

Homework #3

FORMAT of the file to be submitted:

1. All the m-files should be named as pr1.m, pr2.m and so.
2. The results (figure, table, or individual result such as $x = 2.653$, ..., and any comment) should be placed in a WORD file named as yourlastname_HW_03.doc
3. All the m-files should be inserted at the end of the WORD file using COURIER 9 font.
4. The WORD file and all the m-files should ZIPPED together, and the file should be named as yourlastname_HW_03.zip or (yourlastname_HW_03.rar).
5. Place the file to the following folder:
F:\COURSES\UGRADS\MECH\MECH307\HOMEWORK\...

Problem 1.

- a) Plot the given function on the domain $0 \leq x \leq 10$

$$y(x) = 100e^{-0.1x} \cos(4x + \pi) \sin(x + 4)$$

- b) Show its roots on the graph.

- c) Tabulate the roots' x-coordinates in that domain with an accuracy of ± 0.0001 in x.

Root #	x
1	
2	
.	
.	

Problem 2. On $0 \leq x \leq 20$, calculate and tabulate the x value(s) (with an accuracy of ± 0.0001) satisfying:

$$y(x) = y_{average} \quad (1)$$

where;

$$y(x) = \frac{30}{1+x} + 20 \frac{x+x^2}{1+5x^2} + 40 \sin(x) e^{-0.25x}$$

Plot the function and those special points satisfying (1).

Problem 3 Given the function:

$$y(x) = 20 + \frac{100 \sin\left(\frac{x}{2}\right) e^{-0.1bx}}{\sqrt{1+b}} \quad \text{for the domain } x \geq 0$$

What is the smallest positive b (with an accuracy of ± 0.01) such that the maximum of $y(x)$ is 35.

Problem 4

Plot “the number of roots” versus b for

$$y(x) = 15 \cos((2 + b)x) e^{-0.2x} + 10$$

on $0 \leq x \leq 10$ and for the parameter $0 \leq b \leq 4$ (with an increment of 0.1).

Problem 5

- a) Plot x vs θ , y vs θ , z vs θ and u vs θ for $R = 1, 2, 3, 4$ using 4 subplots and appropriate labels and legends. Take $0 \leq \theta \leq 2\pi$.

$$[A]\{x\} = \{r\}$$

$$\begin{bmatrix} 6 + R \sin \theta & 1 & 1 & 0 \\ 1 & 6 + R \cos \theta & 0 & 1 \\ 1 & -1 & 6 - R \sin \theta & 1 \\ 2 & 1 & -1 & 6 - R \cos \theta \end{bmatrix} \begin{Bmatrix} x \\ y \\ z \\ u \end{Bmatrix} = \begin{Bmatrix} 40 \\ 30 \\ 0 \\ 20 \end{Bmatrix}$$

- b) Plot $\det(A)$ vs θ for all R values on the same graph.
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Problem 6

$$\begin{bmatrix} 5 & 3 & 2 & 1 \\ -1 & c & 5 & 0 \\ 0 & 1 & 4 & 3 \\ 4 & 1 & 0 & 2 \end{bmatrix} \begin{Bmatrix} x \\ y \\ z \\ u \end{Bmatrix} = \begin{Bmatrix} 6 \\ 3 \\ 2 \\ 1 \end{Bmatrix}$$

For what value(s) of c , does the system have a **UNIQUE SOLUTION** ?

Problem 7

Find the root of the following non-linear equation set near $(x, y, z) = (1, 1, 1)$

$$3x^2 - 2xy + z^3 = 3$$

$$6x + 3y^2 - 2xyz = 6$$

$$2xz + y^2 - xyz^2 = 2$$

Problem 8

Find the root of the following non-linear equation set near $(x, y) = (2, 3)$

$$e^{-x}y + y^2x = 20$$

$$x^2y - ye^{-x} = 10$$

Problem 9

Plot x vs b and y vs b on the same graph for a parameter of $0 \leq b \leq 1$ for a root near $(x, y) = (1, 0)$

$$(5 + b)x^2 - \frac{1}{(2 + b)}xy = 4$$

$$4xy + bx + y = 1$$
