ChE 272 Introduction to Chemical Engineering Calculations University of Rhode Island
Professor Greenfield Spring 2007

Homework 9
due April 12, 2005

Please feel free to use a spreadsheet, Matlab, etc. Late homeworks will be penalized by the complementary error function erfc(x) = 1-erf(x) = $1 - \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt$, with x equal to days / 15.

1. Chapra and Canale, problem 22.3. Note that x is in radians for $\sin x$.
2. Use Gauss-Legendre integration with Chapra and Canale, problem 22.3. Note that you will need to change variables to obtain the correct limits of integration. Then use both 3-point and 4-point integration. How do your results compare to those in problem 1?
3. Table III in Appendix E.7 of Elliott and Lira lists the thermodynamic properties of superheated steam. Use numerical differentiation to calculate $(\partial G/\partial P)_T$ at $P = 6.0$ MPa, $T = 500°$C. Use
   (a) a forward difference formula of order h,
   (b) a central difference formula of order h^2,
   (c) a central difference formula of order h^4

   Compare your answerse to the value known from thermodynamics, $(\partial G/\partial P)_T = V$; note that this V is listed in the table. Use the thermodynamic relationship $G = H - TS$ to calculate the Gibbs free energy G at the required conditions.
4. Problem 24.6 in Chapra and Canale