Syllabus

This years course structure

The course consists of approximately 60 sessions preparing students for the Feststellungsprüfung. It is divided into 8 sections, each with ~6 sessions. Between sections, 1–2 sessions are reserved for review and reinforcement of key concepts.

Section 1: Mathematical Foundations & Algebra (Basics)

- Mathematical language and notation
- Set theory and number systems (natural, whole, integer, rational, real)
- Properties of operations (commutative, associative, distributive laws)
- Elementary calculations with real numbers
- Fractions, percentages, and applications
- Algebraic manipulation and transformation of terms
- Laws of exponents, logarithms, and scientific notation
- Binomial theorem, factorization, and absolute value
- Mathematical logic and proof techniques (basics)

Section 2: Equations & Basic Functions (Basics)

- Linear equations and inequalities in one variable
- Systems of linear equations and Gaussian elimination
- Quadratic, biquadratic, fractional, and radical equations
- Exponential and cubic equations
- Absolute value equations
- Introduction to functions: concept, notation, and properties
- Linear and quadratic functions
- Graphical representation, domain, and range analysis
- Basic business applications

Section 3: Advanced Functions & Analysis (Exam Focus)

- Polynomial, rational, and root functions
- Power functions with rational exponents
- Exponential and logarithmic functions
- Trigonometric functions and identities
- Inverse functions and composition
- Function properties: symmetry, monotonicity, bounds
- Asymptotes and discontinuities
- Function families and parameter analysis
- Graphing and sketching methods
- Business applications with periodic phenomena

Section 4: Differential Calculus (Exam Focus)

- Fundamental concepts: limits, continuity, difference quotient
- Derivatives and their geometric meaning
- Rules of differentiation: sum, product, quotient, chain, etc.
- Rates of change (local and average)
- Tangent lines and linear approximation
- Function analysis: maxima, minima, inflection points
- Analysis of parameterized function families
- Finding functions from conditions
- Optimization problems with business applications

Section 5: Integral Calculus & Applications (Advanced Topics)

- Antiderivatives of polynomial functions
- Integration techniques (basic and substitution)
- Definite integrals and the fundamental theorem of calculus
- Area calculation problems and applications
- Applications in financial mathematics:
  - Simple and compound interest
  - Present value and future value
  - Annuities and loan amortization
  - Investment analysis

Section 6: Probability Theory (Exam Focus)

- Concepts of probability (Laplace, statistical, subjective)
- Random experiments (single-stage, multi-stage)
- Sample space, events, and probability calculations
- Tree diagrams, path rule, conditional probability
- Contingency analysis (four-field and multi-field tables)
- Combinatorics and counting principles
- Random variables and distributions
- Binomial and other discrete distributions
- Expected value, variance, and measures of dispersion
- Business applications in risk and decision-making

Section 7: Statistics & Linear Algebra (Advanced Topics)

- Populations, samples, and data collection methods
- Descriptive statistics: mean, median, mode
- Measures of dispersion: variance, standard deviation
- Data visualization and basic statistical software
- Hypothesis testing and significance
- Confidence intervals and inference
- Vectors and vector operations
- Matrices, inverses, and solving systems
- Growth models and transition matrices in business contexts

Section 8: Exam Preparation & Integration (Exam Focus)

- Comprehensive review of function analysis
- Advanced problem-solving in calculus
- Probability applications and complex tasks
- Integration of concepts from multiple areas
- Mock Feststellungsprüfung sessions
- Exam-style practice exercises
- Targeted problem remediation and consultation
- Final preparation strategies and exam techniques

Bibliography