HW 3

Q1) $K=2 \quad \theta = \theta_1 - \theta_2$

$$\frac{e^{\theta_K^T x}}{\sum_{i=1:K} e^{\theta_i^T x}} = \frac{e^{\theta_2^T x}}{e^{\theta_1^T x} + e^{\theta_2^T x}}$$

$$= \frac{1}{\frac{e^{\theta_1^T x}}{e^{\theta_2^T x}} + 1}$$

$$= \frac{1}{e^{(\theta_1 - \theta_2)^T x} + 1} \qquad \theta = \theta_1 - \theta_2$$

$$= \frac{1}{e^{\theta^T x} + 1}$$

Q2) For polynomial:

$$P(y^{(n)} = C_k \mid x^{(n)}; \theta_1, \theta_2, \ldots, \theta_K)$$

$$= (h_{\theta_1}(x^{(n)}))^{y_1^{(n)}} (h_{\theta_2}(x^{(n)}))^{y_2^{(n)}} (h_{\theta_3}(x^{(n)}))^{y_3^{(n)}} \cdots (h_{\theta_K}(x)^{(n)})^{y_K^{(n)}}$$

$$= \prod_{i=1}^{n} h_{\theta_K}(x^{(n)})^{y_i^{(n)}} \qquad \text{taking log}$$

$$= \sum_{i=1}^{K} y_i^{(n)} \log h_{\theta_i}(x^{(n)})$$