School of Mathematics

Module MA1131 — Advanced calculus 2009-10
(JF Mathematics, JF Theoretical Physics & JF Two-subject Moderatorship
SF Mathematics, SF Two-subject Moderatorship)

Lecturer: Professor Richard Timoney

Requirements/prerequisites:

Duration: Michaelmas term, 11 weeks

Number of lectures per week: 3 lectures including tutorials per week

Assessment: Regular aassignments and tutorial work.

End-of-year Examination: Continuous assessment. Supplemntal examination only.

Description: Basic notation, functions, limits of polynomials and rational functions. Definition of derivative. Interpretations of the derivative; rules for differentiation. Implicit differentiation; rational powers; trigonometric functions; sign of the derivative and monotone functions.

Exponential function; inverse functions. The natural logarithm; arbitrary powers of positive numbers; Inverse trigonometric functions; hyperbolic functions. Inverse hyperbolic functions.

Functions of several variables. Vector valued functions of one variable (parametric curves). Graphs of functions of two variables, partial derivatives. Directional derivatives, tangent plane to a graph, linear approximation for functions of two variables, (total) derivatives. Gradient vector, its relation to directional derivatives, a chain rule for partial derivatives, level curves and the fact that the gradient is perpendicular to them. Statement of the implicit function theorem and relation to implicit differentiation.

Functions of 3 variables, level surfaces, partials, directional derivatives, gradient vector, gradient perpendicular to level surface, gradient and direction of fastest increase.

Integrals in one variable, both as antiderivatives and as definite integrals (defined by a limit of sums). The fundamental theorem of integral calculus connects the two concepts of 'integral'. Continuous functions do have antiderivatives. Techniques of integration (substitution, integration by parts, trigonometric integrals, and partial fractions).

Double and triple integrals. How to compute them (Fubini theorem) via iterated single integrals. Double integrals in polar coordinates.

October 14, 2010