

Computational Methods in Particle Physics

University of Zurich and ETH Zurich

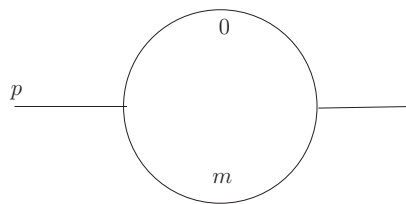
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Problem 1: Mellin-Barnes method

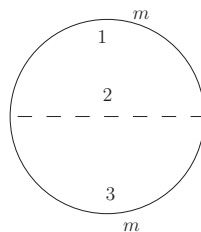


Calculate the one-loop two-point function with one massive propagator

$$F(\nu_1, \nu_2) = \int d\bar{k} \frac{1}{[k^2 - m^2 + i\delta]^{\nu_1} [(p - k)^2 + i\delta]^{\nu_2}}$$

for $\nu_1 = 2, \nu_2 = 1$ using a Mellin-Barnes representation.

Problem 2: Sector decomposition



Using sector decomposition, factorize the singularities of the two-loop vacuum bubble graph with two massive propagators (see figure)

$$G = \int d\bar{k} d\bar{q} \frac{1}{[k^2 - m^2 + i\delta] [(q - k)^2 + i\delta] [q^2 - m^2 + i\delta]}.$$