Week 9 – Plotting

1 Lab Exam 2 – Feedback & Demo
First, your tutor will give you feedback from Lab Exam 2 and show you how to think to create the solutions for these questions. Do not modify the code that you wrote for Lab Exam 2. If you wish to follow the tutor and do the exercises again, make a new folder to keep your work separate from what you did during the lab exam.

2 Plotting Curves in 2-D and 3-D

2.1 Plotting curves in 2-D
Plot two curves on the same set of axes:

\[
y_1 = \tan x \\
y_2 = 50 \sin x
\]

Let the x values range from -10 to 10 with an increment of 0.1.

Plot the tan curve as red dotted line and the sine curve as a solid blue line. Appropriately label your axes, add a title, and also insert a legend to name each curve.

2.2 Plotting curves in 3-D
Plot a curve in 3-D space:

\[
x = (2 + \cos 16t) \times \cos t \\
y = (2 + \cos 16t) \times \sin t \\
z = \sin 16t
\]

where \( t \) is the independent variable that ranges from -10 to 10 with an increment of 0.1.

Remember that when you have two matrices \( a \) and \( b \), and you want to multiply each corresponding element in each matrix individually, rather than perform cross-product matrix multiplication (lecture 3-1), you need to write \( a.*b \) (with the dot) instead of \( a*b \) (without the dot). We will talk more about this in week 10.

Appropriately label your axes and add the title “I really love ENGG1801!” to your figure.

Make sure that you can use the rotate 3D button on the toolbar of the figure to view your plot from different angles.

After you have done the above, use an increment of 0.01 instead of 0.1, and run the code again. Make sure that you understand why the plot looks different.
3 Surface Plots

3.1 Combining surface plots and subploting

Create two plots of the function:

\[ f(x,y) = x^2 + \sin(y) \]

with the first plot using the \texttt{mesh()} function and the second plot using the \texttt{surf()} function.

Use \( x \) and \( y \) values ranging from -10 to 10 with an increment of 1. Label your axes and add an appropriate title to your each of your plots.

The two plots should appear side-by-side on the same figure (window).

Remember that when you have a matrix \( a \), and you want to square each element in each matrix individually, rather than square the entire matrix (which would mean the matrix would be cross-multiplied by itself), you need to write \( a.^b \) (with the dot) instead of \( a^b \) (without the dot). We will talk more about this in week 10.

(This Q is based on Exercise 11 from “Engineering Computation with Matlab”, D.Smith, 2008)

3.2 Designing a roof

You are designing the roof of a swimming pool and you would like it to look like a seaway. You could use the function:

\[ f(x,y) = x^3 + y^2 \]

Plot this function using the \texttt{surf()} function, with \( x \) values ranging from -10 to 10, \( y \) values ranging from -15 to 15, and both \( x \) and \( y \) having an increment of 1. Label your axes and add the title “\texttt{ENGG1801 is a lot of fun!}” to your figure.

Use a different colormap and also use shading (lecture 9-2, slide 16). You can also use the help command (e.g. type \texttt{help shading} into the command window) for more information that is not covered in this course.
4 A deeper understanding
This Q was used recently in the Final Exam

Consider the two figures below:

Incorrect

![Incorrect Figure]

Correct

![Correct Figure]

The figure on the left was generated using the following code:

```matlab
x = 0:0.05:pi;
y = tan(x);
plot(x,y);
xlabel('x');
ylabel('y');
```

The correct figure of a tan curve is shown in the figure on the right, since \( \tan(\pi/2) \) is undefined.

4.1 Why is this error happening?
Explain in detail why the above code, which attempts to plot the tan curve, produces the figure on the left (with the extra line), which is incorrect compared to the figure on the right (without the extra line).

4.2 Fixing the error
Using the exact same values of \( x \) and \( y \) as shown above, write code so that the correct figure (on the right) is generated instead.

Remember, in the final exam (which is paper based), you will not have a computer (and therefore, Matlab) to help correct your mistakes. You must be very accurate on your own. This is only possible by having achieved significant programming experience during the semester.
4.3 What’s wrong with this solution?
This Q is based on the above Q’s which were recently used in the Final Exam

Note: In the final exam, you will be asked to explain some things. It is only possible to get these Q’s correct by having a deep understanding of the material in the lectures and labs. This exercise gives you a relatively simple example of such a Q asking you to explain something.

First, download lab9_q4_3_wrong.m from the course website.

This code attempts to do Exercise 4.2. The general approach used in this code was also used by many students when sitting the Final Exam. However, this general approach is not correct.

Explain why – there is at least one reason why.

Write down these reasons as an additional comment into the code that you downloaded.

4.4 Why is this happening?
This Q is based on the above Q’s which were recently used in the Final Exam

First, download lab9_q4_4_wrong.m from the course website.

This code attempts to do Exercise 4.2. This code was also written by some students when sitting the Final Exam. However, the incorrect graph is produced, which looks like this:

Explain why the straight red line on the bottom-left of the diagram appears.

Write down your explanation as an additional comment into the code that you downloaded.
5 Additional Questions
After completing the above exercises, please go on to the Lab 8 Exercises on Text & File I/O and Strings.

Please open all your exercises before calling the tutor to get marked off and leave early.