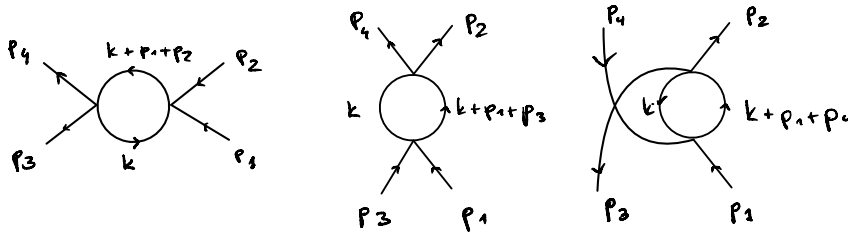# Series 8 - Dimensional regularization of φ^4 theory

I. 2-particle scattering amplitude at one loop

In this exercise, we do in detail the steps for finding the counterterm for the one-loop scattering amplitude in φ^4 theory, see p. 68/69 of the lecture notes.

1. Using the Feynman rules, write down the contributions of the diagrams

2. Using the identity

$$\frac{1}{a_1 a_2} = \int_0^1 \frac{\mathrm{d}x}{(xa_1 + (1-x)a_2)^2} \tag{1}$$

   express the integrals in the form $I_2(d, m^2, q)$.

3. Take the limit $\epsilon \to 0$ (w/o evaluating the x integral).

4. Extract the divergent part.