

# MATH 3013 FIELDS AND EQUATIONS

**Credit Points** 10

**Legacy Code** 301377

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**Description** This unit develops abstract algebraic thought to a higher level. The abstract concepts introduced in the unit, ring theory, field theory and algebraic equations, have many applications in science and technology. The theory of algebraic equations is the study of solutions of polynomial equations. Although the problem originates in explicit manipulations of polynomials, the modern (and far more powerful) treatment is in terms of field extensions. The unit is an introduction to ring theory and field theory; it includes applications to cryptography (RSA) and geometry (proving that it is impossible to trisect an arbitrary angle using only a straightedge and compass).

**School** Computer, Data & Math Sciences

**Discipline** Mathematics

**Student Contribution Band** HECS Band 1 10cp

Check your HECS Band contribution amount via the Fees ([https://www.westernsydney.edu.au/currentstudents/current\\_students/fees/](https://www.westernsydney.edu.au/currentstudents/current_students/fees/)) page.

**Level** Undergraduate Level 3 subject

**Pre-requisite(s)** MATH 3015

**Assumed Knowledge**

Basic notions in algebra, such as equivalence relations, groups, homomorphisms and isomorphisms.

## Learning Outcomes

On successful completion of this subject, students should be able to:

1. Apply fundamental structures in abstract algebra and number theory: rings, integral domains, and fields.
2. Examine practical applications, such as RSA cryptography, based on abstract concepts from ring theory and number theory.
3. Formulate proofs involving rings, integral domains, and fields.
4. Communicate mathematical arguments effectively in both spoken and written format.

## Subject Content

- Introduction to rings
- Ideals and factor rings
- Ring homomorphisms, ring isomorphisms, and related theorems
- Rings of integers and their congruences
- Polynomial rings and factorization of polynomials
- Fields and solutions to equations
- Extension of fields
- Application: RSA cryptography
- Application: Ruler and compass, 2000 years of impossible constructions

## Assessment

The following table summarises the standard assessment tasks for this subject. Please note this is a guide only. Assessment tasks are

regularly updated, where there is a difference your Learning Guide takes precedence.

Item	Length	Percent	Threshold	Individual/Group Task
Quiz	20 minutes	10	N	Individual
Quiz	20 minutes	10	N	Individual
Essay	3-6 pages	20	N	Individual
Presentation	15 minutes	10	N	Individual
Final Exam	2 hours	50	N	Individual

Teaching Periods