Chapter 2. Euclidean Geometry

Note. In Chapter 1, we explored axiomatic systems in general and illustrated them in the setting of finite projective geometries in particular. In this chapter we explore the axiomatic system of Euclidean geometry. Along the way, we will see some weaknesses of Euclid's axiomatic approach in the *Elements*.

2.1. Introduction

Note. A familiarity with Euclidean geometry is assumed. Once we are equipped with appropriate definitions and a sufficient collection of axioms, then many proofs are straightforward. Many of the proofs of results will be left as exercises.

Note. As justification for the approach taken in this chapter, Wylie states (his emphasis; see pages 38 and 39):

> "Our concern here is not with *whether* certain theorems are true or false but rather with exactly *why* they are true or under just what assumptions or conditions they are true. ... Finally, we must think of the students who will someday make their first exploration of geometry under our direction. For the most part they will come to us with only the most primitive notions of intuitive geometry. What we teach them will, in effect, define geometry for them and will be a significant factor in their ultimate appreciation of a logical argument. The better our understanding, the better able we shall be to lead them to a clear understanding of the facts of geometry and to provide them with sound models of precise expression and logical reasoning."