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) \( \frac{3}{25} (4.1)(5^4) + \frac{.573}{3^5 - 123} \)  
   (b) \( \frac{31^2}{7} + \frac{81^{3/4}}{13} + 32 \cdot 4^{-3} \)  
   (c) \( \sin(270) \)  
   (d) \( \sin(270^\circ) \)  
   (e) \( \sin \left( \frac{\pi}{6} \right) \)  
   (f) \( \sin \left( \frac{\pi}{6}^\circ \right) \)  
   (g) \( \pi + 3 \)  
   (h) \( |e - 2| \)  
   (i) \( 2 \ln 100 \)  
   (j) \( 2 \log 100 \)  
   (k) \( \frac{9}{\pi} \cos^{-1}(0.5) + 4 \)  
   (l) \( 5 \cos(3 \arctan(12/5)) \)  

2. **Using Variables.** Define variables with the assignments \( x = 5, y = 2.5, \) and \( X = 1/7. \) Calculate the following within MATLAB. Use the `sqrt` and `nthroot` functions where appropriate.

   (a) \( \frac{5(y - x)}{14X - 19} \)  
   (b) \( \frac{9\sqrt{X}}{11} \)  
   (c) \( 2 \sin x \sec y \)  
   (d) \( e^{(X+y)/x} + 6 \sqrt{7} \)  

3. **More calculations.** Define the variables \( x = 81 \) and \( y = 27. \) 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) \( x^{1/2} \)  
   (c) \( \sqrt{-x} \)  
   (d) \( (-x)^{1/2} \)  
   (e) \( x^{1/4} \)  
   (f) \( \sqrt[4]{x} \)  
   (g) \( y^{1/4} \)  
   (h) \( -y^{1/4} \)  
   (i) \( (-y)^{1/4} \)  
   (j) \( \sqrt[3]{-y} \)  

   (k) From the above calculations, do you see anything surprising with the answers?  
   (l) Calculate \((-x)^{1/4}\) and \(\sqrt[4]{-x}\). What are the differences?

THE REST OF PROBLEMS SHOULD BE DONE WITHIN YOUR M-FILE.

4. **Order of Operations.**

   (a) Calculate, without using any parentheses, \(-5^4\) using the following and write your answers on your own paper.

     i. calculator (specify type/model)  
     ii. Google.com  
     iii. Excel  
     iv. MATLAB.

     Are there differences in the answers?

   (b) Do the same for the calculation of \(-\sin(\pi/4)^2\) (you may use parentheses around the \(\pi/4\)). NOTE: In Excel, to calculate with \(\pi\) 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)?

5. Calculator Precision.

(a) Within an Excel spreadsheet and a calculator (specify type/model), calculate
\[ 12 \sqrt{1782^{12} + 1841^{12}} \]
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 the left and right hand sides of the equation separately and compare (by subtraction) within the spreadsheet and graphing calculator. Is the equation you wrote truly an equation? How far off is the left hand side from the right hand side?

(d) Now do the same calculation as in part (a) within Google.com, WolframAlpha, and MATLAB (use \texttt{format long}) and compare your answers, both in this part and the answers in part (a) by writing all of the calculation answers in a table (specifying where the answers came from).

(e) Compare the left hand side and right hand side of the equation you get in part (b) by subtraction within MATLAB, using \texttt{format long}.

(f) Calculate “2 quadrillion and 9 minus 2 quadrillion and 5” within Google.com, Excel, a graphing calculator, and MATLAB. Compare your answers in a table.

(g) Do the same with 2,000,000,000,000,009 – 2,000,000,000,000,000

6. Ambiguities. 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!

\[
\begin{align*}
(a) & \quad \cos y \\
(b) & \quad \cos y^2 \\
(c) & \quad \cos(y^2) \\
(d) & \quad \cos^2 y \\
(e) & \quad (\cos y)^2 \\
(f) & \quad x^{-1} \\
(g) & \quad \cos^{-1}(x/20) \\
(h) & \quad \text{Use the MATLAB variable \texttt{ans} from your previous calculation to calculate } \frac{\cos^{-1}(x/20)}{4y} \\
(i) & \quad \text{Are any of the above calculations ambiguous in how they are defined (which ones and why)? What could be done to make the calculations clearer to the person performing/entering the calculations?}
\end{align*}
\]

7. It is common to use either of the functions \texttt{mod} or \texttt{rem} to tell whether positive integers are even or odd. Here is another simple use for these functions. You are given a list of 9-digit ID numbers. You’d like to only use the last 4 digits of these numbers (for example, for display purposes). Use both the \texttt{mod} or \texttt{rem} functions to easily get the last four digits of the number 123456789. 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 -123456789. Do you see a difference? Explain in your own words what you think is the difference between the \texttt{mod} and \texttt{rem} functions. Is there a preference between using these functions to tell whether any integer is even or odd?