The quadratic sieve and the number field sieve are two traditional factoring methods. We present here a principle of operation of both these algorithms, focusing mainly on the calculation of asymptotic complexity. The greatest emphasis is placed on the analysis of the sieving phase. However, the main goal of this work is to describe various modifications, estimate their time complexity and compare their practical usability with the basic versions. Apart from several well-known variants, we present our own proposals of both quadratic and number field sieve and analyze their advantages and disadvantages in detail.