$$\Pr(Y=k \mid X=x) = \frac{\pi_k f_k(x)}{\sum_{l=1}^{K} \pi_l f_l(x)}$$ Bayes' Theorem

4.7.3

plugging in:

$$f_k(x) = \frac{1}{\sqrt{2\pi}\,\sigma_k} \exp\left(-\frac{1}{2\sigma_k^2}(x-\mu_k)^2\right)$$

results in:

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

* when $\sigma_1 = \sigma_2 = \sigma_k$ (LDA), these terms cancelled out. Now they do not.

rearranging...

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

$\longrightarrow$ which is quadratic.