

Phase space trajectory of 1D Harmonic Oscillator

1. Calculate $\frac{dp}{dt}$ and $\frac{dx}{dt}$ from the Hamiltonian

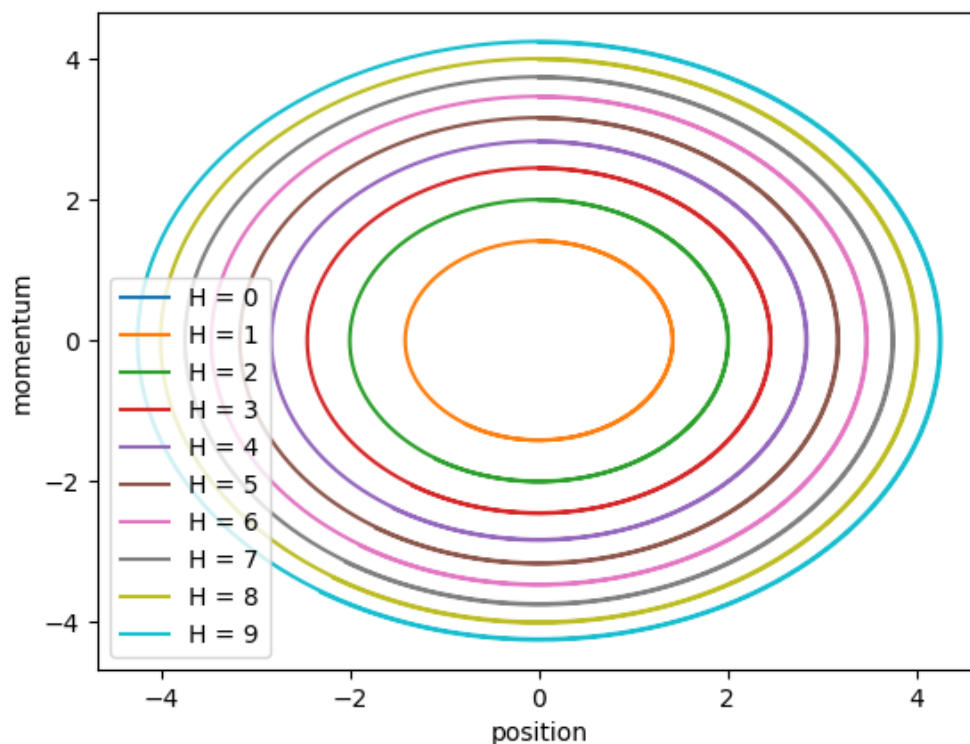
$$H(x, p) = \frac{1}{2}kx^2 + \frac{p^2}{2m}$$

$$\frac{dp}{dt} = -\frac{\partial H}{\partial x} = -kx$$

$$\frac{dx}{dt} = \frac{\partial H}{\partial p} = \frac{p}{m}$$

2. Get the time evolution P and X using these equations and plot the phase space (p vs x). Do this for different initial values of H.

(We move clockwise along each contour)



3. Plot the mean square displacement vs time

(As we are dealing with just one particle, means square displacement is just square displacement)

Below is the plot of mean square displacement vs time for different values of H

