Homework 4, due to March, 6, 2006

All exercise numbers refer to the book ‘Numerical Linear Algebra’ of Trefethen and Bau.

**Problem 1:** Solve exercise 12.1

**Problem 2:** Solve exercise 12.3

**Problem 3:** Solve exercise 13.3

**Problem 4:** Solve exercise 15.2

**Problem 5:** Consider the function

\[ f(x) = \frac{1 - \cos x}{x^2}. \]

Evaluate and plot the function on the range \([-4e^{-8}, 4e^{-8}]\) with grid spacing \(1e^{-10}\) (you get 801 grid points). This function should be about 1/2 across this interval. Where does the deviation come from? In particular, compare \(f(x)\) at \(x=1.1e^{-8}\) and at \(x = 2^{-24}\). Explain the so called *catastrophic cancellation* in one case and the quite accurate result in the other.