Prof. Dr. Dirk Langemann
Institut Computational Mathematics
Technische Universität Braunschweig
Pockelsstraße 14
38106 Braunschweig

Technische Universität Braunschweig

Braunschweig, 9th of January 2017

Mathematics for engineers I (Calculus 1)

1 sequences and limit

sequences, recursion, monotony, bounds, maximum and supremum, geometrical sequence

limit, definition and rules, convergence tests, Cauchy sequence, typical limits, Euler's number e, binomial coefficients (rep.)

Bachmann-Landau notation, limit point, limit inferior and superior

2 series

partial sums, convergence, absolute convergence, geometric and harmonic series

comparison test, ratio test, root test, alternating series test, power series

3 functions

definition, concepts, inverse function, monotony, periodicity, symmetry

standard functions: power functions, polynomials, comparison of coefficients, exponential functions, logarithm, rules of powers, roots and logarithms (rep.)

trigonometric functions, addition theorems, hyperbolic functions, inverse trigonometric and hyperbolic functions

rational functions, partial fraction decomposition

4 limits of functions and continuity

definition, typical examples, unilateral limits, asymptotes, Heaviside step function

continuity, Dirichlet's function, discontinuities and singularities, poles

properties of continuous functions, intermediate value theorem, extreme value theorem

5 differentiation

difference and differential quotient, derivative, differentiability, C^n-spaces and norms

product and chain rule, derivatives of standard functions, derivatives of inverse functions

mean value theorem, de l'Hospital's rule

extreme values, reflection points, necessary and sufficient conditions, monotony, curvature

Taylor polynomials and series, remainder, power series of standard functions, Euler's identity (rep.)

6 integration

definit integral, areas, Riemann's integral concept, mean value theorem for integrals

indefinit integral, fundamental theorem of calculus

integration by parts, integration by substitution, integrals of standard functions, integrals of rational functions and power series

improper integrals, Γ function