ESC 251 **HW 23** **Due: Nov. 7**

Remember to indent the bodies of your IF-THEN and looping structures.

1) (2 pts) Use the files we examined in class to solve the system

$$\begin{aligned} S' &= V, \quad S(0) = 5000 \\ V' &= -g, \quad V(0) = 100 \end{aligned}$$

You should print the time it takes the mass to reach the ground, the time to reach the maximum height and the maximum height. Also, print out the graph of the solution.

2) (10 pts) The model we developed in class does not take wind resistant into account. The most common model of wind resistance assumes that

$$\text{Wind Resistance} \propto V$$

This means that the force on the mass exerted by wind resistance can be written as $W_f = kV$ where k is called the drag coefficient. The value of k depends mainly on the shape of the body and its surface roughness. In most cases, lab experiments are necessary to determine the value of k. If wind resistance is incorporated into the model, the governing system of differential equations can be written as

$$\begin{aligned} S' &= V, \quad S(0) = 5000 \\ mV' &= -mg - kV \quad V(0) = 100 \end{aligned}$$

where m is the mass of the body and k is the drag coefficient. Solve the system above assuming that $m = 1.0\,\text{kg}$ and $k = 0.1\,\text{kg/s}$. You should write your right-hand side function in a manner that allows m and k to be sent in as parameters.

You should print out the time is takes the mass to reach the ground, the time to reach the maximum height, the maximum height, the terminal velocity and the graph of the solution. Comment on how the inclusion of wind resistance affects the values of the quantities you found in Question 1.

.