For a given dataset $D = \{x_i, y_i\}_{i=1}^N$ with $x_i \in R^D$ and $y_i \in \{0, 1\}$, consider the following objective function $L(w)$:

With logistic function

$$L(w) = \sum_{i=1}^{N} \left[f(w^T x_i) - y_i \right]^2 \tag{1}$$

and

$$f(t) = \frac{1}{1 + \exp(-t)} \tag{2}$$

Show that $L(w^*)$ has a minimum value, not a maximum, at the w^* making

$$\left. \frac{\partial L}{\partial w} \right|_{w=w^*} = 0. \tag{3}$$