Homework 5; due Tuesday, Nov. 5

1. Calculate the 1-particle irreducible 2-point function for a quantum particle with potential \( U(q) = m^2q^2/2 + gq^4/4! \) modulo \( g^3 \) (in momentum space, for \( \hbar = 1 \)). In class we did it modulo \( g^2 \).

2. Let \( U(q) = m^2q^2/2 + gq^3/3 \). Calculate the leading term of the 1-point function \( G_1(t) \) (with respect to \( g \)).

3. In problem 2, calculate the connected 2-point function modulo \( g^3 \).

4. Consider the potential \( U(q) = m^2 \sinh^2(gx)/2g^2 \). Find a formula for \( W_0(J) \) (the tree part of \( \ln(Z(J)/Z(0)) \)) as explicitly as you can.