

Math 662
Final Project

April 23, 2005

Due Wednesday, May 11.

Choose one of the following:

- 4–8 page typed paper,
- 45 minute presentation.

Your paper or presentation should give a good overview of your chosen topic and should include at least one proof.

Let me know by e-mail by the end of the week (Fri. 4/29) what topic you have chosen and whether you will write a paper or give a presentation.

Suggested Topics:

You may of course come up with your own topic, and many of you already have done so. Here are some other suggestions, but keep in mind that you probably will not be able to cover all the sub-topics listed. The references suggested are not comprehensive; you may of course find others on your own or ask for additional ones.

- L -functions of modular forms. List of possible items to cover: L -function as Mellin transform, analytic continuation, functional equation, Euler product, twists by characters, Weil's converse theorem. References: Koblitz, Ch. III (spread about); Silverman2, Ch. I; Knapp, Ch. VIII.
- Congruent number problem. References: Koblitz, Ch. I and Ch. IV.
- The Θ -function and modular forms of half-integral weight. References: Koblitz, §III.4 and Ch. IV.
- The Θ -function and applications to sums of squares. References: Koblitz, §III.4 and exercise 2 in §III.5.
- Petersson inner product, newforms, multiplicity 1. References: Koblitz, §III.5; Silverman2, Ch. I (and exercises); Knapp, Ch. VIII.
- Modular curves, modularity of elliptic curves over \mathbb{Q} , and/or the Birch and Swinnerton-Dyer conjecture. References: Silverman1, Appendix C; Knapp, Ch. X, XII.

References:

- A. Knapp, *Elliptic Curves*, Princeton Univ. Press, 1992.
- J. Silverman1, *Arithmetic of Elliptic Curves*, Springer-Verlag, 1986.
- J. Silverman2, *Advanced Topics in the Arithmetic of Elliptic Curves*, Springer-Verlag, 1994.