QFT II exercises - sheet 5

If you find a mistake in this exercise first check the website if the problem has been resolved already in a newer version. Otherwise, please email rutger.boels@desy.de.

Exercise 1

Consider massless Yukawa theory with a so-called pseudo-scalar coupling,

$$\mathcal{L} = \frac{1}{2}(\partial_\mu \phi)(\partial^\mu \phi) - \frac{\lambda}{4!}\phi^4 + \bar{\psi} i \not{\partial} \psi - i g \bar{\psi} \gamma^5 \psi \phi$$

Compute to leading order in the coupling constants the Callan-Symanzik β functions for the coupling λ and g, assuming λ and g^2 are of the same order, as well as the γ functions for the two fields.

Hint: use the reasoning behind equations 12.51 and 12.54 in Peshkin and Schroeder to focus *only* on the information needed to solve the exercise. You will have to consider $\phi^2, \bar{\psi}\psi, \phi^4$ and $\phi\bar{\psi}\psi$ type graphs.