Make sure to write down your procedure clearly and answer exactly what the problem is asking for. Points will be taken off for incomplete, unintelligible, and sloppy procedures and solutions. Include comments in all MATLAB programs.

Follow the five step problem solving in engineering and science whenever required. Graphs are often useful ways to check your calculations.

(20 points) 6.7 A rocket is launched vertically. At time t=0, the rocket's engine shuts down. At that time, the rocket has reached an altitude of 500 m and is rising at a velocity of 125 m/s. Gravity then takes over. The height of the as a function of time is

$$h(t) = -\frac{9.8}{2}t^2 + 125t + 500 \; for \; t > 0$$

(a) Create a function called *height* that accepts time as an input and returns the height of the rocket. Use your function in your solutions to parts b and c.

(b) Plot *height* versus time for times from 0 to 30 seconds. Use an increment of 0.5 seconds in your time vector.

(c) Find the time when the rocket start to fall back to the ground. (The max function will be helpful in this exercise.)

(20 points) 6.10 Create your own Toolbox. This problem requires you to generate temperature-conversion tables. Use the following equations, which describe the relationships between temperatures in degrees Fahrenheit (T_F), degrees Celsius (T_C), kelvins (T_K), and degrees Rankine (T_R), respectively:

$$T_F = T_R - 459.67°R$$

$$T_F = \frac{9}{5}T_C + 32°F$$

$$T_R = \frac{9}{5}T_K$$

You will need to rearrange these expressions to solve some of the problems.

(a) Create a function called F_to_K that converts temperatures in Fahrenheit to Kelvin. Use your function to generate a conversion table for values from 0° F to 200° F.

(b) Create a function called C_to_R that converts temperatures in Celsius to Rankine. Use your function to generate a conversion table from 0° C to 100° C. Print 25 lines in the table. (Use the linspace function to create your input vector.)

(c) Create a function called C_to_F that converts temperatures in Celsius to Fahrenheit. Use your function to generate a conversion table form 0° C to 100° C. Choose an appropriate spacing.

(d) Group your functions into a folder (directory) called *my_temp_conversions*. Adjust the MATLAB search path so that it finds your folder. (Don't save any changes on a public computer!).

(20 points) 6.13 (a) Create an anonymous function called *my_function*, equal to

$$-x^2 - 5x - 3 + e^x$$

(b) Use the *fplot* function to create a plot from x = -5 to x = +5. Recall that the *fplot* function can accept a function handle as input.

© Use the *fminbnd* function to find the minimum function value in this range. The *fminbnd* function is an example of a function function, since it requires a function or function handle as input. The syntax is

fminbnd(function_handle, xmin, xmax)

Three inputs are required: the function handle, the minimum value of x, and the maximum value of x. The function searches between the minimum value of x and the maximum value of x for the point where the function value is a minimum.

(20 points) 7.3 The volume of a cone is

$$V = \frac{1}{3} \times area\ of\ the\ base \times height$$

Prompt the user to enter the area of the base and the height of the cone (Figure P7.3). Calculate the volume of the cone.

(20 points) 7.16 The *ginput* function is useful for picking distances off a graph. Demonstrate this feature by doing the following:

(a) Create a graph of a circle by defining an array of angles from 0 to 2π, with a spacing of π/100.

(b) Use the *ginput* function to pick two points on the circumference of the circle.

(c) Use *hold on* to keep the figure from refreshing, and plot a line between the two points your picked.

(d) Use the data from the points to calculate the length of the line between them. (Hint: Use the Pythagorean theorem in your calculation.)