# MATLAB Project 1, Math 2280, Due Sept 28

1. These exercises will get you started on using MATLAB to answer some questions regarding basic mathematical operations.

   (a) Use the function `plot` to plot the function $y = e^{-x/2}\sin(\pi x),\ -1 \le x \le 5$, using a resolution that the curve looks sufficiently smooth to your eyes. Look up the help menu to learn about the calls to `axis, xlabel, ylabel`, and `title` to annotate the graph.

   (b) Enter the symbolic environment by specifying needed variables, for example

   ```
   >> syms x y
   ```

   will define two symbolic variables $x$ and $y$. Use the function `solve` to find the roots of $2x^2 - x - 1 = 0$, and `int` to find $\int \frac{1}{1+x^2}\,dx$.

   (c) Familiarize yourself with the concept of loop by writing a short program to obtain the sum

   $$\sum_{n=1}^{N} \frac{(-1)^{n+1}}{n}\sin(nx)$$

   at $x = \pi/4$ and $7\pi/8$, with $N = 10$ and 100.

   (d) Read the manual entries for `input` and `fprintf` to understand the syntax, print the results in part (c) in a table with sufficient explanations.

2. Write a MATLAB function that implements the Runge-Kutta method to solve an initial value problem for $y' = f(x, y)$, with the function $f(x, y)$ and the initial conditions to be supplied in separate functions (similar to `frhs.m`). Use your own implementation to solve the following initial value problems

   (a)

   $$y' = \cos x + \sin(2y); \quad y(0) = 0, \quad 0 < x \le 2$$

   (b)

   $$\frac{dv}{dt} = -(0.04)v - 9.8, \quad v(0) = 49, \quad 0 < t \le 5$$

   with step sizes $h = 0.5,\ 0.2$ and 0.1.