1 Riemann Integration and Series of Functions

1.1 Riemann integration

Riemann integration: inequalities of upper and lower sums, Darboux integration, Darboux theorem, Riemann conditions of integrability, Riemann sum and definition of Riemann integral through Riemann sums, equivalence of two definitions. Riemann integrability of monotone and continuous functions, properties of the Riemann integral; Integrability of functions with infinitely many discontinuities having finitely many limit points. Definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorem of Integral Calculus.

1.2 Improper integrals, beta and gamma functions

Improper integrals. Convergence of Beta and Gamma functions.

1.3 Sequences and series of functions

Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and differentiability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test, Weierstrass approximation theorem.

1.4 Fourier series

Fourier series: Definition of Fourier coefficients and series, Riemann-Lebesgue lemma, Bessel's inequality, Parseval's identity, Dirichlet's condition. Examples of Fourier expansions and summation results for series.

1.5 Power series

Power series, radius of convergence, Cauchy Hadamard theorem. Differentiation and integration of power series, Abel's theorem, Dirichlet's Theorem.