Course Description: Axiomatic Euclidean geometry and introduction to the axiomatic method.

Pre: Math 243 or 253A, and Math 321 (or concurrent); or consent.

Content: There are several possible approaches to this course that cover different content but there are certain kinds of content that are common. These are:

1. A bit of history with emphasis on the parallel postulate.
2. Logic with emphasis on quantifications, implications and methods of proof. In particular, direct proof, proof by contradiction and proof by cases should be covered. Intimately related to these is the understanding of how to use and formulate definitions, as well as give examples and counterexamples.
3. The axiomatic method should be presented in some concrete fashions with the notions of independence and consistency as well as the concept of models and isomorphism of models being covered.
4. Incidence geometry should be covered in its most rudimentary form.
5. The Euclidean geometry of the plane with emphasis on the ideas of parallelism, congruence, and linear and angle measurement.

These topics can be supplemented by one or more of the following:

1. Hilbert’s axiomatic approach to Euclidean plane geometry. This means spending time on the concept of ”betweenness” and perhaps axioms of continuity.
2. Euclidean geometry of space.
3. Area.
4. The development of incidence geometry into projective geometry.

No guides to how much time should be spent on particular topics have been given since there are so many approaches to this course. However, it is not unreasonable to spend the whole semester doing the necessary logic and axiomatics followed by a presentation of Hilbert’s approach to Euclidean plane geometry.

Possible Texts: The first text has all the logic and axiomatics you need in it.
Course and program objectives: Many of the students in Math 351 are secondary education majors for whom this is a required course. The way in which this course is taught can have a considerable impact on mathematics taught in high schools.

Students should have a good idea of what it means to implement an axiomatic approach to mathematics. The development of the ability to formulate definitions, present examples and counterexamples, as well the ability to write direct proofs, indirect proofs and proof by cases should be emphasized.