a) If the data is linearly separable, show that for some $w$, $y_n(w^T x_n) \geq 1$ for $n = 1, ...N$.

b) Formulate the task of finding a separator $w$ for separable data as a linear program.

c) If the data is not separable, the condition in (a) cannot hold for every n. Thus introduce the violation $\zeta_n \geq$ to capture the amount of violation for example $x_n$. So, for $n = 1...N$, $y_n(w^T x_n) \geq 1 - \zeta_n$, $\zeta_n \geq 0$. We want to minimize the "amount of violation". One choice is to minimize $\sum_{n=1}^{N} \zeta_n$, i.e. we wish to find $w$ which solves: Minimze $\sum_{n=1}^{N} \zeta_n$ s.t. $y_n(w^T x_n) \geq 1 - \zeta_n$, $\zeta_n \geq 0$, where the inequalities hold for $n = 1...N$. Formulate this as a linear program.