Analysis II: MA139

Keith Ball

Course plan

Power series I: the exponential

Radius of convergence and continuity. The exponential and its characteristic property. Inequalities. The logarithm. Powers.

Limits and the derivative

Limits: relation to continuity. The derivative. The sum and product rules. Polynomials. Local linearisation and the chain rule. Higher order derivatives. Rolle's Theorem and the Mean Value Theorem. Uniqueness of solutions of ordinary differential equations. Extrema and derivatives. The derivatives of inverses.

Power series II: the trigonometric functions

The differentiability of power series. The differentiability of exp and log. Trigonometric functions. The addition formulae. $\cos^2 + \sin^2 = 1$. $e^{i\theta} = \cos\theta + i\sin\theta$. Radians and the choice of the exponential.

Taylor's Theorem

Cauchy's Mean Value Theorem. L'Hôpital's rule. The Lagrange remainder. The log series and binomial series.

The Riemann integral

Upper and lower sums. The integral. Linearity and monotonicity. The Fundamental Theorem of Calculus. Substitution. Improper integrals.