

Introduction to the Math. Dept.

Computing Lab (Mathlab) and MATLAB

- I. To use the Mathlab, you need a scanning ID. To print your assignment, you need a debit card. The Mathlab staff will instruct you how to send your output to the printer. MATLAB is a very useful piece of software with extensive interactive numerical computation and graphical abilities.

II. MAC To initiate MATLAB On a MAC

1. Find a Macintosh computer. If it is not already on, turn it on. The ON-OFF button is the upper right one on the keyboard. Don't turn one off.
2. If the screen is blank except for a small icon with the machine's name (e.g. math-mac 6), use the mouse to put the arrow on the icon and in quick succession, double click
 - a) on this icon
 - b) on "Math Soft"
 - c) on "MATLAB"
 - d) on the colored icon for MATLAB

II. PC On a Windows Machine

1. Find a PC.
2. Press-and-hold the "start" button in the lower left corner in the pop-up menu, move to and press "Programs," in the pop-up menu, find "Matlab," click on "Matlab".

- III. 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

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.

IV. 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

$8.8 \setminus ((5.76^2) * 3.01)$

V. If you type

$x = 2;$

and then

$y = x * (x + 2)$

the screen should read

ans = 8

2

(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 `clear`.

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

`exp(x)` is e^x

`sin(x)` is $\sin x$

`log(x)` is the natural log of x

To see a list of such functions, type

`help`

You get a list of help topics including

`elfun` and `specfun`

Now type

`help elfun`

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

`help topic`

gives you information about 'topic'.

VII. 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 * t);`

`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:

`grid`

on the line following plot. To get a dashed line graph, use

`plot (t, y, ' - -')`

Some other variants are

`plot (t, y, ' -')`

`plot (t, y, ':')`

`plot (t, y, '-.')`

Type

`help plot`

to get much more information about plot.

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

`print`

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

`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.

- X. 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. This is called array multiplication. To do this for z on e.g. $[-1, 1]$ and $n = 80$, type

$$t = -1 : 0.025 : 1;$$

$$z = \exp(t) .* \sin(5 * t)$$

The `.*` indicates array multiplication.

Plot a labelled graph for z on the interval above.

- 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, type e.g.

$$t = -1 : 0.1 : 1;$$

$$u =$$

$$\text{plot}(t, z, t, u, ' - -')$$

- 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 X - XII.