2(a). According to equation 4.33 from the textbook for the LDA rule to classify to class 2, the ratio of ~~pro~~ posterior probability of N_2 & N_1 should be greater than 1.

$$\log \frac{Pr(G=K \mid X=x)}{Pr(G=K \mid X=x)} > 0 \quad \text{where, } k = N_2 \text{ & } K = N_1$$

$$\log \frac{N_2}{N_1} - \frac{1}{2}(\mu_2+\mu_1)^T \Sigma^{-1}(\mu_2-\mu_1) + x^T \Sigma^{-1}(\mu_2-\mu_1) > 0$$

$$x^T \Sigma^{-1}(\mu_2-\mu_1) > \frac{1}{2}(\mu_2+\mu_1)^T \Sigma^{-1}(\mu_2-\mu_1) - \log(N_2/N_1)$$

Therefore, substituting the target, we get

$$x^T \Sigma^{-1}(\mu_2-\mu_1)^* > \frac{1}{2}\mu_2^T \Sigma^{-1}\mu_2 - \frac{1}{2}\mu_1^T \Sigma^{-1} + \log\frac{N_1}{N} - \log\frac{N_2}{N}$$