Information about the Algebra exam 2020 (MMG 500 , MVE 150)

The Algebra exam (MMG 500 and MVE 150) will take place March 20th between 14.00 and 18.00. No aids are allowed. There will be one re-exam in June and one in August.

The exam is based on the topics in the following list.

Contents: Operations, groups, subgroups, symmetries, permutations, equivalence relations and partitions, prime numbers, fundamental theorem of arithmetic, congruences, arrangement of groups and elements in groups, cyclic groups, cosets and Lagrange’s theorem, isomorphism, direct products of groups, isomorphism classes of finite abelian groups, Cayley’s theorem, group homomorphisms, image and kernel, normal subgroups, quotient groups, the fundamental homomorphism theorem, orbits, stabilizers, Burnside’s counting theorem, Sylow’s theorem, the definitions of rings and fields, integral domain, characteristic of a field, polynomial rings, the division algorithm, irreducible polynomials, Euclidean rings, fields with unique factorization, ring homomorphisms, ideals, principal ideals, residue class rings, adjunction of a zero, something about the existence and construction of finite fields, zeros of polynomials, factorization of polynomial rings, various number systems.

Almost all important concepts and results are summarised (in Swedish) at the lecture notes on the home page 2010. But Sylow’s theorem on the existence of subgroups of prime power order and the number of roots of a polynomial over a field can only be found in Durbin’s book (see section 58 and theorem 43.1).

The exam will be dominated by problems, which are similar to the ones listed under “recommended exercises” on the home page. The other problems in the same sections of Durbin’s book are also representative.

The following theorems are particularly important and it is thus more likely that I will ask for proofs of these theorems than for the other ones.

5.1, 6.3, 7.1, 9.1, 10.1, 10.2, the Fundamental Theorem of Arithmetic including the proof of the unique ness part in lemmas 13.1 and 13.2, 14.3, theorem 16.1, Lagrange’s theorem in section 17 (the proof should include proofs of the arguments you need from lemma 16.1 and 16.2, but it suffices to state the results you need from theorems 9.1 and 16.1) ,18.2, 19.3, 21.1, 22.1, the Fundamental Homomorphism Theorem 23.1 for groups, 26.1, 38.1, 40.3 and 43.1.