

Oral examination syllabus

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Major Area: Differential Geometry

References:

- do Carmo, *Differential Geometry of Curves and Surfaces*
- do Carmo, *Riemannian Geometry*
- Meyer, Wolfgang, *Toponogov's Theorem and Applications*

Topics:

- Surfaces in \mathbb{R}^3
- The First and Second Fundamental Forms
- Curvature of Surfaces; Theorema Egregium
- Gauss-Bonnet Theorem
- Riemannian Metrics
- Affine Connections; the Levi-Civita Connection
- Geodesics; Convex Neighborhoods
- Curvature (Sectional, Ricci, Scalar)
- Jacobi Fields
- Isometric Immersions
- Hopf-Rinow Theorem
- Hadamard Theorem
- Spaces of Constant Curvature
- Variations of Energy
- The Rauch and Toponogov Comparison Theorems
- Volume Comparison Theorems; The Bishop-Gromov Theorem

- The Morse Index Theorem
- Manifolds of Negative Curvature; Preissman's Theorem
- The Sphere Theorem

Minor Area: Logic and Finite Model Theory

References:

- Enderton, *A Mathematical Introduction to Logic*
- Libkin, *Elements of Finite Model Theory*

Topics:

- Compactness and Completeness Theorems for First-Order Logic
- Löwenheim-Skolem Theorem
- Gödel's First and Second Incompleteness Theorems
- Non-Standard Models of Arithmetic
- Karp's Theorem
- Ehrenfeucht-Fraïssé Games
- Trakhtenbrot's Theorem
- Fagin's Theorem
- 0-1 Law for $L_{\infty\omega}^{\omega}$