Numerical Analysis – MATH 270 A/B/C

Topics for 2026 Qualifying Exam

270A:

James Demmel's "Applied Numerical Linear Algebra", chapters 1, (2.1-2.6), (2.7.1-2.7.3), 3, (4.1-4.4), (5.1-2), 5.3.1, 5.4.1, (6.5-6)

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1. Nonlinear equations (Newton's iteration, fixed-point iteration);

2. Optimization (Necessary and sufficient conditions, the gradient descent method, the method of Lagrange multipliers, a penalty method);

3. Polynomial approximation (Weierstrass theorem, best uniform approximation, Chebyshev polynomials, uniform approximation by trigonometric polynomials, least-squares approximation, orthogonal polynomials, Legendre polynomials);

4. Polynomial interpolation (Lagrange interpolation, different formulas and remainders, Peano kernel, Hermite interpolation, piecewise linear interpolations);

5. Numerical quadrature (basic concepts, interpolatory quadrature, Peano kernel and errors, trapezoidal and Simpson's rules, weighted Gaussian quadrature, composite quadrature, errors and convergence).

270C

Iserles, A First Course in Numerical Analysis of Differential Equations, Chapters 1-4