1. This exercise will involve graphing using MATLAB.

   (a) One of the things MATLAB can do is graph functions given a formula. To plot the function $f(x) = x^2$ on the domain $[-5, 5]$, type the following into the Command Window:

   ```
   f = ezplot('x^2',-5,5)
   ```

   and press Enter.

   (b) Plotting two or more functions is easy; just enter the command

   ```
   hold on
   ```

   between the two ezplot commands. It's nice to know which function is which, so we'll also add some color. For example, we'll plot the two functions

   $$f(x) = x^2 \text{ (in blue)} \qquad \text{and} \qquad g(x) = 3x - 2 \text{ (in red)}$$

   . To do this, in the Command Window, enter the following sequence of commands;

   ```
   f = ezplot('x^2',-5,5);
   hold on
   g = ezplot('3* x-2',-5,5);
   set(g,'color','red')
   ```

   Where do these two graphs appear to intersect? How would you verify this algebraically?

   (c) MATLAB can plot trigonometric functions (we'll talk more about these later). By default, the domain is always $[-2\pi, 2\pi]$, so in order to see two cycles of the sine function, you could enter (in the Command Window)

   ```
   ezplot('sin(x)');
   ```

   Go ahead and try this.

   (d) Try plotting three or more functions at a time, all on the same domain, and each in a different color. (Hint: you can cut and paste from the entries above, but make sure you make the necessary adjustments to get the same domain but different colors. What happens if you DON'T specify the same domain for all three functions?)
   Note: MATLAB needs an asterisk "`*`" to multiply correctly and a caret "`^`" for exponents. For instance, the function $0.5x^3 - 5x$ has to be typed in as `0.5*x^3-5*x`.

2. (For this exercise, you can continue working in the MATLAB Command Window. To clear the Workspace variables, simply enter the command `clear all`).

   Sometimes we want to plot a function given by data points instead of a formula. The easiest way to enter data into MATLAB is in vector format.

   (a) Suppose that you measured the outdoor temperature as 33°F at 1 p.m., then 30°F at 3 p.m., then 25°F at 5 p.m., and then 18°F at 8 p.m. Try entering this data into MATLAB as two vectors:

   ```
   times=[1;3;5;8];
   temps=[33;30;25;18];
   ```

   One you've typed this in, what do you see in the Workspace memory box (lower left corner of your MATLAB window)?

   (b) To make a nice plot of just the points, type:

   ```
   plot(times,temps,'*')
   ```

   and evaluate again. Describe the figure that is returned.

   (c) Lastly, we might want to see our data displayed in a table. To do this, just use the command

   ```
   t = table(times,temps,'VariableNames',{'Time','Temp'})
   ```

   in the Command Window. (This uses the *times* and *temps* vectors that we defined in part (b) of this exercise. The option 'VariableNames' allows us to appropriately name the columns of the table. When you press Enter, you should see a nice table of your data, with time values in the first column and corresponding temperatures in the second column.) Either print the table (highlight table, right click, select 'print selection'), or simply draw the table in the space below.

Before moving on to the next exercise, please clear your Workspace Variables by using the command:

```
clear all
```

You may also clear your Command Window by using the command:

```
clc
```

3. For this problem, you will need the MATLAB m.file WaterDensity.m, available on our course webpage. This program will produce a plot of measured water density (in kg/m^3) as a function of temperature (in °C).

   (a) Download and open the m-file WaterDensity.m in the MATLAB editor. Save the file in the appropriate MATLAB directory (it should default to the correct directory) as WaterDensity. In the MATLAB Command Window, enter the command

   ```
   WaterDensity
   ```

   This should produce both a graph of data points and a table of data for you.
   What shape of graph do you get? What type of function does this look like?

   (b) What are the domain and range of this function (as shown)? What is the largest domain that might be reasonable?

   (c) Use the table of data (you can scroll through it) to find the density of water at a temperature of 3°C.
   Roughly find the point on the graph corresponding to this temperature and density.

   (d) At what temperature(s) is the density equal to 999.955 kg/m^3?
   Is there only one temperature where this occurs, or are there several?

   (e) Would it make sense to say that temperature is a function of water density?
   Why or why not?