3. ISLR, 4.7.3

$$p_k(x) = \frac{\pi_k \frac{1}{\sqrt{2\pi}\sigma_k} \exp\left(-\frac{1}{2\sigma_k^2}(x-\mu_k)^2\right)}{\sum_{l=1}^{K} \pi_l \frac{1}{\sqrt{2\pi}\sigma_l} \exp\left(-\frac{1}{2\sigma_l^2}(x-\mu_l)^2\right)}$$

The denominator of $p_k(x)$ is the same for each k, so it does not influence the Bayes

's classifier. Thus, when taking the log of $p_k(x)$, the denominator can be removed.

The log of the numerator of $p_k(x)$ is

$\log\left(\frac{\pi_k}{\sqrt{2\pi}\sigma_k}\right) - \frac{1}{2\sigma_k^2}(x-\mu_k)^2.$

It is not linear but quadratic, that is, the quadratic function of x.