MATH1010: CALCULUS AND LINEAR ALGEBRA
UNIT OUTLINE, FIRST SEMESTER, 2009

Textbooks:


Calculus:

• Logic and induction (4 lectures)

• Real numbers, inequalities (1 lecture)
  Basic properties of \( \mathbb{R} \) as an ‘ordered field’. Inequalities involving real numbers. Absolute value and its properties.

• Sups and infs, sequences (4 lectures)

• Limits of functions, continuity (5 lectures)

• Differentiation (5 lectures)
  Derivatives (one-sided and otherwise) and rules for differentiation. The Chain Rule and the use of L’Hospital’s rule. Differentiability implies continuity. Geometrical meaning of derivatives via tangent lines. Critical points and inflection points, and their relevance. Mean Value Theorem and applications. Implicit differentiation, related rates and applications.

• Integration (7 lectures)
Linear Algebra:

- Systems of linear equations and matrices (6 Lectures)
  Gaussian elimination, consistent systems of linear equations, matrices and matrix operations, algebraic properties of matrix operations, matrix inverses.

- Vector geometry (5 Lectures)
  Vectors in space, parallel and coplanar vectors, lines and planes, dot products, cross products, review of vectors in the plane.

- Euclidean $n$-space (11 Lectures)
  Vectors in $\mathbb{R}^n$, subspaces and spanning sets, nullspaces, linear independence, basis and dimension, row and column space, rank of a matrix, rank-nullity Theorem for matrices.

- Determinants and eigenvalues (4 Lectures)
  Definition of eigenvalues and eigenvectors of an $n \times n$ matrix. Definition and properties of determinants, and methods of calculation. Use of determinants in calculating eigenvalues and eigenvectors. Definition of eigenspaces.