Matlab – Functions & Graphs

Task A – Miscellaneous *[2]*

Use Matlab to calculate the following expressions:

1. $\sqrt{101}-\sqrt{99}$ _____;
2. $\sqrt[3]{500}$ _____;
3. π^3 _____;
4. $\cos^{-1}\left(\sin\left(\pi/7\right)\right)-\sin^{-1}\left(\cos\left(\pi/7\right)\right)$ _____.

Find the roots of the following polynomials:

5. x^4+4 _____;
6. $x^5+x^4+x^3+x^2+x+1$ _____.

Show how to create the following sequences in Matlab, and use the ***sum( )*** command to find the sum of elements in each of these:

7. $\begin{pmatrix}1 & -i & -1 & i\end{pmatrix}$ _____, _____;
8. $\begin{pmatrix}1 & 1/4 & 1/9 & 1/16 & 1/25\end{pmatrix}$ _____, _____.

Show how to create the following matrices in Matlab:

9. $\begin{pmatrix}1 & 7\\ -3 & 4\end{pmatrix}$ _____;
10. $\begin{pmatrix}-2 & 1 & 0\\ 0 & -1 & 2\end{pmatrix}$ _____.

Task B – Multiple Graph Plotting *[1]*

In the following, two curves are plotted together. Use a suitable legend to keep track of which curve is which.

Tasks

1. Use the ***fplot*** command to plot the graphs of $\sin(x+c)$ and $\cos(x)$, from -2π to 2π, on the same figure. Find the value of the phase angle c, to one decimal place only, such that the graphs coincide: [½]

$c =$ _____.

2. Use the ***figure*** command to create a new figure window and plot the graphs of $\ln(x)$ and $\ln(1/x)$ on the same graph between 0.2 and 5. What is their relationship? [½]

_____

Ask a tutor to check your PNG image and mark and collect your sheet.
Absolute final deadline: 10 a.m. Friday 18th November, 2011.

Task C – Torque Transducer *[2]*

In an experiment to calibrate a torque transducer, the following data was obtained relating the Voltage (V) to the Torque (T):

Signal Voltage (V)	0.16	0.42	0.69	1.21	1.67	1.99	2.22	2.49
Torque (Nm)	1.40	2.29	3.66	5.93	8.15	9.24	10.32	11.41

It is assumed that the relationship between these two quantities is linear and we want to find coefficients a and b such that:

$$T = a * V + b$$

In order to plot out the above experimental data, you should first store the x-values (the Voltage) and the y-values (the Torque) in separate variables. Use commands like:

```
>> V=[0.16,0.42,0.69];
```

to enter the data; you should end up with two arrays (row vectors) with 8 numbers in each.

Tasks

3. Use the ***plot*** command to plot the graph with the data points being displayed as small red circles. Suitable labels should then be given to the axes and the figure given a title. [½]
4. The values of the coefficients a and b that determine the best-fitting straight line through the data can then be determined by using the ***polyfit*** command. [½]

The best fitting line is given by: $T =$ _____ $* V +$ _____.

5. Using the ***fplot*** command you should add in the best-fitting line determined above as a solid blue line. (Use a range for the Voltage on the x-axis of $0 \leq V \leq 3$.) [½]
6. Save the plot (using **File → Save As…** in the figure's menu) as file type "Portable Network Graphics" (PNG), which has file extension *.png*. [½]

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