

### Problem Set 3: Coupling Constant Renormalization

Due Thursday, February 23.

1. Consider the scalar nucleon-meson theory with  $\mathcal{L}_I = -g\psi^*\psi\phi$ . Compute the renormalized 3-point function  $\tilde{\Gamma}(m^2, m^2, q^2)$  to  $\mathcal{O}(g^3)$ . (The nucleons are on the mass shell and the meson has 4-momentum  $q$ . The renormalization condition is  $\Gamma(m^2, m^2, \mu^2) = g$ .) Leave your answer in the form of an integral over Feynman parameters.

Show that your expression, considered as a function of complex  $q^2$ , is analytic in  $q^2$  except for a cut along the real axis. Locate the branch point at finite  $q^2$ .