1 (a) Note that $\frac{1}{1+e^z} = 1 - \sigma(z)$ and $\frac{\partial \sigma(z)}{\partial z} = \sigma(z)(1 - \sigma(z)$.

$$\frac{\partial E(w)}{\partial w} =$$

$$y^T \frac{1}{\sigma(Xw)} \sigma(Xw)(1 - \sigma(Xw))X$$

$$+ \frac{1}{1 - \sigma(Xw)}(-\sigma(Xw)(1 - \sigma(Xw)))X - y^T \frac{1}{(1 - \sigma(Xw))}(-\sigma(Xw)(1 - \sigma(Xw)))X$$

$$= y^T X - y^T \sigma(Xw))X - \sigma(Xw)X + y^T \sigma(Xw)X$$

$$= y^T X - \sigma(Xw)X$$

$$\frac{\partial^2 E(w)}{\partial w} = -\sigma(Xw)(1 - \sigma(Xw))XX^T$$