Problem 2

Part a.

$$L(\beta|X,\vec{y}) = \prod_{i=1}^{n} p_i^{y_i}\left(1-p_i\right)^{1-y_i} \quad , \; y_i = 1,0$$

$$= \prod_{i=1}^{n} \left(\frac{e^{x_i\beta}}{1+e^{x_i\beta}}\right)^{y_i} \cdot \left(1-\frac{e^{x_i\beta}}{1+e^{x_i\beta}}\right)^{1-y_i} \quad , \; y_i = 1,0$$

$$= \prod_{i=1}^{n} \left(\frac{e^{x_i\beta}}{1+e^{x_i\beta}}\right)^{y_i} \cdot \prod_{i=1}^{n} \left(1-\frac{e^{x_i\beta}}{1+e^{x_i\beta}}\right)^{1-y_i}$$

$$= \prod_{i=1}^{n} \left(\frac{e^{x_i\beta}}{1+e^{x_i\beta}}\right)^{y_i} \cdot \prod_{i=1}^{n} \left(\frac{1}{1+e^{x_i\beta}}\right)^{1-y_i}$$