Homework 05

For problems that require you to write a script, save your script in a directory named `scripts/` in the top of the homework directory. Write your script assuming the data file(s) it will use are in the current working directory. I will run your script by first `cd`'ing to the directory containing the data file to be plotted, opening `gnuplot`, and loading it with the `load` command.

1. The homework directory contains a directory named `files/`, which contains several files with data in them.

    1. Write a gnuplot script that will reproduce the png image shown in Figure 1. Name your script `Figure1.gnuplot` and have your script create a file named `Figure1.png`.

    2. Write a gnuplot script that will reproduce the png image shown in Figure 2. Name your script `Figure2.gnuplot` and have your script create a file named `Figure2.png`.

    3. Write a gnuplot script that will reproduce the png image shown in Figure 3. Name your script `Figure3.gnuplot` and have your script create a file named `Figure3.png`.

2. A damped harmonic oscillator will oscillate back and forth in time, with the displacement given by a sine/cosine function, just like the non-damped oscillator. However, the amplitude of the oscillation will exponentially decrease with time (because energy is being removed from the system by friction). The oscillations are described by the following equation

$$y(t) = Ae^{-\alpha t}\cos\left(\frac{2\pi}{T}t\right)$$

    where T is the period of oscillation, A is the initial amplitude, and α is the rate of amplitude decay.

    Write a gnuplot script that will reproduce the png image shown in Figure 1. Name your script `Figure4.gnuplot` and have your script create a file named `Figure4.png`.

    The parameters used to create figure were $A = 2\,\text{cm}$, $T = 2\,\text{s}$, and $\alpha = 0.1\,\frac{1}{\text{s}}$.

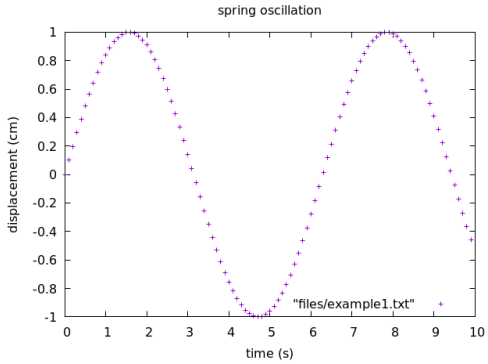

Figure 1:

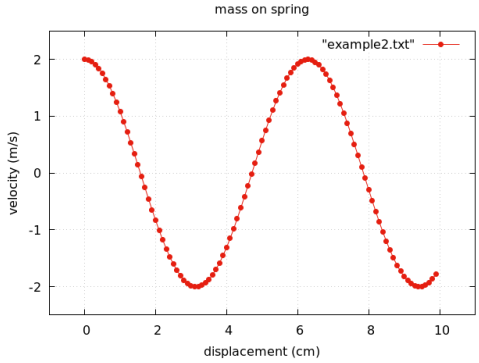

Figure 2:

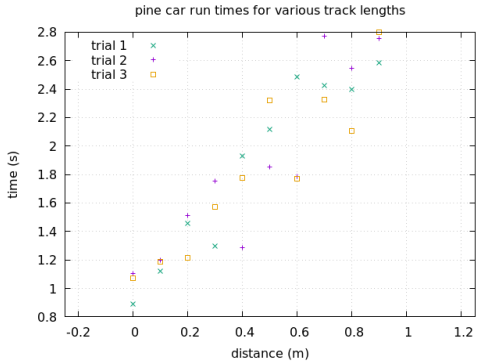

Figure 3:

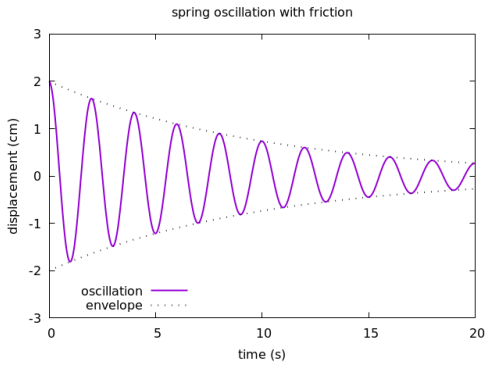
spring oscillation with friction
displacement (cm)
time (s)
oscillation
envelope
3
2
1
0
-1
-2
-3
0
5
10
15
20

Figure 4: