Quantum field theory I	**Exercise sheet 13**

1-loop integrals and the Feynman parametrization

Exercise 1: Many loop integrals can be simplified with the so-called Feynman parametrization. Its starting point is the identity

$$\frac{1}{ab} = \int_0^1 \frac{\mathrm{d}t}{[at + b(1-t)]^2} \;, \quad a, b > 0 \;.$$

Verify the validity of this relation.

Exercise 2: We consider the integral

$$B(Q^2; m^2, m^2) \equiv \int \frac{\mathrm{d}^d P}{(2\pi)^d} \frac{1}{P^2 + m^2} \frac{1}{(P+Q)^2 + m^2} \;.$$

(a) Argue that the result only depends on the length squared $Q^2 = \sum_\mu Q_\mu Q_\mu$, rather than the individual components of the vector Q.

(b) Show examples of Feynman diagrams that would lead to this integral.

(c) After inserting $d = 4 - 2\epsilon$, make use of the Feynman parametrization and the results in exercise 12.2, in order to determine $B(Q^2; m^2, m^2)$ up to order ϵ^0.