

MATH 7853 - TOPICS IN TOPOLOGY
Spring 2005

THE FIRST CLASS WILL MEET ON JANUARY 18

This course will cover some recent results in Teichmüller theory. We'll begin with some introductory material about Teichmüller space: quasiconformal maps, quadratic differentials, the Teichmüller metric, the Weil-Petersson metric. An emphasis will be on the geometric and topological aspects. I will usually simply quote any analytic results that are needed.

The first paper we will go through is "Simple geodesics and the Weil-Petersson volumes of bordered Riemann surfaces" by Maryam Mirzakhani. The first paper of this paper is a generalization of McShane's identity. McShane showed that for any hyperbolic punctured torus X we have

$$\sum_{\gamma} \left(1 + e^{\frac{\ell_{\gamma}(X)}{2}}\right)^{-1} = \frac{1}{2}$$

where the sum is over all simple geodesics γ on X and $\ell_{\gamma}(X)$ is the length of the geodesic. Mirzakhani generalizes this identity to surfaces of arbitrary genus with non-empty boundary of fixed length. She then uses this identity to calculate the Weil-Petersson volume of the corresponding moduli space.

After we finish this paper there are a number of possibilities for what we will do next. We may continue going through some more of Mirzakhani's papers. Another possibility is to look at some of the recent work on billiards on polygons with rational angles (there are many choices here). I may also decide to talk about the recent proofs of tameness of finitely generated hyperbolic 3-manifolds. However, this would be a significant change of topic.