DSC 140A - Discussion 02

Problem 1.

Let A be a *symmetric* $n \times n$ matrix, with entries:

$$\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix}.$$

Suppose $\vec{x} \in \mathbb{R}^n$.

a) Show that $\vec{x}^T A \vec{x} = \sum_{i=1}^{n} \sum_{j=1}^{n} x_i x_j a_{ij}$.

b) Show that

$$\frac{\partial}{\partial x_1} \left(\vec{x}^T A \vec{x} \right) = 2 \sum_{j=1}^{n} x_j a_{1j}$$