Physics 412-3 Spring 2020

Problem Set 5

Due by 5pm Monday June 8th.

1) (5 pts) Using the definition of the Weyl transform provided in class, show that the trace of the product of two operators A and B which depend on the position and momentum operators (x,p) is given by the integral over phase space of the product of their Weyl transforms:

$$Tr\left[\hat{A}\hat{B}\right] = \frac{1}{\hbar}\int\int dx\, dp\, \tilde{A}(x,p)\tilde{B}(x,p)$$

2) (5 pts) For the ground state of the 1-dimensional simple harmonic oscillator, show that the expectation value of $< H^2 >= \left(\frac{\hbar\omega}{2}\right)^2$ using the Wigner function method.