Homework 1

Create a single MATLAB script with each problem below as a separate section (hint: %%).

1. Create a new script
2. Create a comment section at the top with your name, date, HW#, class, etc.
3. The first script commands should erase all the workspace data, command window output, and close all figures.
4. Create separate sections (%%) for each problem

Problem 1:

1. Calculate the monthly payment (P) for a loan using the following formula:

$$P(N) = \frac{rL(1 + r/12)^{12N}}{12\{(1 + r/12)^{12N} - 1\}}$$

where N is the number of years used to pay back the loan, r is the interest rate, and L is the loan amount. Set r to 15%, L to $50,000, and vary N from .5 to 20 years. If you enter your formula correctly P(20) = 658.39. Make sure to add comments explaining what the formula is doing.

2. Plot the monthly payment vs. the number of years (make sure you have enough data points to make a smooth curve).
3. Use the "text" command to print your name on the plot. Search MATLAB's help files for information if needed.

Problem 2:

Create another section to do the following. Add a comment at the end of each line detailing what each line does. Make sure command outputs are not suppressed so outputs are published in your final document (as well as to the command window).

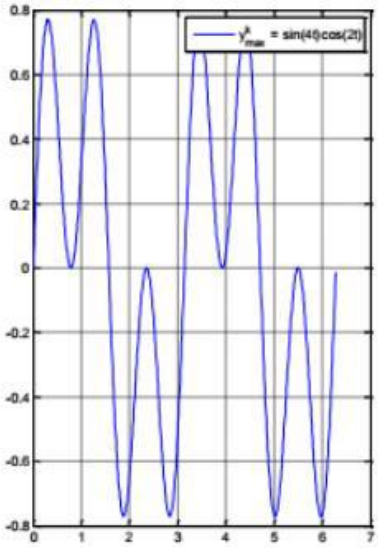
a. Create the matrix

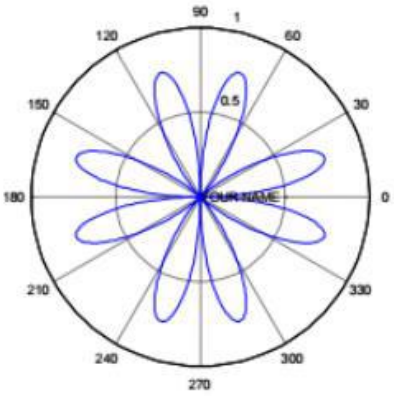
$$A = \begin{matrix} 20 & 4 & 2 & 6 \\ 6 & 37 & 2 & 3 \\ 8 & 5 & 9 & 9 \end{matrix}$$

b. assign the first row of A to a vector called x1
c. assign the last 2 rows of A to an array called y
d. assign the even-numbered columns of A to an array called B
e. assign the transpose of A (i.e. turns it into a 4-by-3 array) to C
f. compute the reciprocal of each element of A
g. change the number in column 2, row 3 of A to 100.

Problem 3:

a. Create an empty figure
b. Plot $y_{max}^{k} = sin(4t)cos(2t)$ for $0 \leq t \leq 2\pi$ using **subplots** to generate normal **and** polar plots. Make sure there is enough data points to make a smooth plot.
c. Add a legend with the formula plotted with correctly formatted subscripts and superscripts if applicable to the xy plot.
d. Turn on the grid lines for the xy plot
e. Add your name to the polar plot at the origin (0,0) using the text function
f. If done correctly your figure should look like this:





Problem 4:

Write code, in the following order, to convert inches into both centimeters and mm.

a. Prompt the user to enter a number.
b. Using **`fprintf( )`**, output a string, using a complete sentence that contains:
    i. The number the user just entered
    ii. The number converted to cm (there are 2.54 cm/in)
c. Using **`disp( )`**, output a string, using a complete sentence that contains:
    i. The number the user just entered
    ii. The number converted to mm
d. Make sure ALL the numbers have 2 numbers after the decimal point.
e. When run, the command window may look like :

```
Enter a number:  5
5.00 inches is 12.70 cm
5.00 inches is also 127.00 mm
```

Problem 5:

Moody's diagram as shown on the next page is a famous plot used to determine the effect internal friction (surface roughness) has on fluids flowing in pipes. The equation below has been developed by Jain and Swamee for the friction factor (f) for turbulent pipe flow.

$$f = \frac{0.25}{\left[\log\left(\frac{1}{3.7(D/\varepsilon)} + \frac{5.74}{N_R^{0.9}}\right)\right]^2}$$

a. Plot the friction factor following function for values Reynolds number (N_R) between 10^4 and 10^8 for D/ε values of 20, 100, 1000, 10,000, and 100,000. Your plot should look similar to example below. A couple of hints:
   a. Notice that both axes are log scaled
   b. log( ) in MATLAB does not do what you think it does
   c. The logspace( ) function may be a helpful in generating data that is evenly spaced on log-scaled axes (similar to linspace( )).

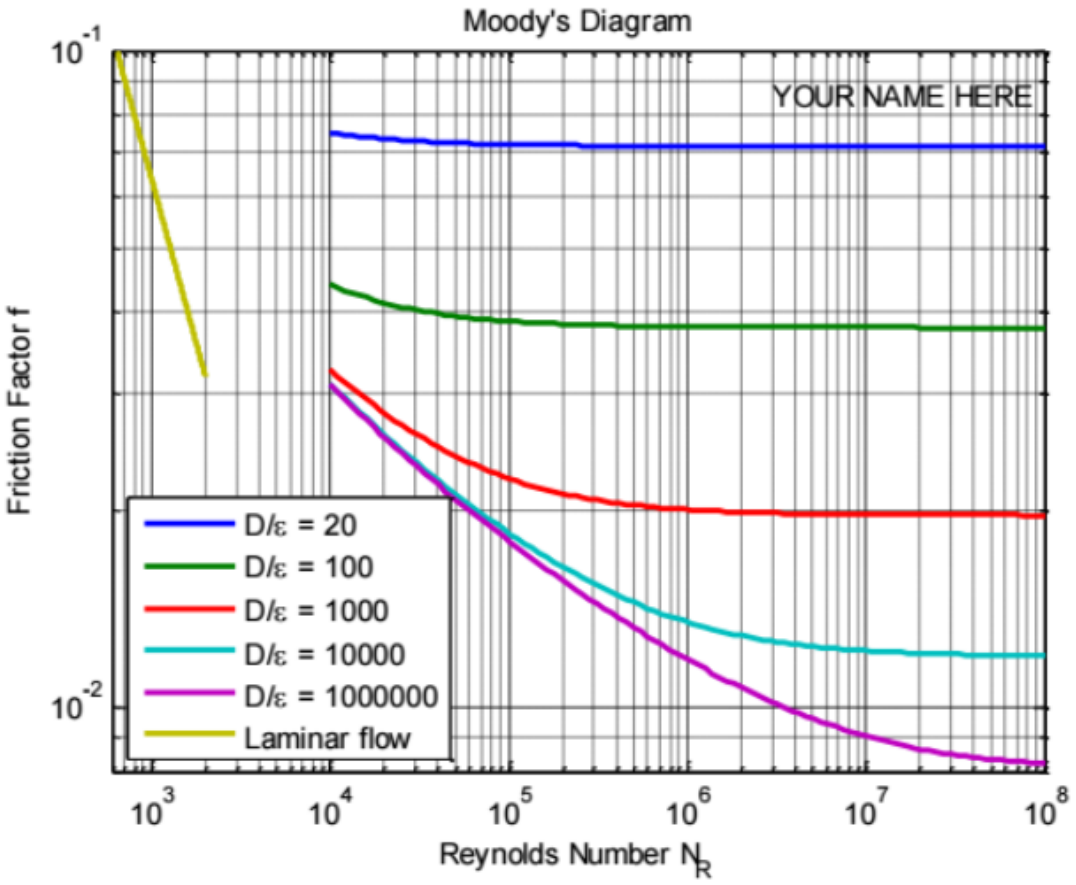
b. Add a line for $f = 64/N_R$ for smooth pipes to the same plot (be sure to match the N_R range shown in the figure).

c. Add a complete title and x and y axis labels (including any of the subscripts or superscripts).

d. Add a legend with the actual Greek character epsilon for each trace (e.g. D/ε = 1000, etc.). It can be in any position on the figure.

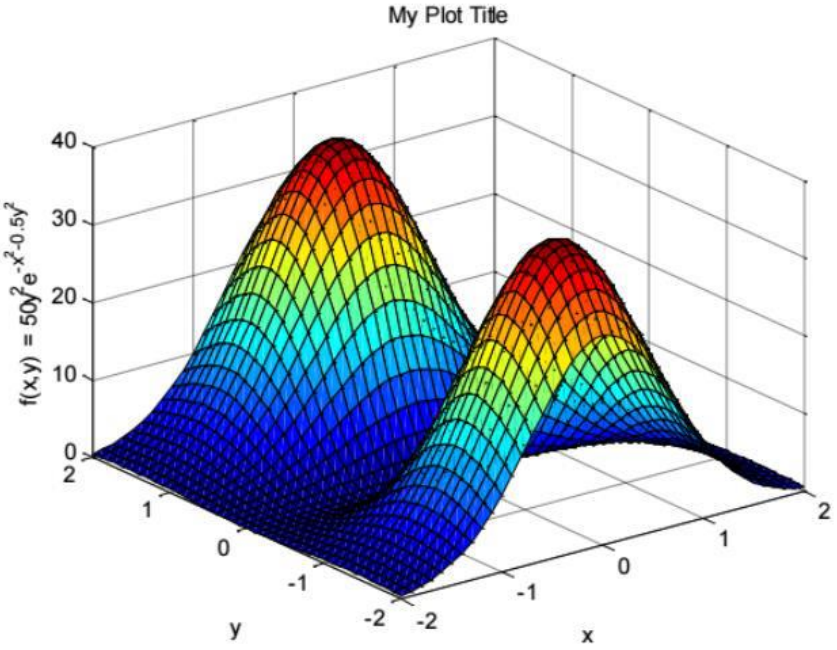
e. Adjust the axis limits so it looks like the figure on the last page.

f. Use the "text" command to print your name anywhere on the plot.



Problem 6:

1. Plot $f(x,y) = 50y^2e^{-x^2-0.5y^2}$ for -2 ≤ (x,y) ≤ 2. Use the step size of 0.1 for x and y.
2. Put a descriptive title and axes labels on the figure as shown. Include your name in the title.
3. If you plot it correctly, it will look like the figure below except that you will need to a different title.



Turn in the following:
1. A Word (.doc, .docx) document created using the MATLAB publish feature to publish your script.
2. Your .m script file(s) (these are separate files from the document above). Make sure you use plenty of comments. Before submitting, rename all *.m files to have a .txt extension. For example, rename MyHW6.m to MyHW6.txt before submitting.
Submit all files electronically on Blackboard. See syllabus for late assignment policy.

Late submissions will receive a 10% deduction!
No submissions will be accepted after one day!