

* If $a \in \mathbb{R}$ i.e. a is (1×1) matrix
 then, $\text{tr}(a) = a$ prop ①

If A & B are two matrices s.t. $\text{tr } BA = \text{tr } AB$

$$\text{tr } ABC = \text{tr } CAB = \text{tr } BCA$$

$$\text{tr } ABCD = \text{tr } DABC = \text{tr } CDAB = \text{tr } BCDA$$

$$\text{tr } A = \text{tr } A^T$$

$$\text{tr } (A + B) = \text{tr } A + \text{tr } B$$

$$\text{tr } aA = a \text{tr } A$$

$$\nabla_A \text{tr } AB = B^T$$

$$\nabla_{A^T} f(A) = (\nabla_A f(A))^T$$

$$\nabla_A ABAT^T C = CAB + C^T A B^T$$

$$\nabla_A |A| = |A| (A^{-1})^T$$

$$X = \begin{bmatrix} -(x^{(1)})^T \\ -(x^{(2)})^T \\ \vdots \\ -(x^{(m)})^T \end{bmatrix}$$

$$\vec{y} = \begin{bmatrix} y^{(1)} \\ y^{(2)} \\ \vdots \\ y^{(m)} \end{bmatrix}$$

$$\theta = \begin{bmatrix} \theta_0 \\ \theta_1 \\ \vdots \\ \theta_n \end{bmatrix}$$

$$h_\theta(x^{(i)}) = (x^{(i)})^T \theta$$

$$X\theta - \vec{y} = \begin{bmatrix} (x^{(1)})^T \theta \\ \vdots \\ (x^{(m)})^T \theta \end{bmatrix} - \begin{bmatrix} y^{(1)} \\ \vdots \\ y^{(m)} \end{bmatrix}$$

$$= \begin{bmatrix} h_\theta(x^{(1)}) - y^{(1)} \\ \vdots \\ h_\theta(x^{(m)}) - y^{(m)} \end{bmatrix}$$