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★**Modern geometry with applications. (English summary)**
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This book is an outstanding undergraduate text presenting a collection of topics in modern geometry. It is easily accessible to a student who has studied calculus and has a modicum of maturity. The text is organized into five chapters, each focusing on one topic: Euclidean geometry, spherical geometry, conics, projective geometry and special relativity. Each topic is beautifully motivated by applications, and filled with creative, engaging problems.

The first chapter deals with Euclidean geometry, emphasizing the concept of an isometry. In content, it presents highlights from a standard high school geometry course: the Pythagorean theorem and results related to parallelism, the congruence theorems, results about subtended arcs and secants on circles, the orthocenter and circumcenter of a triangle, and the laws of sines and cosines. Some of the main applications considered are kaleidoscopes, billiards, and an excellent discussion of the planimeter.

The next chapter, perhaps the best chapter, is devoted to spherical geometry. It begins by introducing geodesics as arcs of great circles, showing them to be distance minimizing. It then develops the basic results of spherical trigonometry relying heavily on cross products. In particular, the relation between area and angular defect is derived, as are the laws of sines and cosines for sides and angles. It then turns to applications, considering first navigation, and then a lengthy discussion of map making, including a digression into conformal mapping.

The third chapter deals with conic sections, covering the standard material about foci, eccentricity and so on. The proofs, however, involve a novel construction due to Dandelin, involving spheres tangent to a cone from the inside along a circle. The applications considered include the focusing properties of conics, LORAN navigation, and finally a rather involved derivation of Kepler's laws of planetary motion from Newton's laws of motion, foreshadowing ideas that reappear prominently in the last chapter on special relativity.

Projective geometry is taken up next, covering Desargues's and Pappus' theorems, cross ratios, duality, homogeneous coordinates, and even a brief introduction to homogeneous polynomials, algebraic curves and tangents. The application here is the obvious one—perspective drawing—and is perhaps a bit beneath the standard set by the rest of the text for motivation and relevancy.

In the final chapter, the author turns to special relativity and Lorentz geometry. He begins by carefully explaining and motivating the notion of an inertial observer, first deriving Galilean transforms from Newtonian hypotheses, and then deriving the Lorentz transforms from relativistic hypotheses. That done, the standard consequences of special relativity are developed: relativistic addition of velocities, Lorentz-Fitzgerald contraction, the twin paradox, and so on. Finally, Minkowski space is abstractly introduced and related to the material presented earlier in the chapter.

Reviewed by *Robert R. Miner*