**MA549 – Geometry and Symmetry**
**Summer II 2017**

*Time and Location:* MTWTh 1-3, PSY B53
*Instructor:* Steve Rosenberg
*Office Hours:* MW 3-4, Thursday 11-12 or by appointment in room 248
*Email:* sr@math.bu.edu
*Course webpage:* http://www.bu.edu/tech/services/teaching/lms/blackboard/
*(Non-required) Texts:* D. Brannan, M. Esplen, J. Gray, *Geometry*, Cambridge U. Press, 2007.

This book has lots of very nice material and uses no calculus. It does not discuss axiomatics, and some proofs have gaps. It is analytic in spirit.

A. Baragar, *A Survey of Classical and Modern Geometries*, Prentice-Hall, 2001.

This book covers more topics than *Geometry*, particularly in Euclidean geometry, but the non-Euclidean geometries are covered in less detail. It is synthetic in spirit. The discussion of axiomatics is problematic.

Lecture notes: on the Blackboard course site.
*Prerequisites:* Consent of instructor

This course will study geometry from the point of view of symmetry/transformation groups. We will study Euclidean, projective and hyperbolic geometries over both infinite and finite fields by focusing on the key properties of their groups of symmetries. We will discuss the relationships between the symmetry groups and fundamental properties of length and area in these geometries. The course will provide enough abstract algebra to discuss the symmetry groups in some depth. We will use these properties to understand paradoxical decompositions of spheres, i.e. the Banach-Tarski paradox.

There are lecture notes for the first part of the course. These will be posted on the course webpage as they get typed up.

*Grading:* Homework, which will be intensive and extensive, will count for 75% of the grade. Students are not expected to do all homework problems, but to do a representative sample of problems. As a rough guideline, you should be doing four to five problems well per day. You are encouraged to do group work on the homework.

In addition, each student will pick a subject area and write a report, worth 25% of the grade. Subjects should be chosen by the end of the second week, in consultation with the instructor. Possible topics include projective geometry and perspective drawing, properties of the symmetry group of hyperbolic space, tilings of the Euclidean and hyperbolic plane, abstract properties of groups, etc. The length and depth of the project will be worked out in conversations with the instructor.

*Plagiarism:* Although it is highly recommended that you work on homework problems on your own or with others, you are welcome to use outside sources sparingly. However, all

outside sources must be cited, as in any other course. Quoting other sources without citations is plagiarism, and is subject to the University's policy on plagiarism, available at `http://www.bu.edu/academics/resources/academic-conduct-code/`.