Homework #5 - Due Nov. 10, 2016

1. Given that the initial probability density P(x,t=0) of a biased random walker moving on a 1-dimensional continuum is a Gaussian of width w, calculate it all times t, i.e., P(x,t). By taking the moments of P(x,t), i.e. doing the x-integrals, calculate the time evolution of the mean displacement <x(t)> and the mean square displacement <x^2(t)>. Show plots of P(x,t) at the initial and two more times.

2. Do the exact same problem for a random walker that is pulled towards a point (NOT THE ORIGIN) via a Hookes law interaction. What this means is that the initial Gaussian in problem 2 with the Hookes law attraction is centered around a point which does NOT coincide with the attractor.

For both the problems you might want to use the Fourier transform. For the second problem you might find, additionally, the method of characteristics useful.

Needless to say, you are being asked to solve the advective diffusion and the Smoluchowski equation above.