

Chapter 24: Conjugacy Classes and the Sylow Theorems

- Know the conjugacy class of an element of a group and the definition of the conjugacy class of a subgroup or subset of a group.
- Be able to find the conjugacy classes of the elements of a group.
- Recall the definition of the centralizer of an element of a group and know the statement of Theorem 24.1 and its two Corollaries.
- Know the statement and proof of Theorem 24.2 and the statement and the proof of its Corollary.
- Know the statements of Theorems 24.3, 24.4, and 24.5 and the Corollary to Theorem 24.5.
- Know the definition of conjugate subgroups and the definition of a Sylow p -subgroup of a group.
- Be able to apply the Sylow Theorems in order to determine whether or not a group of a given order has a proper normal subgroup.

Chapter 12: Introduction to Rings

- Memorize the definition of a ring and be familiar with standard examples of rings.
- Know the definition of a commutative ring, a ring with unity, a unit in a ring, divisibility, and scalar multiplication in a ring.
- Know the properties of rings from Theorem 12.1 and be prepared to prove one or more of these properties.
- Know the statement and proof of Theorem 12.2.
- Know the definition of a subring of a ring and be able to apply either the definition or Theorem 12.3 to determine whether or not a subset of a ring is a subring.
- Be familiar with standard examples of subrings of well known rings.

Chapter 13: Integral Domains

- Know the definition of a zero divisor of a ring and the definition of an integral domain.
- Be able to find examples of zero divisors in various rings. Also be able to determine whether or not a given ring is an integral domain.
- Know the definition of a field and be able to determine whether or not a given ring is a field.
- Know the statements and proofs of both Theorem 13.1 and Theorem 13.2.
- Know that every field is an integral domain, every integral domain is a commutative ring with unity, and every commutative ring with unity is a ring. Also know examples that show that each of these inclusions is proper.
- Know the definition of the characteristic of a ring with unity. Also know the statements of Theorem 13.3 and Theorem 13.4.

Chapter 14: Ideals and Factor Rings

- Know the definition of a (two sided) ideal of a ring. Also be able to use Theorem 14.1 to determine whether or not a given subset of a ring is an ideal.
- Know examples of ideals and examples of subrings that are not ideals.
- Know the definition of a factor ring. Also know the statement and proof of Theorem 14.2
- Be able to build the Cayley tables for a specific factor ring and be able to carry out computations in a given factor ring.
- Know the definition of a prime ideal and the definition of a maximal ideal.
- Be able to find the maximal ideals of a given ring. Also be able to determine whether or not a given ideal is prime.
- Know the statement and proof of Theorem 14.3 and the statement of Theorem 14.4. Also be able to apply these theorems to specific rings.

Chapter 15: Ring Homomorphisms

- Know the definition of a ring homomorphism. Also be able to determine whether or not a given function between two rings is a homomorphism.
- Know the definition of a ring isomorphism. Also be familiar with examples of ring homomorphisms and ring isomorphisms.
- Know the statements of Theorems 15.1, 15.2, 15.3, and 15.4. Be able to prove one or two of the properties from Theorem 15.1.
- Know the statement and proof of Theorem 15.5 and the statements of its Corollaries. Be able to apply these results to specific rings.

Note: You are also expected to remember and be able to apply key concepts and definitions from previous exams.