Due: Wednesday, January 28 at 4 PM.

1. For #1, #2, and #3, use the `diary` command to create a `.txt` file with "hw1" followed by **the first 4 letters of your last name**. For example, mine would be `hw1Ober.txt`. To understand the command `diary`, you can type `help diary` in the command window and read about it.

   - The first command given after starting the `diary` should be: `disp('Your Name')` (with your actual name in the single quotes).
   - The next command should be: `disp('----- Problem 1 -----')`. You do not need to separate part a from b, etc.
   - The different NUMERIC problems should be separated using the `disp` command (so you can easily go to the command(s) for #3, etc.). For example, between the commands for Problem #1and Problem #2, there should be the command `disp('----- Problem 2 -----')`. You do not need to separate part a from b, etc.
   - Use one line of commands for each computation in MATLAB and use the default format unless told otherwise.
   - If you make a mistake typing a command, don't worry; leave it in the diary for problem 1. It will not count against you as long as you end up doing the problem correctly. In fact, it may look strange that you DON'T make a mistake/typo at some point.

   Here is an example of what you may see in the command window while doing #1:

```
>> diary hw1ober.txt
>> disp('Lisa Oberbroeckling')
Lisa Oberbroeckling
>> disp('----- Problem 1 -----')
----- Problem 1 -----
>> 2*3/4

ans =

    1.5000

>> diary off
>> diary hw1ober.txt
>> 3^6/2

ans =

  364.5000

>> diary off
```

2. For the rest of the problems (#4 on), you will be creating a basic SCRIPT FILE (m-file), with "hw1" followed by **the first four letters of your last name**. For example, mine would be `hw1Ober.m`.

   - The first line of the file should be a comment with your name.
   - The next line should have the commands `clear, format, clc`.
   - The line after that should have the line `disp('----- Problem 4 -----')`. For example, the beginning of your m-file may look something like this:

```
% Lisa Oberbroeckling
clc, clear, format
disp('----- Problem 4 -----')
5^2
2^3
-4^3
```

- The different NUMERIC problems should be separated using the `disp` command (so you can easily go to the command(s) for #5, etc.). For example, between the commands for Problem #4 and Problem #5, there should be the command `disp('----- Problem 5 -----')`. You do not need to separate part a from b, etc.
- Use one line of commands for each computation in MATLAB and use the default format unless told otherwise.

3. Several of the problems require written answers on paper and handed in. Please be as neat and clear as possible.

4. Upload the file(s) to Moodle and turn in the paper work by the due date/time.

You will be graded on accuracy, readibility and your programming ability. For instance, if there is one command to do the task but you use 3, you may lose points. Also, you will lose points (up to 5 points!) for not following the directions, including not submitting the files/problems correctly. You may also lose points if extraneous output is in the command window. You shouldn't suppress the output of the calculations, but any intermediate steps (like variable assignments as in #3), the output should be suppressed.

1. **Basic calculations.** Use MATLAB to do the following calculations. Be careful! The following are displayed using regular mathematical notation; you need to figure out what MATLAB functions are needed.

   (a) $\dfrac{3}{19}(2.6)(4^5) + \dfrac{.51^3}{3^4 - 123}$

   (b) $\dfrac{23^2}{5} + \dfrac{81^{3/4}}{11} + 35 \cdot 4^{-3}$

   (c) $\cos(135)$

   (d) $\cos(135^\circ)$

   (e) $\cos\left(\frac{\pi}{3}\right)$

   (f) $\cos\left(\frac{\pi}{3}^\circ\right)$

   (g) $\pi + 2$

   (h) $|e - 1|$

   (i) $2\ln 1000$

   (j) $2\log 1000$

   (k) $\dfrac{9}{\pi}\cos^{-1}(0.5) + 8$

   (l) $5\cos(3\arctan(12/5))$

2. **Using Variables.** Define variables with the assignments $x = 4$, $y = 3.5$, and $X = 1/8$. Calculate the following within MATLAB. Use the `sqrt` and `nthroot` functions where appropriate.

   (a) $\dfrac{5(y - x)}{14X - 19}$

   (b) $\dfrac{9\sqrt{X}}{11}$

   (c) $2\sin x \sec y$

   (d) $e^{(X+y)/x} + 6\sqrt[3]{x}$

3. **More calculations.** Define the variables $x = 256$ and $y = 125$. Calculate the following within MATLAB. When radical notation is used in the problem, use the `sqrt` and `nthroot` functions and use exponential calculations when exponential notation is used in the problem.

   (a) $\sqrt{x}$ (b) $x^{\frac{1}{2}}$ (c) $\sqrt{-x}$ (d) $(-x)^{\frac{1}{2}}$ (e) $x^{\frac{1}{4}}$

   (f) $\sqrt[4]{x}$ (g) $y^{\frac{1}{3}}$ (h) $-y^{\frac{1}{3}}$ (i) $(-y)^{\frac{1}{3}}$ (j) $\sqrt[3]{-y}$

   (k) From the above calculations, do you see anything surprising with the answers?

   (l) Calculate $(-x)^{\frac{1}{4}}$ and $\sqrt[4]{-x}$. What are the differences?

4. **Order of Operations.**

   (a) Calculate, without using any parentheses, -6^4 using THREE of the following and write your answers on your own paper, specifying which you did and what answers they gave.

   i. calculator (specify type/model)
   ii. Google.com
   iii. Excel or Google Sheets
   iv. Desmos.com or Wolfram Alpha

   Now calculate -6^4 using MATLAB. Are there differences in the answers? Based on your knowledge of Order of Operations, what should be the answers?

   (b) Do the same for the calculation of $-\cos(\pi/4)^2$ (you may use parentheses around the $\pi/4$; i.e. you should calculate `-cos(pi/4)^2`). NOTE: In Excel, to calculate with π use "PI()", again noting the differences (if any) in the answers.

   (c) Do the same for the calculation of -3^{10} and $-16^{1/3}$ (without using any parentheses). Should parentheses be used to get the proper calculations? Where?

(d) How should the Table for precedence rules within MATLAB in Chapter 1 of our notes (Table 1.3) be changed to include functions and negation (unary minus)? Answer this by rewrite the table on paper.

5. **Calculator Precision.**

   (a) Within an Excel spreadsheet or Google Sheet, calculate $\sqrt[12]{1782^{12} + 1841^{12}}$ using exponential notation. Write your answers clearly.

   (b) Rewrite the above with what you get from the spreadsheet into an equation and simplify so there are no radicals or rational exponents.

   (c) Now calculate $\sqrt[12]{1782^{12} + 1841^{12}}$ using MATLAB.

   (d) Compare the left hand side and right hand side of the equation you get in part (b) by subtraction within MATLAB, using `format long`).

   (e) Calculate "3 quadrillion and 18 minus 3 quadrillion and 14" in your head and write it down. Now translate this into mathematics so you can calculate it within Google.com, Excel, and MATLAB. (You may need to look up how many zeros you'll need!) Compare your answers in a table.

   (f) Do the same with $2.000000000000018 - 2.000000000000014$

6. **Ambiguities with notation.** Define variables with the assignments $x = 10$ and $y = \pi/4$. Calculate the following within MATLAB. You may have to adjust from mathematical notation to correct MATLAB notation. MAKE SURE YOU RETURN BACK TO THE DEFAULT FORMAT!

   (a) $\cos y$ (b) $\cos y^2$ (c) $\cos(y^2)$ (d) $\cos^2 y$
   (e) $(\cos y)^2$ (f) x^{-1} (g) $\cos^{-1}(x/20)$

   (h) Use the MATLAB variable `ans` from your previous calculation to calculate $\dfrac{\cos^{-1}(x/20)}{4y}$

   (i) Are any of the above calculations ambiguous in how they are defined (which ones and why)? What could be done to make the calculations clearer to the person performing/entering the calculations?

7. It is common to use either of the functions `mod` or `rem` to tell whether *positive* integers are even or odd. Here is another simple use for these functions. You are given a list of 10-digit numbers. You'd like to only use the last 4 digits of these numbers (for example, for display purposes). Use both the `mod` or `rem` functions to easily get the last four digits of the number `4108675309`. Use the commands in such a way that they would work on any large number, or vector of large numbers. Do you see a difference in their use for this?

8. Now use the same commands in the previous problem on the number `-4108675309`. Do you see a difference? Explain in **your own words** what you think is the difference between the `mod` and `rem` functions. Is there a preference between using these functions to tell whether *any* integer is even or odd?

9. Can you come up with a way, using MATLAB functions such as `mod`, `rem`, `round`, `ceil`, `fix`, etc. to capture the "area code" (first three digits) of 4108675309? Experiment with at least two phone numbers with different area codes.

10. What about capturing the "central office" part of the number (867)? Do it for 4108675309 and 4106172516.