Physics 221A
Fall 2019
Homework 6
Due Friday, October 11, 2019

Reading Assignment: Notes 9, Secs. 5–9, 11–13, 16–18; Notes 10, Secs. 1-4. We won't cover all of Notes 9. In Notes 9, you may skip Sec. 10, on the second order variations of the action and Secs. 14–15, on the stationary phase approximation applied to the discretized path integral. The main thing is the van Vleck formula, Eq. (84). Just have a general idea where this comes from, based on the 1d stationary phase approximation, presented in Sec. 13. That is, the phase $e^{iS/\hbar}$ is the integrand of the path integral, evaluated at on the critical paths of the action functional (which are the classical paths); and the amplitude prefactor takes into account the rate at which paths nearby the classical path dephase relative to the classical path. If you're motivated you can read the omitted sections to see how a Gaussian integral is done in infinite dimensions and how all the details are assembled. You may also skip Sec. 19, on the path integral applied to statistical mechanics; the main result is the classical expression for the partititon function, which was derived by a different method in Notes 7. **Supplementary reading:** Commins covers the path integral in Sec. 6.14.

Please do problems 9.2, 9.3, 9.4 and 9.5. For problem 9.3, the point is just to see how the van Vleck formula works out in the case of the harmonic oscillator, and to see how much of the propagator is determined by classical mechanics; you may skip part (c), which concerns material we did not cover. Also, you may set $\mu = 0$ in Eq. (84); this is valid for $t < \pi/\omega$.