Problem 2:

$$J(\theta) = -\sum_{n=1}^{N}\left[y_n \log h_\theta(x_n) + (1-y_n)\log(1-h_\theta(x_n))\right]$$

$h_\theta(x_n) = \sigma(\theta^T x)$, by differentiate:

$$\frac{\partial J}{\partial \theta_j} = -\sum_{n=1}^{N} y_n x_{n,j}(1-\sigma(\theta^T x_n)) - x_{n,j}(1-y_n)(\sigma(\theta^T x_n))$$

$$= -\sum_{n=1}^{N} y_n x_{n,j} - \cancel{y_n x_{n,j}\sigma(\theta^T x_n)} - x_{n,j}\sigma(\theta^T x_n) + \cancel{y_n x_{n,j}\sigma(\theta^T x_n)}$$

$$= -\sum_{n=1}^{N} y_n x_{n,j} - x_{n,j}\sigma(\theta^T x_n)$$

$$= -\sum_{n=1}^{N} x_{n,j}(y_n - \sigma(\theta^T x_n))$$

$$= \sum_{n=1}^{N} x_{n,j}(\sigma(\theta^T x_n) - y_n)$$

Transfer back to h_θ:

$$= \sum_{n=1}^{N} x_{n,j}(h_\theta(x_n) - y_n)$$

Problem 3:

a). $$\frac{\partial J}{\partial \theta_0} = \sum_{n=1}^{N} 2w_n(\theta_0 + \theta_1 x_{n,1} - y_n)$$

$$\frac{\partial J}{\partial \theta_1} = \sum_{n=1}^{N} 2w_n(\theta_0 + \theta_1 x_{n,1} - y_n)\cdot x_{n,1}$$