Homework #3

Math 529 - Section 10

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1. $f(x) = a + b \cdot x + \frac{1}{2} x \cdot Ax$

Newton's iteration on a function $f(x)$ is

$$x_{k+1} = x_k - \left(Hf(x_k)\right)^{-1} \nabla f(x_k)$$

In our case, $k=0$, $\nabla f(x_0) = b + Ax_0$, and $Hf(x_0) = A$. Thus,

$$x_1 = x_0 - A^{-1}(b + Ax_0) = x_0 - A^{-1}b - A^{-1}Ax_0 =$$

$$\cancel{x_0} - A^{-1}b - \cancel{x_0} = -A^{-1}b.$$

But $-A^{-1}b = x^*$, the solution of the system $Ax = -b$.

This demonstrates that Newton's method

reaches x^* in one step from any initial point x_0.

2.
3. } Code.
4.
5.