Oral Qualifying Examination Syllabus

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Algebraic Number Theory

1. Invariants of number fields: embeddings, discriminants and orders

2. Arithmetic of orders in number fields: fractional ideals, splittings of primes, ramification

3. Ideal Class Group of number fields

4. Structure of units in orders of number fields

Elliptic Curves

1. The group law for adding points on an elliptic curve

2. The group of rational solutions to $E : y^2 = x^3 + Ax + B$ form a finitely generated group (the Mordell-Weil group of E)

3. Effective bounds on the rank of the Mordell-Weil group

4. Conjectural effective algorithms to find all rational solutions to $y^2 = x^3 + Ax + B$

5. L–series of elliptic curves and relations to modular curves

6. Applications to classical Diophantine problems

Modular Forms

1. Elliptic Modular Curves as Riemann Surfaces

2. Elliptic Functions

3. Modular Functions and Modular Forms

4. Hecke Operators

Automorphic Forms

1. Discontinuous groups

2. Automorphic Forms

3. Eisenstein series

4. Spectral theorem

5. Trace formula

6. Estimates for the Fourier coefficients of cusp forms

7. Automorphic L–functions