Oral Qual Syllabus

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1 Riemannian Geometry

- Riemannian metric
- Levi-Civita connection
- Riemannian curvature tensor
- Sectional curvature
- Ricci curvature, scalar curvature
- Geodesics
- Exponential map
- Jacobi fields, conjugate points
- First and second variation of arc length
- Bonnet-Myers theorem
- Hopf-Rinow theorem
- Cartan-Hadamard theorem
- Space form
- Second fundamental form on hypersurfaces
- Differential operators: grad, div and Hess

2 Algebraic Topology

- Singular homology
- Homotopy invariance
- Exact sequences

- Excision
- Cellular homology
- Mayer-Vietoris sequence
- Universal coefficient theorem
- Cohomology ring
- Künneth formula
- deRham cohomology
- Poincaré duality