Eng 5A                                     Fall 2001
Instructor: David Pine

Homework #1

Homework due: Wednesday, 3 October 2001

Reading: Mathematica Primer Chapters 1-2

Note: You are strongly encouraged to do items 1-3 below before Friday, September 28 so that if you have any problems, you can see the TA and get some help. There will be no extensions of the Wednesday homework deadline.

1. Apply for an account to use the Engineering Computing Infrastructure (ECI) workstations (if you do not already have one). To obtain an account, you will need to fill out a College of Engineering Computer Account Request Form. This form may be obtained from the TA or from Shaunn Howze (EII Rm. 3357). After completing the form, it must be signed by Laura Crownover (EII Rm. 3355). Then, take the form to the ECI main office located in Engineering I, Rm. 3110 (third floor). On the form, you will select a temporary password which you will have to change the first time you use the account. The workstations are distributed around the Engineering Buildings I, II, and III; perhaps the most convenient are those in room 3236 Eng. II. Note, however, that you can use workstations at any of the locations.

2. Once you have your account, login to any machine and change your password to maintain security. You can change your password using the web by going to the following web page:

http://www.engineering.ucsb.edu/~eci-web/

Click on the ”To change your ECI password” link and follow the instructions.

If you are working on a computer running under the Unix or Linux operating system, you will need to become familiar with basic Unix shell commands, e.g. ls, cat, mail, lp, etc., if you are not already. You may also find it useful to learn a basic Unix text editor such as “vi”. Type “netscape &” at the Unix prompt to bring up the Netscape browser in background mode. (On the Linux machines, there is a ”Terminal emulation program” which has an icon at the bottom of the screen. The icon looks like a computer screen with a foot print on it. This must be opened to get a ”shell” or unix prompt. The netscape & command works from a Unix shell. There is also a Netscape icon on the Linux machines at the bottom of the screen.)

Whether using a Windows, Unix, or Linux machine, go to the class web page
http://www.chemengr.ucsb.edu/~ceweb/courses/eng5a/index.html

to bring up our class home page. Familiarize yourself with the pages and pay particular attention to the “Notices” page, which has links to useful tutorials on Unix commands and tools as well as instructions on how to read various file formats in the ECI environment.

3. **Mathematica** may be run from computers using the *Windows* operating system and from computers using the *Linux* or *Unix* operating system.

In *Windows*, **Mathematica** can be run by clicking on the Start Menu, then opening the successive folders: `Programs\Global Applications\Math Stuff\Mathematica4`.

On a *Linux* or *Unix* machine, execute the program **Mathematica** (in the background, notebook environment) by typing `mathematica &` at the Unix prompt.

**Mathematica** commands within a particular cell are executed by selecting the cell (mouse click) and then by typing “shift-enter”. If you are not familiar with **Mathematica**, a tutorial is available on the World Wide Web at: http://www.wolfram.com. Another **Mathematica** tutorial has been prepared by a former TA for this course, Jim Oberhauser, and can be accessed as “demo1” from the “Mathematica Notebooks” link of our Eng 5A home page.

4. (5 pts) Use the “Series” command in **Mathematica** to find the Taylor expansion of the following function about \(x = 0\) to order \(x^{12}\): \(f(x) = \sin[\ln(\sqrt{1 + x})]\).

5. (5 pts) Use the “Solve” command in **Mathematica** to solve the quadratic equation \(ax^2 + bx + c = 0\) for \(x\).

6. (5 pts) Use the “NSolve” command in **Mathematica** to numerically solve the quadratic equation \(7x^2 + x - 5 = 0\) for \(x\). Repeat this for the equation \(7x^2 + x + 5 = 0\). Use “Solve” to find the exact solutions to these two equations.

7. (10 pts) Consider the polynomial expression

\[x^6 + 2x^5 - 50x^4 - 160x^3 + 289x^2 + 1238x + 840\]

(a) Define a function \(f(x)\) equation equal to this expression.

(b) Evaluate \(f(-0.1)\) and \(f(1+y)\).

(c) Use the “Factor” command to factor the polynomial.

(d) Use the “Solve” command to find the roots of the polynomial.

(e) Plot the polynomial for \(-9 < x < 2\).

8. Save the results of your calculations as a **Mathematica** notebook and e-mail them to Grant Templin at engr5a@engineering.ucsb.edu. Please be sure to annotate your solutions so that your TA can easily understand your work. If the TA has too much difficulty following your work, full credit may not be given.

9. Come see Grant Templin or David Pine if you have any problems with the above.