Take Home Portion of Final Exam Math 496, Section 006: Inverse Theory

Points: 50

Due Date: Three days from pickup.

Instructions: Show your work and give reasons for your answers. There is to be absolutely no consultation of any kind with anyone else other than me about the exam. If there are points of clarification or corrections, I will post them on our message board. ALL materials used in your work that have not been provided by me for this course must be explicitly credited in your write-up. Point values are indicated. You may send an email document (preferably a pdf file, but Word documents will be accepted) or hand in hard copy at my office.

(19 pts) **1.** Textbook 2.5. Modify the data to have noise in the second coordinate by adding `1e-6*randn` to each term. Then answer the exercise questions. Regularize this problem so as to obtain a better answer (any method, your choice, but let the method determine parameters like α, not your knowledge of the solution.) The coefficient matrix for this model is a van der Monde matrix. You will find the Matlab command `vander` helpful.

(19 pts) **2.** Textbook 10.2. (a),(c),(d). In place of (b), use forward differences to approximate the Jacobian. Look in our Math496S06 public directory under MatlabTools/Homework/chap10.

(12 pts) **3.** Consider the linear model $G\mathbf{m} = \mathbf{d}$. Show that if $\mathbf{d} \in R\left(G^T G\right)$, then $\|\mathbf{m}_\alpha - \mathbf{m}_\dagger\| = \mathcal{O}(\alpha)$ as $\alpha \to 0$. (The SVD can be very helpful here.)