MATH 468
Potpourri

Fall 2010
MWF 1:00-1:50
Frank Jones

This fall I have chosen to spend the entire semester studying just one theorem of classical geometry, **Poncelet's Porism.**

- Prerequisite: a course in complex analysis, such as MATH 382 or MATH 427.
- Format: the students in the class will do all the lecturing.
- Text book: Leopold Flatto, *Poncelet's Theorem*, American Mathematical Society 2009

I plan for us to cover this entire book. I do not think that this theorem of Poncelet, though it is indeed wonderful, deserves an entire course to give a proof of it. However, Flatto's book will introduce us to an amazing array of beautiful mathematics. Here's the AMS blurb:

Poncelet's theorem is a famous result in algebraic geometry, dating to the early part of the nineteenth century. It concerns closed polygons inscribed in one conic and circumscribed about another. The theorem is of great depth in that it relates to a large and diverse body of mathematics. There are several proofs of the theorem, none of which is elementary. A particularly attractive feature of the theorem, which is easily understood but difficult to prove, is that it serves as a prism through which one can learn and appreciate a lot of beautiful mathematics.

The author's original research in queuing theory and dynamical systems figures prominently in the book. This book stresses the modern approach to the subject and contains much material not previously available in book form. It also discusses the relation between Poncelet's theorem and some aspects of queueing theory and mathematical billiards.

The proof of Poncelet's theorem presented in this book relates it to the theory of elliptic curves and exploits the fact that such curves are endowed with a group structure. The book also treats the real and degenerate cases of Poncelet's theorem. These cases are interesting in themselves, and their proofs require some other considerations. The real case is handled by employing notions from dynamical systems.

The material in this book should be understandable to anyone who has taken the standard courses in undergraduate mathematics. To achieve this, the author has included in the book preliminary chapters dealing with projective geometry, Riemann surfaces, elliptic functions, and elliptic curves. The book also contains numerous figures illustrating various geometric concepts.