Cruise Controller

The model of the cruise control system is relatively simple. If the inertia of the wheels is neglected, and it is assumed that air drag (which is proportional to the car's speed at low speeds) is what is opposing the motion of the car, along with rolling friction and on a slope downwards gravity, then the problem is reduced to a simple first order system. Considering air drag and incline of the surface, the motion of the car can be written as,

$$m\dot{v} + bv - mg\sin\theta = u$$

where m is mass of the car, b is air drag coefficient, g is gravity, theta is the incline and u is the input force provided by the car to move the car at the desired velocity.

Task:

1. Define your constant parameters for the car i.e. mass and the drag coefficient.
2. Find v and $\dot{v}$ from the dynamical model and compare it with the set point values.
3. Find the error and use the PID controller with appropriate tuning parameters to tune the controller to an acceptable level of accuracy
4. Make sure that the tuning parameters you choose give the system a rise time of about 10 secs and maximum overshoot of less than 5%. Remember that rise time is the time it takes to reach 90% of the steady state value.
5. Plot the results in a graph showing the set point change and the response of the system to the change.