This is the instruction sheet for running the solution for Worksheet 3 problems.

The Jupyter notebook `WS3_notebook.ipynb` contains solution for all problems Worksheet 3.

Separate `.py` files are also provided for each problem.

Problem 1

- Run the file `WS3_1.py` to generate the solution of damped harmonic oscillator. The figures for this problems are:
    1. `Damped_oscillator_Under-damped.jpg` : This is for the *Under-Damped* Case.
    2. `Damped_oscillator_Over-damped.jpg` : This is for the *Over-Damped* Case.

Problem 2

- Run the file `WS3_2_0.py` to generate solution for simple harmonic oscillator. The figure for this problem is: `anh_osc_L0.jpg` .
- Run the file `WS3_2_a.py` to generate solution for part **a** of this problem, *"Plot of energy vs time for 3 different step sizes"*. The figure for this problem is: `anh_osc_energy.jpg` .
  For this part, the Y-axis is set to be `Energy - Initial Energy` . This is done to avoid auto scaling of the Y-axis by Matplotlib.
- Run the file `WS3_2_b.py` to generate solution for part **b** of this problem, *"Phase Space plot for different values of Lambda"*. The figure for this problem is: `anh_osc_phase_space.jpg` .
- **Comment on the phase-space plot:** One can see that for higher values of λ, the plot tends to more rectangular plot, suggesting that the particle spends longer time at the extreme velocities and then quickly decays to $v=0$, which is expected for x^3 force term.