MATH 113 – MAPLE ASSIGNMENT 4 – DUE 24 APRIL 2007

Answer all of the following questions. You may work in groups of no more than three persons to complete this assignment. One copy of the completed assignment is to be turned in for each group. **Each member of the group must sign the assignment.**

You are expected to turn in a printout of a MAPLE worksheet containing the MAPLE commands and output that you used to complete the assignment. You must also include text explaining what you are doing (this can be typed onto the MAPLE worksheet or written by hand on the printout). Include any hand calculations.

This assignment is due at the beginning of class on Tuesday 24 April 2007. No late assignments will be accepted under any circumstances whatsoever. If you are not finished with the assignment by the due date, you should turn in what you have for partial credit. You may turn in the assignment early if you wish.

1. (a) (4 pts.) Use MAPLE to define the function

$$f(x) = (1/5)x^5 - 2x^4 + 7x^3 - 11x^2 + 8x - 5$$

Use MAPLE to plot the graph of $f(x)$, $f'(x)$, and $f''(x)$ separately using the horizontal and vertical viewing windows `x=0..5` and `y=-5..5`. Use MAPLE to plot the graphs on the same set of axes using the same viewing windows.

(b) (4 pts.) Use the graphs you found in part (a) estimate the intervals on which $f(x)$ is increasing and decreasing and where $f(x)$ is concave up and concave down.

2. In this problem, we will use Newton's method to find the positive solution to the equation $\cos(\pi x) = x^2$.

(a) (4 pts.) Plot the functions $\cos(\pi x)$ and x^2 on the same set of axes using the horizontal viewing window `x=-1..1`. (Hint: Use `Pi` for the number π in your MAPLE commands.) Conclude that the equation $\cos(\pi x) = x^2$ has only one positive solution. Use the MAPLE command `fsolve` to find the solution correct to 10 decimal places.

(b) (4 pts.) Use MAPLE to define a function $F(x)$ that gives the Newton iteration for this problem. Specifically,

$$F(x) = x - \frac{f(x)}{f'(x)}$$

where in this case, $f(x) = \cos(\pi x) - x^2$. You can use MAPLE to find the derivative $f'(x)$ or you can do it by hand.

(c) (4 pts.) Use the function you found in part (b) to compute the first 5 Newton iterates with the initial value $x_0 = .5$, and the first 10 Newton iterates with the initial value $x_0 = .01$. For which of the initial values does Newton's method appear to be converging? Give as full an explanation as you can for the different behavior of the iterates using the different initial values.