Spring 2010 Math 541

Homework 2

Work the Problems in WeBWorK. Create or modify the lecture programs (preferably MatLab) for the Bisection, Secant, and Newton's Method for finding a root to $f(x) = 0$, then use these programs to solve the problems. In addition on your written part of the HW, answer the questions below.

1. Find *all real* solutions of the following equations and indicate the method you used (from the 3 listed above). Give your answer correct to **5 significant** digits and provide an appropriate graph for each equation. Briefly discuss how you found your solution and why a particular method was chosen.

a. $x^{10} = 2^x$.

b. $0.4 = \int_0^x \frac{\sin(t)}{t}\, dt$. Use a series expansion to evaluate this problem.

c. $1 - x + \frac{x^2}{(2!)^2} - \frac{x^3}{(3!)^2} + \frac{x^4}{(4!)^2} - ... = 0$. Find the two smallest positive roots.

2. **Radius of the Earth problem**: From a point in Mission Valley, the top of Cowles Mountain and the top of Mount Cuyumaca line up. The height above sea level of the point in Mission Valley is 40 ft, the height of Cowles Mountain is 1591 ft, and the height of Mount Cuyumaca is 6512 ft. The distance between this point in Mission Valley and Cowles Mountain is 9.2 miles. The distance between this point in Mission Valley and Mount Cuyumaca is 34.85 miles. From these observations calculate the radius of the Earth. Briefly outline the steps required to solve this problem. Discuss which numerical iteration method you used, why it was chosen, and show the iterations stating the type of convergence.

Hint: Center a coordinate system at the center of the Earth with the point in Mission Valley having coordinates (Radius + height, 0). The polar coordinate of the mountain tops will then be given by (Radius + height, Angle), where the Angle can be determined by the definition of radian measure (Angle = Distance/Radius). Now write the coordinates of these two mountain tops in Cartesian coordinates. Since the line Mission Valley to Cowles and the line Mission Valley to Cuyumaca are the same, they have the same slope. Compute and equate these slopes to derive the equation in the variable R. Now solve for R.