2) a) $\max_{\lambda_i \geq 0} \min_{\omega, \alpha} \|\omega\|^2 - \sum_{i=1}^{n} \lambda_i (y_i (X_i \cdot \omega + \alpha) - 1)$

$\max_{\lambda_i \geq 0} \sum_{i=1}^{n} \lambda_i - \frac{1}{4} \sum_{i=1}^{n} \sum_{J=1}^{n} \lambda_i \lambda_j y_i y_j X_i \cdot X_j$ subject to $\sum_{i=1}^{n} \lambda_i y_i = 0$

b) $r(x) = \begin{cases} +1 & \text{if } \omega \cdot x + \alpha \geq 0 \\ -1 & \text{otherwise} \end{cases}$

$\downarrow$

$r(x) = \begin{cases} +1 & \text{if } \alpha^* + \frac{1}{2} \sum_{i=1}^{n} \lambda_i^* y_i X_i \cdot x \geq 0 \\ -1 & \text{otherwise} \end{cases}$

c) Looking at the condition, for all $i > 0$, the condition goes to 0, therefore for points corresponding to $\lambda_i^* > 0$ the other variables y_i, X_i, α, ω must result in 0.

d) Support vectors are the only training points needed because they add meaningful information to the training set, while other training sets may not.

e) The support vectors are the points on the graph closest to the Margin

f)