

Math 4513, Homework 4, Due on 11/10/2014

1. (8 points) Derive a numerical differentiation formula for approximating $f'''(x_0)$. The minimum requirement is that your formula should at least converge to $f'''(x_0)$ as $h \rightarrow 0$. Then, compute the order of the truncation error of your formula.
2. (12 points) Consider $\int_0^{\pi/2} x^2 \sin x dx$. Compute its exact value.
 - (a) Approximate the integral using the closed Newton-Cotes formula with 2, 3, 4, and 5 points. Find the error for each case.
 - (b) Download `lgwt.m` from <http://www.mathworks.com/matlabcentral/fileexchange/4540>. Then approximate the integral using Gaussian quadratures with $n = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$. Find the error for each n .

(Use “format long e” in Matlab to get 15 digits of you answer.)