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MATH31022/MATH41022 - 2007/2008

General Information

- Title: Number Theory: the Riemann Zeta Function
- Unit code: MATH31022/MATH41022
- Credits: 10 (MATH31022), 15 (MATH41022)
- Prerequisites: MATH20101 or MATH20142
- Co-requisite units: None
- School responsible: Mathematics
- Member of staff responsible: Prof. Roger Plymen

Specification

Aims

To prove some basic results in number theory.

Brief Course Description

The distribution of the prime numbers appears to be rather irregular, although they certainly thin out as x increases. How can we describe the distribution? How many primes are there less than x? The key to all this is the Riemann Zeta function, the Riemann zeros, and the famous Explicit Formulas in Number Theory. The Riemann Formula counts up precisely the number of primes less than x. This formula contains oscillatory terms corresponding to the Riemann zeros, and gives rise to the "music of the primes".

Learning Outcomes

On successful completion of this course students will:

- Work with the Riemann zeta function.
- have some familiarity with the Explicit Formulas of number theory.

Syllabus

- Riemann Zeta Function. Basic properties. Into the critical strip. The Riemann zeros. The Riemann Hypothesis. The Euler constant. [6]
- The Euler product. The Hadamard product. The functional equation. The trivial zeros of the zeta function. [6]
- The von Mangoldt explicit formula. The oscillatory terms. [6]
- The Riemann explicit formula. The oscillatory terms. The Riemann approximation to p(x). The prime number theorem. The largest known prime. The distribution of prime numbers. The music of the primes. The spiral curves. [6]

For MATH41022 the lectures will be enhanced by additional reading on related topics.

Textbooks

- J. Stopple., *A Primer of Analytic Number Theory*, Cambridge 2003
- M. du Sautoy., *The Music of the Primes*, Fourth Estate 2003.
- J. Derbyshire, *Prime Obsession*, Plume 2004.

Teaching and learning methods

Two lectures each week and a weekly examples class.

Assessment

MATH31022: end of semester two hour examination: 100%

MATH41022: end of semester three hour examination: 100%

Arrangements