

Maple Lab 1  
Due June 9, 2011

*Instructions:* Please show all of your work when solving the following problems. Please also answer all of the questions on a separate sheet of paper. On that paper, please write “see Maple worksheet” to let me know if your work and/or answer is on the Maple worksheet. Many similar problems are posted online in the example worksheet. Finally, please make sure that your solutions are neat, organized, and legible. If you want to write comments on your Maple worksheet, you can click on the “T” button at the top of the worksheet; to go back to math mode, click the “[ $\int$ ” button at the top of the worksheet.

1. Consider the polynomial

$$p(x) = x^5 - 3x^4 - 23x^3 + 51x^2 + 94x - 120.$$

- (a) Please use Maple to find the roots of  $p$ .
  - (b) Plot the function on the interval  $[-5, 6]$ . Please shrink the plot to a much smaller size (about 2 x 2 inches will be fine) before you print your worksheet.
2. Now consider the function  $f(x) = \sin(x) + \cos(x)$ . Use Maple to find the roots of  $f$  on the interval  $[0, 10]$ . (Hint: type “?Roots” and click on the link “Student[Calculus1][Roots]” near the bottom of the page for the syntax on how to do this.
  3. This problem will be concerned with the row picture of the following system of equations.

$$\begin{cases} 2x_1 + x_2 + x_3 = 1 \\ 2x_1 + x_2 - 3x_3 = 2 \\ -x_1 + x_2 + 3x_3 = 3 \end{cases}$$

- (a) What are the equations of the 3 planes in the row picture of this system? How many solutions do you expect this system to have? Please answer this second question by plotting the 3 planes in a single figure in Maple. Please also shrink the plot before printing your worksheet.
- (b) What is the coefficient matrix for this system? What is the vector  $\mathbf{b}$  in the matrix form of this system ( $A\mathbf{x} = \mathbf{b}$ )?
- (c) Create the augmented matrix  $[A, \mathbf{b}]$  in Maple.
- (d) Using elimination matrices and permutation matrices, reduce the system to one of the form  $U\mathbf{x} = \mathbf{c}$ , where  $U$  is an upper triangular matrix. Please show each step using Maple (see the file posted online for how to do this).
- (e) Use the “BackwardSubstitute” command in Maple to find the solution(s) to the system, or explain why there is no solution (whichever case occurs).