School of Mathematics

Course 121 - Introduction to Analysis 2006-07
(JF Mathematics, JF Theoretical Physics, JF Two-Subject Moderatorship (for Mathematics + Economics), SF Two-Subject Moderatorship)

Lecturer: Dr. Paschalis Karageorgis

Requirements/prerequisites: Some mathematical intuition

Duration: Full year

Number of lectures per week: 4 + 1 tutorial

Assessment: Homework Homework assignments every other week. Exams at the end of the Michaelmas term and at the end of Hilary term.

End-of-year Examination: A 3-hour paper.

Description: See [http://www.maths.tcd.ie/~pete/ma121/](http://www.maths.tcd.ie/~pete/ma121/) for more complete information.

The course will cover the following topics, yet not necessarily in the order listed.

- A short introduction to mathematical logic and proofs
- Definition of the real numbers (using Dedekind cuts)
- Definition and properties of min/max/inf/sup
- Logarithms, powers and roots
- Definition and properties of limits; limits at infinity
- Definition and properties of derivatives
- Definition of continuity; continuous and discontinuous functions
- Intermediate value and Mean value theorems
- Applications of derivatives in optimization problems
- Definition and properties of (in)definite integrals
- Techniques of integration; the Fundamental Theorem of Calculus
- Infinite and power series; tests for convergence
- Taylor’s Theorem; binomial and exponential series
- Applications of integrals in computations of area
- Surfaces of revolution and their volumes
- Double integrals and polar coordinates
• Fubini’s Theorem
• Basic Theory for ordinary differential equations (ODE)
• Separable and 1st-order linear ODE
• 2nd-order ODE with constant coefficients
• Homogeneous and non-homogeneous ODE

**Textbook.** Although there is no official textbook for the course, some typical references are

1. Calculus by Michael Spivak,
2. Principles of mathematical analysis by Walter Rudin,

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