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# Exercises #5

•**Problem 1.** Write a function which takes in a list of numbers and produces a list containing the average and standard deviation.

•**Problem 2.** Write a function which takes in an arbitrary Lagrangian, i.e. a function of  $q$  and  $\dot{q}$ , and emits the Hamiltonian.

•**Problem 3.** Write a function which takes in a Hamiltonian and an initial  $p$  and  $q$ , and plots the corresponding trajectory in phase space.

•**Problem 4.** Extend the function to plot the evolution of a small finite region of phase space, either by evolving a cluster of randomly distributed points, or by mapping out the boundaries. (According to a theorem of classical mechanics, the area of such a region is preserved under time evolution.)