# 13.024 Problem Set 7:

## Fluid Dynamics and Root Finding Using MATLAB

**Due: April 8, 2003**

Problem 1

Do Problem 11 on page 286 of the Recktenwald Textbook

Problem 2

Do Problems 18 and 19 on page 286 of the textbook. In your MATLAB code, include the programming that will tell you the run time for the iterative parts of the computations. Compare the run times for the bisection method and Newton's method.

Problem 3

Supposed a box shaped barge that is 50 m long, 10 m wide and with a draft of 4 m is in head seas with 1 meter amplitude (2 m high) and 100 meters long. The wave number is k $=0.0628\ m^{-1}$ and the wave circular frequency is $\omega = 0.785\ s^{-1}$ (8 second wave period). The wave pressure formula is given on page 56 of the lecture notes for which the wave elevation is $\varsigma = A \cos(kx - \omega t)$ .

A. Calculate the fore and aft Froude Krylov force on the barge as a function of time during the 8 second wave period due to wave pressure acting normal to the hull surface . Hint: The fore and aft force is maximum when a wave node (midway between crest and trough) is at the midship with positive wave elevation at the stern ($x = -L/2$) and negative wave elevation at the bow ($x = L/2$) . For a maximum force to the right for the conditions on pages 56 and 57 of the lecture notes, $\sin \omega t = -1$

B. Use the formula at the bottom of page 57 of the lecture notes to estimate the force vs time without having to do integrations over surfaces.

C. Compare the results of the two methods