

MATH 335: Numerical Analysis

Problem Set 1, Final version

Due Date: Thurs., Feb. 5, 2009

Read: Chapter 1 in Kharab & Guenther.

Problems:

1. Look over the course webpage at <http://www.calvin.edu/~scofield/courses/m335/S09/>. In particular, read through the course syllabus, get accustomed to requesting a course calendar, and the links from there to homework assignments.
2. Work through and understand the MATLAB/OCTAVE examples in Section 1.2 of Kharab & Guenther. (If you wish to download OCTAVE, you may do so from <http://www.gnu.org/software/octave/download.html>.) Then skim through the tutorial found at <http://www-mdp.eng.cam.ac.uk/web/CD/engapps/octave/octavetut.pdf>, perhaps working some examples there as well. While this tutorial is several years old now, it gives a more in-depth treatment of the use of OCTAVE than the text.
3. In Kharab and Guenther, do these Chapter 1 exercises: 7, 9, 14, 15, 18, and 21.

Here are some favorite Taylor series (all of these are MacLaurin series) from calculus:

$$\begin{aligned}\frac{1}{1-x} &= \sum_{n=0}^{\infty} x^n \\ &= 1 + x + x^2 + \cdots + x^n + \cdots, \quad -1 < x < 1\end{aligned}$$

$$\begin{aligned}e^x &= \sum_{n=0}^{\infty} \frac{x^n}{n!} \\ &= 1 + x + \frac{x^2}{2} + \frac{x^3}{3!} + \cdots + \frac{x^n}{n!} + \cdots, \quad -\infty < x < \infty\end{aligned}$$

$$\begin{aligned}\sin x &= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!} \\ &= x - \frac{x^3}{3!} + \frac{x^5}{5!} + \cdots + (-1)^n \frac{x^{2n+1}}{(2n+1)!} + \cdots, \quad -\infty < x < \infty\end{aligned}$$

$$\begin{aligned}\cos x &= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n}}{(2n)!} \\ &= 1 - \frac{x^2}{2!} + \frac{x^4}{4!} + \cdots + (-1)^n \frac{x^{2n}}{(2n)!} + \cdots, \quad -\infty < x < \infty\end{aligned}$$

$$\begin{aligned}\arctan x &= \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)} \\ &= x - \frac{x^3}{3} + \frac{x^5}{5} + \cdots + (-1)^n \frac{x^{2n+1}}{2n+1} + \cdots, \quad -1 \leq x \leq 1\end{aligned}$$

$$\begin{aligned}\ln(1+x) &= \sum_{n=1}^{\infty} (-1)^{n+1} \frac{x^n}{n} \\ &= x - \frac{x^2}{2} + \frac{x^3}{3} + \cdots + (-1)^{n+1} \frac{x^n}{n} + \cdots, \quad -1 < x \leq 1\end{aligned}$$