(1)

a, $\theta = \begin{bmatrix} \theta_0 \\ \vdots \\ \theta_n \end{bmatrix}$ $\quad x^i = \overset{n \times 1}{\begin{bmatrix} x_0 \\ \vdots \\ x_n \end{bmatrix}}$ $x_0 = 1$

$$h_\theta(x) = \theta^T x \; (= X\theta)$$

b, $$J(\theta) = \frac{1}{2m} \sum_{i=1}^{m} (\theta^T x^i - y^i)^2$$

~~$\frac{1}{2m}$~~

c, $$\frac{dJ}{d\theta_j} = \frac{1}{m} \sum_{i=1}^{m} (\theta^T x^i - y^i) x_j^i$$

d, $$\theta_j := \theta_j - \frac{\alpha}{m} \sum_{i=1}^{m} (\theta^T x^i - y^i) x_j^i$$

e. $h_\theta(x) = X\theta$

$$J(\theta) = \frac{1}{2m} \sum_{i=1}^{m} (X\theta - y^i)^2$$

$$= \frac{1}{2m} (X\theta - y)^T (X\theta - y)$$

$$\frac{dJ}{d\theta} = \frac{1}{m} X^T (X\theta - y)$$

$$\theta_j := \theta_j - \frac{\alpha}{m} X^T (X\theta - y)$$