We consider two models for the force of drag on an object moving through a fluid:

Model I: The magnitude of the drag force is directly proportional to the speed of the object.
Model II: The magnitude of the drag force is directly proportional to the square of the speed of the object.

1. Find and solve the appropriate differential equation for each model to express the speed and distance traveled as functions of time. Find the total distance traveled by the object in each model. Assume that the initial velocity, v_0, the mass of the object, m, and the constant of proportionality, k, are given and that drag is the only force acting on the object.

2. Assume for this problem that the magnitude of the drag force on a ferry is directly proportional to the square of its speed. A Washington Sate ferry travelling at 20 ft/sec loses power and starts to drift. One **minute** later the speed of the ferry is 10 ft/sec. Two minutes after losing power the ferry crashes into the dock. How far was the ferry from the dock when it lost power? Assume that the drag force is the only force acting on the ferry while it drifts.

3. Assume for this problem that the drag force on a styrofoam ball dropped near the surface of the earth is directly proportional to its velocity. If the speed of the ball is 6 m/s one second after being dropped, determine the average speed of the ball during the first two seconds of its fall.

4. Repeat problem 3, except assume that the magnitude of the drag force is proportional to the square of the speed.

5. Determine the terminal velocities of the balls in problems 3 and 4.

6. A ball dropped from rest falls 60 meters in 4 seconds. Find the terminal velocity of the ball in each model. You will need a calculator.

7. If the styrofoam ball in problem 3 were replaced with another ball of the same density but twice the radius, find the speed of the larger ball one second after being dropped.