MATH 435 **Computer Homework #3**

Spring 2009 **Prof. Biswa Nath Datta**

Due March 30, 2009

1. Since

$$\int_0^1 \frac{4}{1+x^2}\, dx = \pi$$

one can compute an approximate value for π using numerical integration of the given function.

(a) Write two MATLAB functions which implement the trapezoidal and Simpson composite quadrature rules. Input should be: *function, interval, h*. Tabulate the approximate values for π for various step sizes $h(10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5})$. Try to characterize the error as a function of h for each rule, based on the known value of π (*pi* in MATLAB), and also compare the accuracy of the rules with each other.

(b) Compute π again by using the built-in MATLAB functions *quad* and *quadv*, with various error tolerances. Compare the work required (integrand evaluations and elapsed time) with those for parts a. To measure elapsed time use *tic, toc* (type, help *tic* in MATLAB).

2. Implement Gaussian Quadrature Rule for $n = 3$ for evaluating the following integral:

$$\int_0^1 \frac{2}{x^2-4}\, dx$$

using zeros of the Legendre polynomial of an appropriate degree.