PHYS639, Spring16, Problem 2

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1. A cannon shell is shot at an angle θ with initial velocity v_o. Numerically compute and plot the cannon's trajectory. Assume the earth is flat.
2. Do the same thing but now accounting for the air resistance. Assume $F_{res} = -Bv^2$.
3. Do the same but now also accounting for the varying density of air. Assume that the coefficient B is proportional to the density of air and the density of air follows $\rho = \rho_o \exp(-y/y_o)$, where ρ_o is density at the sea level ($y = 0$). Reasonable values for free parameters are $B/m \sim 10^{-5}$ m^{-1} and $y_o \sim 10^4$ m.
4. Do the same but now also accounting for the fact that g changes with height (gravity becomes weaker as you go higher).
5. Plot trajectories for $v = 700$ m/s and two angles $\theta_1 = 30^o$ and $\theta_2 = 45^o$. Make four plots for each angle: idealised case, accounting for air resistance, accounting for varying air density, accounting for changing gravity. What's the weakest assumption in the idealised case?
6. Check different firing angles and determine θ_{max} that results in the maximum range.

Bonus Problems

1. Write a program that will take as an input the position of a target and will compute initial velocity and angle resulting in a close hit (within 100 meters of a target).
2. Do the regular problem but also account for the *Coriolis* force.