

## Homework 2; due Tuesday, Sept. 24

1. Compute the 1-loop contribution to  $\ln(Z/Z_0)$  for  $S(x) = x^2/2 - g(x + x^3/6)$ . Using this, compute the number of labeled n-vertex 1-loop graphs with 1-valent and 3-valent vertices only.

2. Find the generating function  $\sum a_n z^n/n!$  for the numbers  $a_n$  of labeled n-vertex trees with 1-valent and 4-valent vertices. You may express the answer via inverse functions to polynomials.

3. Find the one-loop contribution to the effective action for  $S(x) = x^2/2 + gx^3/3!$ . That is, one has  $S_{eff} = S + \hbar S_1 + O(\hbar^2)$ , and you need to find  $S_1$ . Which Feynman diagrams need to be considered?