Engineering Differential Equations

Simple MATLAB Graphics and Some Useful Functions

Please note that in MATLAB, everything that follows the % symbol is a comment. You do not have to type the comments in the sample commands below.

A. Graphing

The basic MATLAB graphing command is the plot command. Here are some examples of what you can do:

```
x=linspace(0, 2*pi, 100);   %This creates a vector of 100 numbers evenly spaced
                            %between 0 and 2π.
y=sin(x); %This creates a vector containing the values of the sine function
          % at each of the entries in the x vector
plot(x,y)  %This plots the (x,y) points connected with a straight line
```

To plot more than one graph on the same set of axes, you can try something like this:

```
z=cos(x);
plot(x, y, '-', x, z, ':')   %This plots the (x,y) points connected with a straight line ('-') and the (x,z)

                             % points connected with a dotted line (':')
title( 'Graphs of sine and cosine functions' )  %This creates a title at the top of the graph.
xlabel('x')    %Puts a label under the horizontal axis
ylabel('y')    %Puts a label next to the vertical axis
legend('y = sin(x)', 'y = cos(x)')  %Creates a legend indicating which graph is which
axis([0, 2*pi, -1.5,1.5])   %Redraws the graph with the indicated upper and lower limits on the
                            % horizontal and vertical axes
```

B. Notation

MATLAB notation for operations and functions is pretty much what you would expect, with a few notable exceptions:

1. To multiply two numbers or to multiply corresponding elements in two vectors, use .*, NOT just * For example, to compute the product of the two vectors y and z you generated earlier, you should type y.*z
2. Similarly, division is accomplished using ./ To square a number or each element of a vector, use .^ For example, x.^2 gives a vector containing the squares of the elements in vector x.
3. The exponential function is denoted exp. For example, to compute $e^{1.5}$ you would type exp(1.5)
4. The natural log function is denoted log, NOT ln.
5. Putting a semicolon at the end of a MATLAB statement tells MATLAB not to show the output after that statement is executed. This can be useful if you are working with a long array of numbers.

C. Exercises (These are just for practice. You do not have to hand them in.)

1. Graph $y = e^x$ and $y = \ln(x)$ for $0 \le x \le 2$ on the same set of axes.

2. Graph $y = x$, $y = -x$, and $y = x\cos(x)$ for $-4\pi \le x \le 4\pi$ on the same set of axes.