Section 4, Exercise 1

With a parachute, the terminal velocity decreases. Change the parameters in the Skydiver2 example to plot the velocity vs time with a parachute. You can assume C = 1.5, the area of the parachute is 180 square feet, or about 17 m^2, and the combined weight of the skydiver plus parachute is 90 kg.

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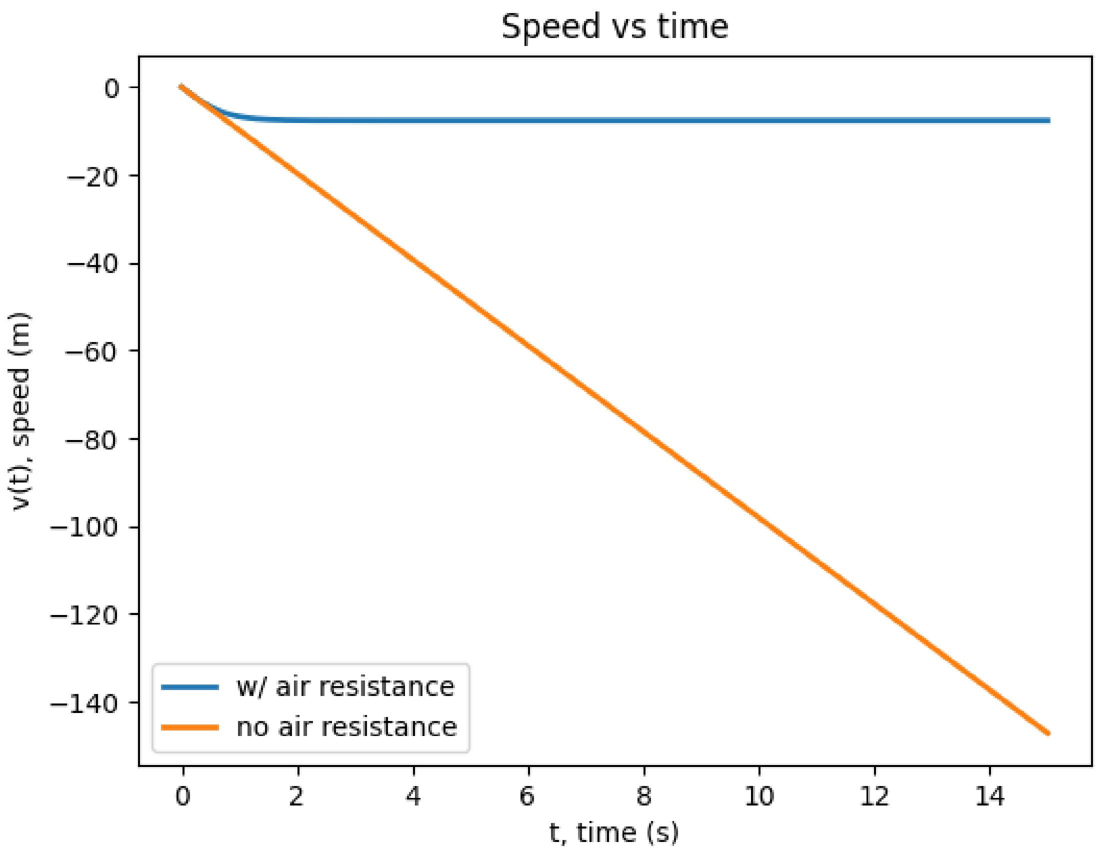

Section 4, Exercise 2

Other than the effects mentioned in the notes (air resistance, variable air density, projectile shape and speed, and wind), suggest TWO additional examples of features that could affect the trajectory of a projectile.

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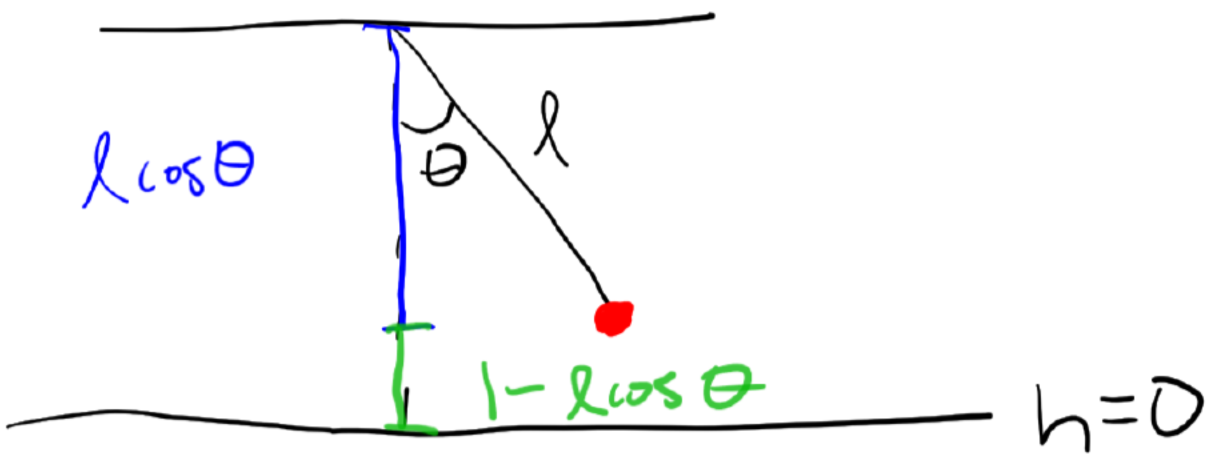
Force of gravity actually varies with height, rotation of the Earth, curvature of the Earth

Section 4, Exercise 3

Using the *PendulumEuler1.py* example, plot the kinetic energy ($K = (1/2)mv^2$, where $v = \ell\omega$), potential energy ($U = mgh$, where $h = 1 - \ell\cos\theta$, see figure), and total energy $E = K + U$ to show that this system does not conserve energy. Assume $m = 1$ kg. What should this plot look like for the true solution?



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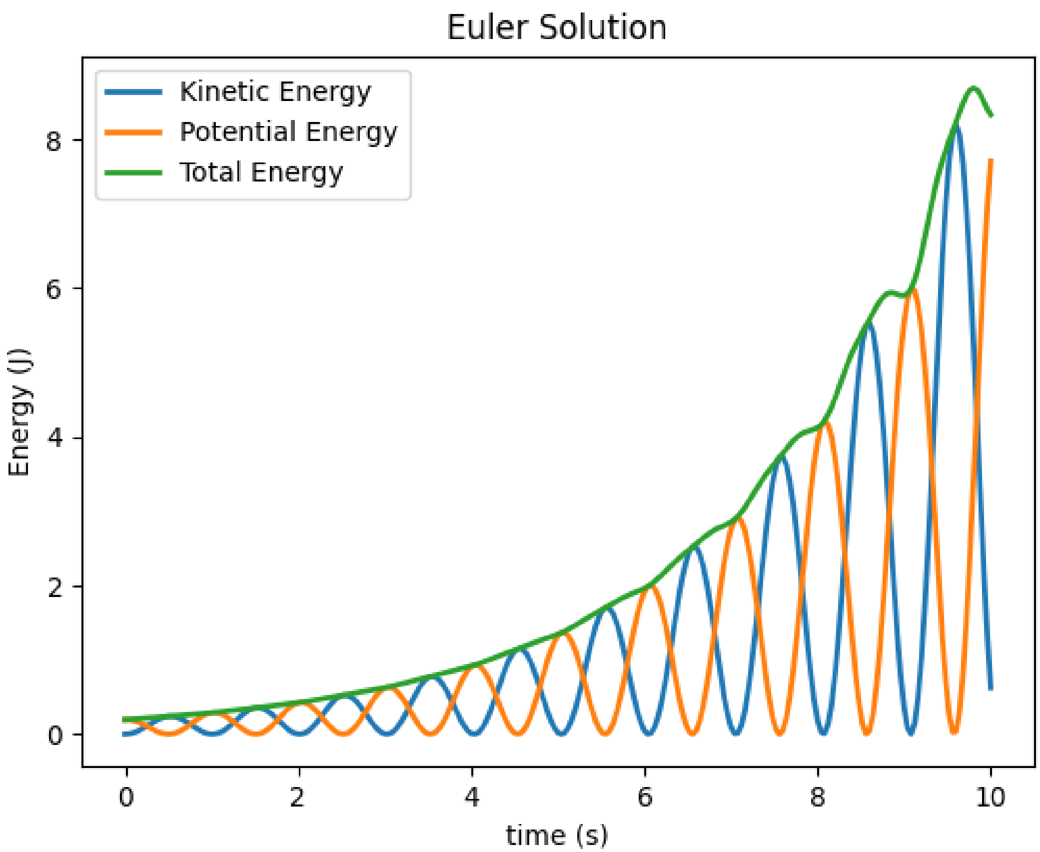

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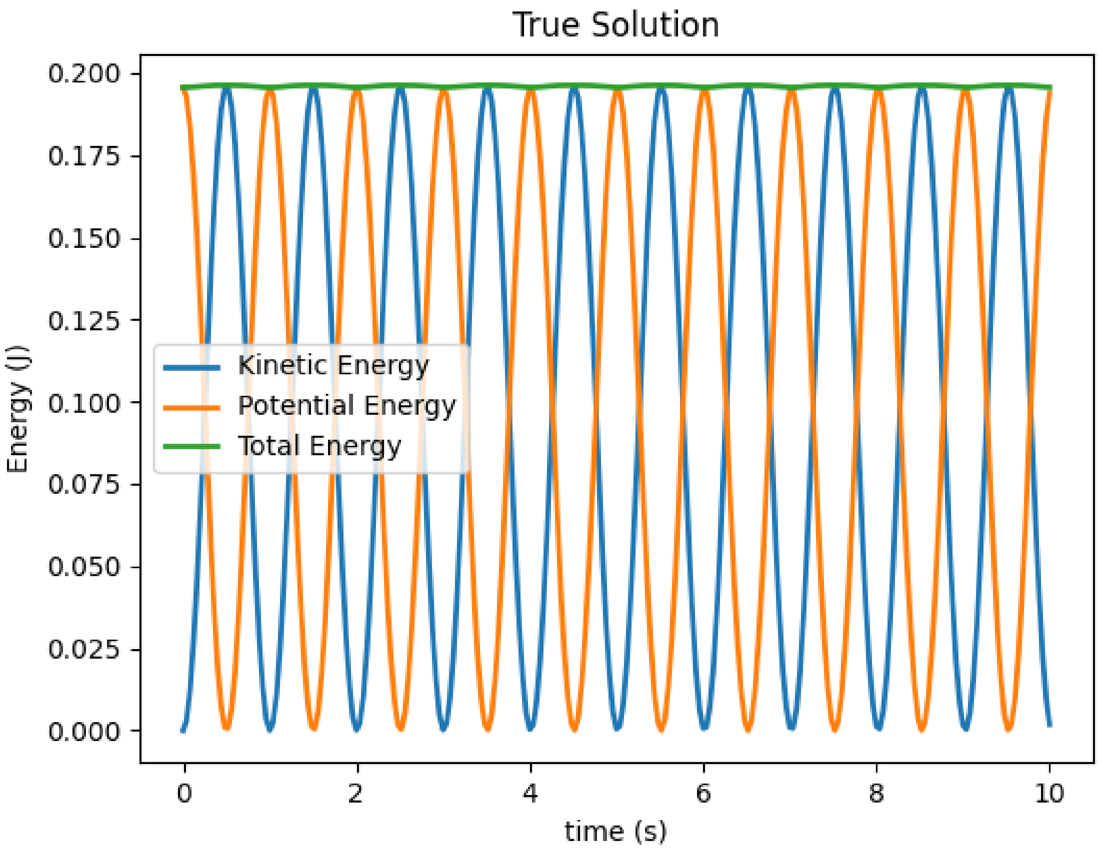

Section 4, Exercise 4

For a fixed value of β, how does increasing or decreasing the mass affect the damping?

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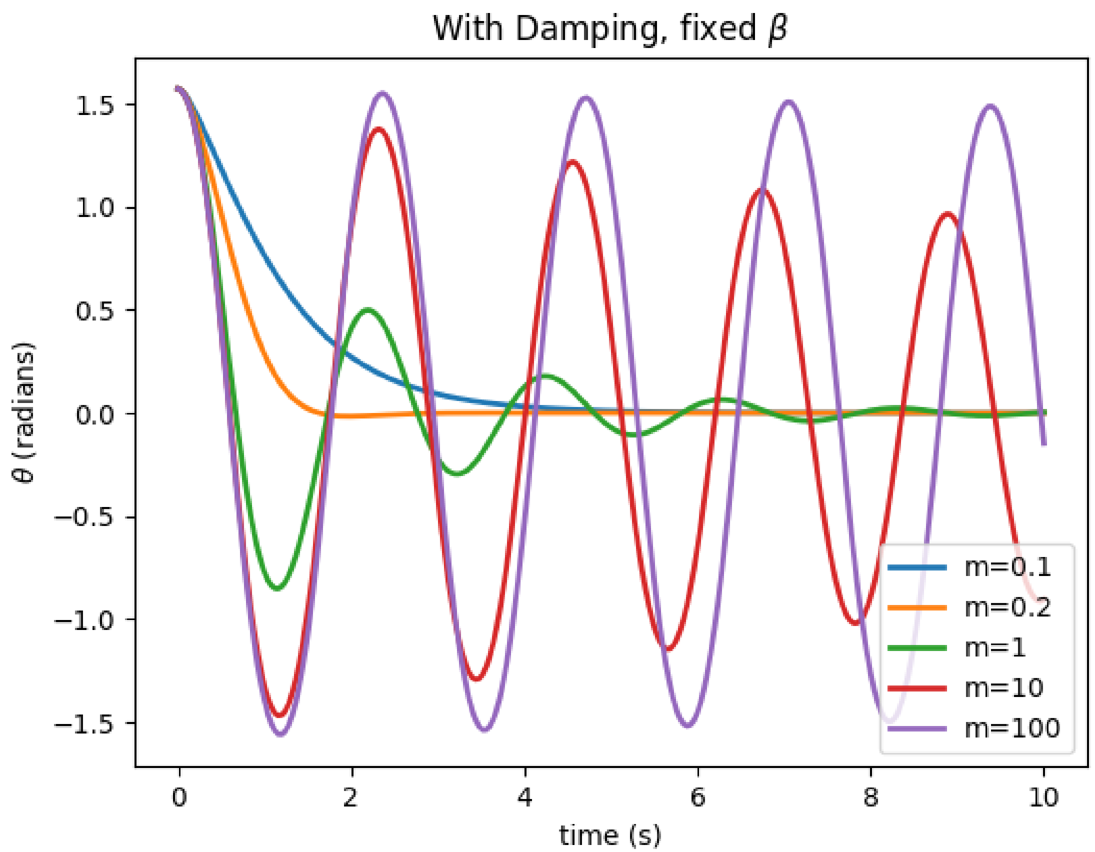

Section 4, Exercise 5

Construct a difference plot (Δz) for the Lorenz model, for different initial conditions $z_0 = 0$ and $z_0 = 0.001$. Use parameter values $\sigma = 10$ and $b = 8/3$. Use initial conditions $x_0 = 1$ and $y_0 = 0$. Use a time step of $h = 0.01$ s and plot the Δz from $t = 0$ to $t = 100$ s. Consider different values of r and try to determine more precisely the value of r at which the transition to chaos takes place by the slope of the Δz vs t plot.

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The transition is supposed to happen at r = 24.74, but I see it around 24.1

Averaging over many trials would give a better result.