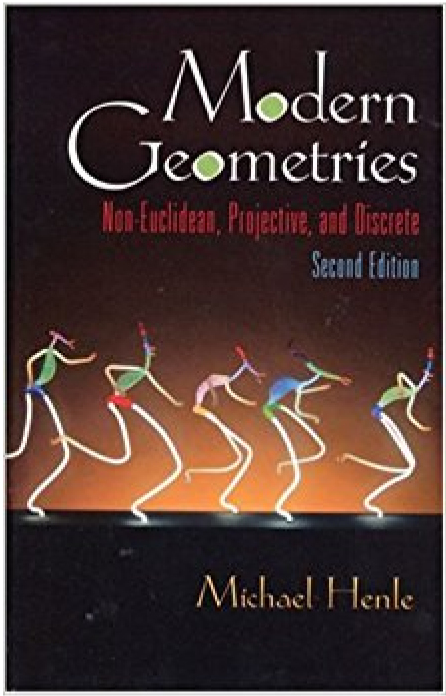
Modern Geometries: Non-Euclidean, Projective, And Discrete Geometry (2nd Edition)



Synopsis

Engaging, accessible, and extensively illustrated, this brief, but solid introduction to modern geometry describes geometry as it is understood and used by contemporary mathematicians and theoretical scientists. Basically non-Euclidean in approach, it relates geometry to familiar ideas from analytic geometry, staying firmly in the Cartesian plane. It uses the principle geometric concept of congruence or geometric transformation--introducing and using the Erlanger Program explicitly throughout. It features significant modern applications of geometry--e.g., the geometry of relativity, symmetry, art and crystallography, finite geometry and computation.   Covers a full range of topics from plane geometry, projective geometry, solid geometry, discrete geometry, and axiom systems. For anyone interested in an introduction to geometry used by contemporary mathematicians and theoretical scientists.

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PREFACE What Is Modern Geometry? For most of recorded history, Euclidean geometry has dominated geometric thinking. Today, however, while Euclidean geometry is still central to much engineering and applied science, other geometries also playa major role in mathematics, computer science, biology, chemistry and physics. This book surveys these geometries, including non-Euclidean metric geometries (hyperbolic geometry and elliptic geometry) and nonmetric geometries (for example, projective geometry), The study of such geometries complements and deepens the knowledge of the world contained in Euclidean geometry. Modern geometry is a fascinating and important subject. Above all, it is pure mathematics filled with startling results of great beauty and mystery. It also lies at the foundation of modern physics and astronomy, since non-Euclidean geometries appear to be the geometry of physical reality in several different ways: on the surface of the earth, as well as in the universe as a whole at very small and very large scales. Finally, modern geometry plays an important role in the intellectual history of Western civilization. Its development, in the nineteenth century, radically altered our conception of physical and geometric space, creating a revolution in philosophical, scientific, artistic and mathematical thought comparable to the Copernican revolution, which changed forever the relationship between science, mathematics, and the real world. The main purpose of this book is to describe the mathematics behind this revolution. Analytic versus Synthetic Geometry Despite its crucial influence on modern scientific thought, non-Euclidean is not well known. In part, this is due to the general neglect of geometry in the mathematics curriculum. However, another factor is the axiomatic format in which geometry is usually presented. Axiomatic geometry (also called synthetic geometry) is a legacy of the Greeks and suited admirably their view of geometry. However, it has no particular relevance to the modern viewpoint and indeed tends to obscure connections among the real world, geometry, and other parts of mathematics. In an age in which applications are paramount, there is no reason why geometry alone among mathematical subjects should be singled out for a quasi-archaic treatment that conceals its practical value. An axiomatic approach is particularly inappropriate with the current generation of mathematics students, since they have had only the briefest exposure to it in high school geometry classes. It makes much more sense to base a geometry course on analytic methods, with which students are much more familiar. The purpose of this book is to provide a brief, but solid, introduction to modern geometry using analytic methods. The central idea is to relate geometry to familiar ideas from analytic geometry, staying firmly in the Cartesian plane and building on skills already known and extensively practiced there. The principal geometric concept used is that of congruence or geometric transformation. Thus, the Erlanger Programm, fundamental to modern geometry, is introduced and used explicitly throughout. The hope is that the resulting treatment will be accessible to all who are interested in geometry. At the same time, synthetic methods should not be neglected. Hence, we present (in Part VI) axiom systems for Euclidean and absolute geometry. Presenting alternative systems demonstrates how axiomatics can clarify logical relationships among geometric concepts and among different geometries. Use of the Book This book is intended for an undergraduate geometry course at the sophomore level or higher. Parts I, II, and VII are the heart of the book. The remaining parts are almost independent of each other. They include material on solid geometry, projective geometry, discrete geometry, and axiom systems. (See the Dependency Chart on page ix.) These parts can be added to a syllabus, depending on the time available, and the interests of the instructor and students. In this way, a wide variety of different courses can be constructed. Prerequisites A previous acquaintance with (high school) Euclidean geometry and analytic geometry is needed to read this book. Specific Euclidean topics used include the sum of the angles of a triangle, the congruence of triangles, and the theory of parallels. From analytic geometry, the reader needs to be familiar with Cartesian and polar coordinates, and to be able to graph straight lines and circles from their equations (including parametric equations). Some familiarity with vector operations (addition and scalar multiplication) is also useful, and some linear algebra is used (but only in later chapters on projective geometry and discrete geometry).

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It was amazing

First of all, there are numerous minor errors in the printing; they get to be annoying at best, and extremely confusing at their worst.The book also is too much of an overview--it makes a good introduction but a poor reference text. It is also very poorly indexed, which can make it hard to find things. The exercises are also poor--many new concepts are introduced in the exercises at the end of the chapters.The writing is actually pretty good, for the most part. I think that the stuff that is explained in the book is explained well in most places, and the author does a very good job of tieing things together and bringing in historical background and significance of the topics being discussed.I lastly might add that the name is very misleading--the geometries described in this book were mostly discovered over 100 years ago--there is nothing drastically "modern" about them.Overall, this book was not prepared for being published--it needs a new edition to correct errors and tie up loose ends.

Modern Geometries: Non-Euclidean, Projective, and Discrete Geometry (2nd Edition) Euclidean and Non-Euclidean Geometries: Development and History Euclidean and Non-Euclidean Geometries Foundations of Euclidean and non-Euclidean geometry Euclidean and Non-Euclidean Geometry: An Analytic Approach Ideas of Space: Euclidean, non-Euclidean, and Relativistic Taxicab Geometry: An Adventure in Non-Euclidean Geometry (Dover Books on Mathematics) Janos Bolyai, Non-Euclidean Geometry, and the Nature of Space Non-Euclidean Geometry for Babies (Math for Babies) Non-Euclidean Geometry (Dover Books on Mathematics) Introduction to Non-Euclidean Geometry (Dover Books on Mathematics) Non-Euclidean Geometry (Mathematical Association of America Textbooks) Non-Euclidean Geometry in the Theory of Automorphic Functions (History of Mathematics) The elements of non-Euclidean geometry The Non-Euclidean Revolution (Modern BirkhÃ¤user Classics) Projective Geometry: Creative Polarities in Space and Time Basic Algebraic Geometry 1: Varieties in Projective Space Projective Synthetic Geometry (Mathematical Monographs) (Volume 2) Projective Geometry Foundations of Projective Geometry