^2)$ for $k \in \{0, 1\}$

Hint: In both parts, start with $p(\mathbf{x}|y = 0) = p(\mathbf{x}|y = 1)$ and solve for $\mathbf{x}$.