Applied Mathematics I
Worksheet #2

September 4, 1998 - Professor Broughton

Name:_____ Box #:_____

1. Scalar Equations

1. In a linear resistor model $V = RI$ the following table of measurements has been made.

V	I
5	:25
10	:49
15	:76

1.1 Estimate R and explain how you did it.

1.2 Estimate I when $V = 50$.

2. Existence of solutions

2. Find the number of solutions to $y = f(x)$ in the following cases. Justify your count. If there are parameters, state what restrictions are required to guarantee a solution.

2.a $f(x) = ax + b$

2.b $f(x) = x^2 + 5x + 10;\ y = 25$

2.c $f(x) = x^2 + 5x + 10;\ y = 1$

3. Sensitivity to Errors for Inverse Problems

3. In each of the following cases compute the following:

   - ² the solution to x_0 to $f(x) = y_0$; the solution x_1 to $f(x) = y + ²$; and x_2 to $f(x) = y ¡ ²$:
   - ² for the solution above $f^0(x_0); 1=f^0(x_0)$ and the larger of the two values you …nd for $\frac{\mathbf{M}x}{4y}$: Note that $4y$ is either ² or ¡² and that ¢x is the corresponding change in the value of x; i.e., either $x_1 ¡ x_0$ or $x_2 ¡ x_0$:

3.a $f(x) = 10x + 5;\ y_0 = 13;\ ² = :01$

3.b $f(x) = :001x + 5$; $y_0 = 13$; $^2 = :01$

3.d $f(x) = x^2 + 5x + 10$; $y_0 = 20$; $x_0 > 0$; $^2 = :01$

3.e $f(x) = x^2 + 5x + 10$; $y_0 = 3:75$; y_0; $^2 = :01$ (this one is a bit odd)

4. Answer the following questions based on what happened in question 3.

4.a Formulate a rule for estimating the sensitivity of solution errors in terms of the error of the initial data.

4.b When should a warning ‡ag go up for the reliability of solutions of a linear scalar equations?

4.c When should a warning ‡ag go up for the reliability of solutions of a general scalar equations?