Introduction to MATLAB

I. To initiate MATLAB, double click on the colored icon for MATLAB.

II. You now have a window on the computer called the MATLAB command window with the MATLAB prompt >>. If you want to save the material that will appear in the command window during the session choose a filename, e.g. badger1, and when you enter MATLAB, type

    diary badger1

and then press the enter key. (Always press the enter key after typing the material below.) If at some point you want to stop recording this material, type

    diary off

To resume recording, type

    diary on

The file that you create is a simple text file which can be opened later by an editor to clean it up or to add some remarks.

III. It is easy to use MATLAB as a calculator. The symbols +, -, and / have their usual meaning; * denotes multiplication and ^ exponentiation. E.g. type

    ((5.76^2) * 3.01)/8.8

and the screen should read

    ans = 11.3482

There is also a symbol \ for ‘left’ division (e.g. 2\3 reads 2 divides 3) so the above can also be written as

    8.8\((5.76^2) * 3.01)
IV. If you type

\[ x = 2; \]

and then

\[ y = x \times (x + 2) \]

the screen should read

\[ \text{ans} = 8 \]

(If you don’t type the semicolon after the 2, you will get some additional output on the screen). The computer will also remember that \( x = 2 \) if you use \( x \) again unless you reset the variable. To reset the workspace, type \texttt{clear}.

V. MATLAB has a large number of built in functions. E.g.,

\[ \exp(x) \text{ is } e^x \]

\[ \sin(x) \text{ is } \sin x \]

\[ \log(x) \text{ is the natural log of } x \]

To see a list of such functions, type

\[ \text{help} \]

You get a list of help topics including

\texttt{elfun} and \texttt{specfun}

Now type

\[ \text{help elfun} \]

to get a list of the elementary functions that MATLAB contains. In general typing

\[ \text{help topic} \]

gives you information about ‘topic’.
VI. MATLAB can graph functions. To plot a function over \( n + 1 \) equally spaced points of the interval \([a, b]\), calculate \( h = (b - a)/n \) and type:

\[
t = a : h : b;
\]

MATLAB generates an \( n+1 \) component vector. If you don’t type the semicolon, the vector will be printed out. To graph e.g. \( \sin 5t \) over \([a, b]\), type

\[
y = \sin(5 \times t);
\]

\[
\text{plot}(t, y)
\]

You get the plotted points connected by straight line segments. Do this for \( a = 0, b = 1 \) and \( n = 20 \). To add a grid to the graph, type:

\[
\text{grid}
\]
on the line following \text{plot}. To get a dashed line graph, use

\[
\text{plot}(t, y, '-' - ')
\]

Some other variants are

\[
\text{plot}(t, y, ' :')
\]

\[
\text{plot}(t, y, ' -. ')
\]

Type

\[
\text{help plot}
\]
to get much more information about plot.

VII. To print what is in the current window, type

\[
\text{print}
\]

VIII. To add a title or labels to the graph follow the commands above by e.g.

\[
\text{title('graph 1')}
\]
xlabel ('t = time')

ylabel ('y = distance')

gtext ('y = sin 5t')

The last command places text anywhere in the figure window. To activate it, click the mouse at the point where the lower left part of the text is to be placed.

IX. For the simple example of $\sin 5t$ above, to graph it involves calculating the function at the points in the given interval. For a more complicated expression like $z = e^t \sin 5t$, you have to calculate $e^t$ and $\sin 5t$ at each point and multiply them. Doing this for a given range of $t$'s is called array multiplication. To do this for $z$ on e.g. $[-1, 1]$ and $n = 80$, type

\[ t = -1 : 0.025 : 1; \]

\[ z = \exp(t) \times \sin(5 \times t); \]

The $\times$ indicates array multiplication. Plot a labelled graph for $z$ on the interval above. FOR EACH GRAPH THAT YOU ARE ASKED TO HAND IN, AFTER YOUR PLOT STATEMENT TYPE:

\[ \text{gtext(['your name at', num2str(fix(clock))])} \]

AND INSERT THIS TEXT BELOW THE $t$ AXIS. Replace $t$ by whatever the independent variable is if necessary.

X. The same care must be taken in graphing powers. E.g. if $w = t^3$ and it is to be plotted for $t = -1 : 0.1 : 1$, the array power $\wedge$ must be used:

\[ w = t \wedge 3 \]

XI. To plot 2 functions, say $z$ and $u = t^3 \log(1 + |t|)$ on the same graph with e.g. the first a solid curve and the second a dashed curve for $t = -1 : 0.1 : 1$; enter $t, z,$ and $u$ and type
XII. Plot a labelled graph for

\[ v = \sin(t^3) - \cos 3t \quad \text{on} \quad [0, 1] \quad \text{with} \quad n = 20. \]

XIII. Hand in the graphs for IX, XI, and XII.