For all of these problems, your scripts should not request any user input.

1) (5 pts) Suppose you have a bar made of aluminum. You don't have functions for either the area or the temperature distributions in the bar, but you do have these as a table of values (see `hw24_1.dat`; the first column is x, the second column is A and the third column is T).

   a) Describe the shape of the bar. HINT: Plot the first 10 values of $A(x)$. Be sure to look at the axis limits on your plot.
   b) What is a common object that has this shape?
   c) Compute the total thermal energy in the bar.

2) (3 pts) Suppose you have almost the same situation as in Question 1, but the first half of the bar is made of aluminum and the second half of the bar is made of iron. Compute the total thermal energy in the bar.

3) (8 pts) Suppose you have a bar with the following properties:

   - $\rho(x) = 2500\left(1 + e^{\frac{x}{5}}\right)$
   - $c(x) = 400\left(1 - 0.2x^2\right)$
   - $A(x) = \frac{1}{1000}\left(1 - 0.04x^3\right)$
   - $T(x) = 280 + 20e^{2x}$

   Do the following:

   a) Compute the total energy (Q_{total}) in the bar assuming the length is 1 meter.
   b) Find the point along the length of the bar where the energy is one half the total value. To do this, follow a process similar to Question 4 on Homework 23. Create a vector t using

      ```
      t = linspace(0,1,51)';
      ```

      then compute

      $$Q(t) = \int_0^t \rho(x)\, c(x)\, A(x)\, T(x)\, dx$$

      for each value of t. Use the $(t, Q(t))$ table of values and inverse spline interpolation to determine the value of t^* where $Q(t^*) = \frac{Q_{\text{total}}}{2}$.