MATH 284 Mathematical Programming
Homework 3: Due Wednesday February 28 at 1:00pm

Exercises:

1. The altitude, h, as a function of air pressure can be calculated by

$$h = 145366.45 \left[1 - \left(\frac{p}{1013.25}\right)^{0.190289}\right],$$

where h is in units of feet and the pressure p in units of millibars (mb). Write a MATLAB script called `altitude.m` that calculates the h for a given p. For input, the program should ask the user to enter the pressure in units of millibars. Thus, you will have to use the MATLAB `input` function. The program should then calculate the altitude and print out the results rounded to the nearest integer. Specifically, make your program output the message "The altitude is: XX ft." where XX us the calculated and rounded value of h. **Hint:** Look into using the `round` function in MATLAB in order to round to the nearest integer.

2. Either modify your `altitude.m` script or create a new script that plots the altitude as a function of pressure for a range of pressure values input as a vector by the user. Make sure your plot has appropriately labelled axes and a title.

3. Radioactive decay can be modeled by the equation

$$A = A_0 e^{-kt},$$

where A is the amount at time t, A_0 is the amount at time $t = 0$, and k is a constant. Recall that in MATLAB e^x is written as `exp(x)`. Write a MATLAB program in a script called `radioactive.m` that calculates the amount of a radioactive material. When executed, the program should ask the user to input the half-life of the material (in years), the current amount of material (in lb), and the number of years t from now for which the amount should be calculated. From the information the program should first calculate the constant k, and then the amount at t years. For computing k from the half-life, recall that

$$k = \frac{\ln 2}{\text{half-life}},$$

and that $\ln x$ is `log(x)` in MATLAB. For output, the program should display the message "The amount of material left after XX years is XX lb" where XX are the corresponding computed values.

4. Either modify your `radioactive.m` script or create a new script that plots A as a function of t for a range of pressure values input as a vector by the user. Notice that you will also have to input values for A_0 and k. Make sure your plot has appropriately labelled axes and a title.