Problem Set 0

1. (a) $\nabla f(x) = \nabla \frac{1}{2} x^T A x + \nabla b^T x$

$= \frac{1}{2} x^T (A + A^T) + b^T$

$= x^T A + b^T$

$= Ax + b^T$

(b) $\nabla f(x) = \nabla g(h(x))$

$= \frac{\partial g(z)}{\partial z} \cdot \frac{\partial z}{\partial x}$ when $z = h(x)$.

(c) $\nabla^2 f(x) = $

$= \nabla^2 \frac{1}{2} x^T A x + \nabla^2 b^T x$

$= \frac{1}{2} \cdot 2A + 0 = A.$

(d) $\nabla f(x) = \frac{\partial g}{\partial z} \cdot \frac{\partial z}{\partial x}$ when $z = a^T x$

$= g' \cdot a^T$

$\nabla^2 f(x) = $