Euclidean And Non Euclidean Geometry Solutions Manual

This book offers a unique opportunity to understand the essence of one of the great thinkers of western civilization. A guided reading of Euclid's Elements leads to a critical discussion and rigorous modern treatment of Euclid's geometry and its more recent descendants, with complete proofs. Topics include the introduction of coordinates, the theory of area, history of the parallel postulate, the various non-Euclidean geometries, and the regular and semi-regular polyhedra.

Examines various attempts to prove Euclid's parallel postulate -- by the Greeks, Arabs and Renaissance mathematicians. Ranging through the 17th, 18th, and 19th centuries, it considers forerunners and founders such as Saccheri, Lambert, Legendre, W. Bolyai, Gauss, Schweikart, Taurinus, J. Bolyai and Lobachewsky.

The distinctive approach of Henderson and Taimina's volume stimulates readers to develop a broader, deeper, understanding of mathematics through active experience--including discovery, discussion, writing fundamental ideas and learning about the history of those ideas. A series of interesting, challenging problems encourage readers to gather and discuss their reasonings and understanding. The volume provides an understanding of the possible shapes of the physical universe. The authors provide extensive information on historical strands of geometry, straightness on cylinders and cones and hyperbolic planes, triangles and congruencies, area and holonomy, parallel transport, SSS, ASS, SAA, and AAA, parallel postulates, isometries and patterns, dissection theory, square roots, pythagoras and similar triangles, projections of a sphere onto a plane, inversions in circles, projections (models) of hyperbolic planes, trigonometry and duality, 3-spheres and hyperbolic 3-spaces and polyhedra. For mathematics educators and other who need to understand the meaning of geometry.

"'Geometry by construction' challenges its readers to participate in the creation of mathematics. The questions span the spectrum from easy to newly published research and so are appropriate for a variety of students and teachers. From differentiation in a high school course through college classes and into summer research, any interested geometer will find compelling material"--Back cover.

This book is a text for junior, senior, or first-year graduate courses traditionally titled Foundations of Geometry and/or Non Euclidean Geometry. The first 29 chapters are for a semester or year course on the foundations of geometry. The remaining chap ters may then be used for either a regular course or independent study courses. Another possibility, which is also especially suited for in-service teachers of high school geometry, is to survey the the fundamentals of absolute geometry (Chapters 1 -20) very quickly and begin earnest study with the theory of parallels and isometries (Chapters 21 -30). The text is self-contained, except that the elementary calculus is assumed for some parts of the material on advanced hyperbolic geometry (Chapters 31 -34). There are over 650 exercises, 30 of which are 10-part true-or-false questions. A rigorous ruler-and-protractor axiomatic development of the Euclidean and hyperbolic planes, including the classification of the isometries of these planes, is balanced by the discussion about this development. Models, such as Taxicab Geometry, are used exten sively to illustrate theory. Historical aspects and alternatives to the selected axioms are prominent. The classical axiom systems of Euclid and Hilbert are discussed, as are axiom systems for three and four-dimensional absolute geometry and Pieri's system based on rigid motions. The text is divided into three parts. The Introduction (Chapters 1 -4) is to be read as quickly as possible and then used for ref erence if necessary.

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.

This fine and versatile introduction begins with the theorems common to Euclidean and non-Euclidean geometry, and then it addresses the specific differences that constitute elliptic and hyperbolic geometry. 1901 edition.

Euclidean and Non-Euclidean GeometriesDevelopment and HistoryMacmillan

This book develops a self-contained treatment of classical Euclidean geometry through both axiomatic and analytic methods. Concise and well organized, it prompts readers to prove a theorem yet provides them with a framework for doing so. Chapter topics cover neutral geometry, Euclidean plane geometry, geometric transformations, Euclidean 3-space, Euclidean n-space; perimeter, area and volume; spherical geometry; hyperbolic geometry; models for plane geometries; and the hyperbolic metric.

An account of the major work of Janos Bolyai, a nineteenth-century mathematician who set the stage for the field of non-Euclidean geometry. Janos Bolyai (1802-1860) was a mathematician who changed our fundamental ideas about space. As a teenager he started to explore a set of nettlesome geometrical problems, including Euclid's parallel postulate, and in 1832 he published a brilliant twenty-four-page paper that eventually shook the foundations of the 2000-year-old tradition of Euclidean geometry. Bolyai's "Appendix" (published as just that--an appendix to a much longer mathematical work by his father) set up a series of mathematical proposals whose implications would blossom into the new field of non-Euclidean geometry, providing essential intellectual background for ideas as varied as the theory of relativity and the work of Marcel Duchamp. In this short book, Jeremy Gray explains Bolyai's ideas and the historical context in which they emerged, were debated, and were eventually recognized as a central achievement in the Western intellectual tradition. Intended for nonspecialists, the book includes facsimiles of Bolyai's original paper and the 1898 English translation by G. B. Halstead, both reproduced from copies in the Burndy Library at MIT.

A reissue of Professor Coxeter's classic text on non-Euclidean geometry. It surveys real projective geometry, and elliptic geometry. After this the Euclidean and hyperbolic geometries are built up axiomatically as special cases. This is essential reading for anybody with an interest in geometry. The Elements of Non-Euclidean Geometry by Julian Lowell Coolidge Ph.D. - Harvard University Contents: CHAPTER I FOUNDATION FOR METRICAL GEOMETRY IN A LIMITED REGION Fundamental assumptions and definitions Sums and differences of distances Serial arrangement of points on a line Simple descriptive properties of plane and space CHAPTER II CONGRUENT TRANSFORMATIONS Axiom of continuity Division of distances Measure of distance Axiom of congruent transformations Definition of angles, their properties Comparison of triangles Side of a triangle not greater than sum of other two Comparison and measurement of angles Nature of the congruent group Definition of dihedral angles, their properties CHAPTER III THE THREE HYPOTHESES A variable angle is a continuous function of a variable distance Saccheri's theorem for isosceles birectangular quadrilaterals The existence of one rectangle implies the existence of an infinite number Three assumptions as to the sum of the angles of a right triangle Three assumptions as to the sum of the angles of any triangle, their categorical nature

Definition of the euclidean, hyperbolic, and elliptic hypotheses Geometry in the infinitesimal domain obeys the euclidean hypothesis CHAPTER IV THE INTRODUCTION OF TRIGONOMETRIC FORMULAE Limit of ratio of opposite sides of diminishing isosceles quadrilateral Continuity of the resulting function Its functional equation and solution Functional equation for the cosine of an angle Non-euclidean form for the pythagorean theorem Trigonometric formulae for right and oblique triangles CHAPTER V ANALYTIC FORMULAE Directed distances Group of translations of a line Positive and negative directed distances Coordinates of a point on a line Coordinates of a point in a plane Finite and infinitesimal distance formulae, the non-euclidean plane as a surface of constant Gaussian curvature Equation connecting direction cosines of a line Coordinates of a point in space Congruent transformations and orthogonal substitutions Fundamental formulae for distance and angle CHAPTER VI CONSISTENCY AND SIGNIFICANCE OF THE AXIOMS Examples of geometries satisfying the assumptions made Relative independence of the axioms CHAPTER VII THE GEOMETRIC AND ANALYTIC EXTENSION OF SPACE Possibility of extending a segment by a definite amount in the euclidean and hyperbolic cases Euclidean and hyperbolic space Contradiction arising under the elliptic hypothesis New assumptions identical with the old for limited region, but permitting the extension of every segment by a definite amount Last axiom, free mobility of the whole system One to one correspondence of point and coordinate set in euclidean and hyperbolic cases Ambiguity in the elliptic case giving rise to elliptic and spherical geometry Ideal elements, extension of all spaces to be real continua Imaginary elements geometrically defined, extension of all spaces to be perfect continua in the complex domain Cayleyan Absolute, new form for the definition of distance Extension of the distance concept to the complex domain Case where a straight line gives a maximum distance CHAPTER VIII THE GROUPS OF CONGRUENT TRANSFORMATIONS Congruent transformations of the straight line ,, ,, ,, hyperbolic plane ,, ,, ,, elliptic plane ,, ,, ,, euclidean plane ,, ,, ,, hyperbolic space ,, ,, ,, elliptic and spherical space Clifford parallels, or paratactic lines CHAPTER IX POINT, LINE, AND PLANE TREATED ANALYTICALLY CHAPTER X THE HIGHER LINE GEOMETRY CHAPTER XI THE CIRCLE AND THE SPHERE CHAPTER XII CONIC SECTIONS CHAPTER XIII QUADRIC SURFACES CHAPTER XIV AREAS AND VOLUMES Volume of a cone of revolution, a sphere, the whole of elliptic or of spherical space CHAPTER XV INTRODUCTION TO DIFFERENTIAL GEOMETRY CHAPTER XVI DIFFERENTIAL LINE-GEOMETRY CHAPTER XVII MULTIPLY CONNECTED SPACES CHAPTER XVIII

THE PROJECTIVE BASIS OF NON-EUCLIDEAN GEOMETRY CHAPTER XIX THE DIFFERENTIAL BASIS FOR EUCLIDEAN AND NON-EUCLIDEAN GEOMETRY

The Russian edition of this book appeared in 1976 on the hundred-and-fiftieth anniversary of the historic day of February 23, 1826, when LobaeevskiI delivered his famous lecture on his discovery of non-Euclidean geometry. The importance of the discovery of non-Euclidean geometry goes far beyond the limits of geometry itself. It is safe to say that it was a turning point in the history of all mathematics. The scientific revolution of the seventeenth century marked the transition from "mathematics of constant magnitudes" to "mathematics of variable magnitudes. " During the seventies of the last century there occurred another scientific revolution. By that time mathematicians had become familiar with the ideas of non-Euclidean geometry and the algebraic ideas of group and field (all of which appeared at about the same time), and the (later) ideas of set theory. This gave rise to many geometries in addition to the Euclidean geometry previously regarded as the only conceivable possibility, to the arithmetics and algebras of many groups and fields in addition to the arith metic and algebra of real and complex numbers, and, finally, to new mathe matical systems, i. e. , sets furnished with various structures having no classical analogues. Thus in the 1870's there began a new mathematical era usually called, until the middle of the twentieth century, the era of modern mathe matics.

The mathematical sciences are part of everyday life. Modern communication, transportation, science, engineering, technology, medicine, manufacturing, security, and finance all depend on the mathematical sciences. Fueling Innovation and Discovery describes recent advances in the mathematical sciences and advances enabled by mathematical sciences research. It is geared toward general readers who would like to know more about ongoing advances in the mathematical sciences and how these advances are changing our understanding of the world, creating new technologies, and transforming industries. Although the mathematical sciences are pervasive, they are often invoked without an explicit awareness of their presence. Prepared as part of the study on the Mathematical Sciences in 2025, a broad assessment of the current state of the mathematical sciences in the United States, Fueling Innovation and Discovery presents mathematical sciences advances in an engaging way. The report describes the contributions that mathematical sciences research has made to advance our understanding of the universe and the human genome. It also explores how the mathematical sciences are contributing to healthcare and national security, and the importance of mathematical knowledge and training to a range of industries, such as information technology and entertainment. Fueling Innovation and Discovery will be of use to policy makers, researchers, business leaders, students, and others interested in learning more about the deep connections between the mathematical sciences and every other aspect of the modern world. To function well in a technologically advanced society, every educated person should be familiar with multiple aspects of the mathematical sciences.

College-level text for elementary courses covers the fifth postulate, hyperbolic plane geometry and trigonometry, and elliptic plane geometry and trigonometry. Appendixes offer background on Euclidean geometry. Numerous exercises. 1945 edition.

This accessible approach features stereometric and planimetric proofs, and elementary proofs employing only the simplest properties of the plane. A short history of geometry precedes the systematic exposition. 1961 edition.

Richard Trudeau confronts the fundamental question of truth and its representation through mathematical models in The Non-Euclidean Revolution. First, the author analyzes geometry in its historical and philosophical setting; second, he examines a revolution every bit as significant as the Copernican revolution in astronomy and the Darwinian revolution in biology; third, on the most speculative level, he questions the possibility of absolute knowledge of the world. Trudeau writes in a lively, entertaining, and highly accessible style. His book provides one of the most stimulating and personal presentations of a struggle with the nature of truth in mathematics and the physical world.

Develops a simple non-Euclidean geometry and explores some of its practical applications through graphs, research problems, and exercises. Includes selected answers.

Fascinating, accessible introduction to unusual mathematical system in which distance is not measured by straight lines. Illustrated topics include applications to urban geography and comparisons to Euclidean geometry. Selected answers to problems.

Martin Gardner's Mathematical Games columns in Scientific American inspired and entertained several generations of mathematicians and scientists. Gardner in his crystal-clear prose illuminated corners of mathematics, especially recreational mathematics, that most people had no idea existed. His playful spirit and inquisitive nature invite the reader into an exploration of beautiful mathematical ideas along with him. These columns were both a revelation and a gift when he wrote them; no one-before Gardner-had written about mathematics like this. They continue to be a marvel. This is the original 1997 edition and contains columns published from 1980-1986.

The word barycentric is derived from the Greek word barys (heavy), and refers to center of gravity. Barycentric calculus is a method of treating geometry by considering a point as the center of gravity of certain other points to which weights are ascribed. Hence, in particular, barycentric calculus provides excellent insight into triangle centers. This unique book on barycentric calculus in Euclidean and hyperbolic geometry provides an introduction to the fascinating and beautiful subject of novel triangle centers in hyperbolic geometry along with analogies they share with familiar triangle centers in Euclidean geometry. As such, the book uncovers magnificent unifying notions that Euclidean and hyperbolic triangle centers share. In his earlier books the author adopted Cartesian coordinates, trigonometry and vector algebra for use in hyperbolic geometry that is fully analogous to the common use of Cartesian coordinates, trigonometry and vector algebra in Euclidean geometry. As a result, powerful tools that are commonly available in Euclidean geometry became available in hyperbolic geometry as well, enabling one to explore hyperbolic geometry in novel ways. In particular, this new book establishes hyperbolic barycentric coordinates that are used to determine various hyperbolic triangle centers just as Euclidean barycentric coordinates are commonly used to determine various Euclidean triangle centers. The hunt for Euclidean triangle centers is an old tradition in Euclidean geometry, resulting in a repertoire of more than three thousand triangle centers that are known by their barycentric coordinate representations. The aim of this book is to initiate a fully analogous hunt for hyperbolic triangle centers that will broaden the repertoire of hyperbolic triangle centers provided here.

The name non-Euclidean was used by Gauss to describe a system of geometry which differs from Euclid's in its properties of parallelism. Such a system was developed independently by Bolyai in Hungary and Lobatschewsky in Russia, about 120 years ago. Another system, differing more radically from Euclid's, was suggested later by Riemann in Germany and Cayley in England. The subject was unified in 1871 by Klein, who gave the names of parabolic, hyperbolic, and elliptic to the respective systems of Euclid-Bolyai-Lobatschewsky, and Riemann-Cayley. Since then, a vast literature has accumulated. The Fifth edition adds a new chapter, which includes a description of the two families of 'mid-lines' between two given lines, an elementary derivation of the basic formulae of spherical trigonometry and hyperbolic trigonometry, a computation of the Gaussian curvature of the elliptic and hyperbolic planes, and a proof of Schlafli's remarkable formula for the differential of the volume of a tetrahedron.

This book is unique in that it looks at geometry from 4 different viewpoints - Euclid-style axioms, linear algebra, projective geometry, and groups and their invariants Approach makes the subject accessible to readers of all mathematical tastes, from the visual to the algebraic Abundantly supplemented with figures and exercises

An Introduction to Non-Euclidean Geometry covers some introductory topics related to non-Euclidian geometry, including hyperbolic and elliptic geometries. This book is organized into three parts encompassing eight chapters. The first part provides mathematical proofs of Euclid’s fifth postulate concerning the extent of a straight line and the theory of parallels. The second part describes some problems in hyperbolic geometry, such as cases of parallels with and without a common perpendicular. This part also deals with horocycles and triangle relations. The third part examines single and double elliptic geometries. This book will be of great value to mathematics, liberal arts, and philosophy major students.

The discovery of hyperbolic geometry, and the subsequent proof that this geometry is just as logical as Euclid's, had a profound in fluence on man's understanding of mathematics and the relation of mathematical geometry to the physical world. It is now possible, due in large part to axioms devised by George Birkhoff, to give an accurate, elementary development of hyperbolic plane geometry. Also, using the Poincare model and inversive geometry, the equiconsistency of hyperbolic plane geometry and euclidean plane geometry can be proved without the use of any advanced mathematics. These two facts provided both the motivation and the two central themes of the present work. Basic hyperbolic plane geometry, and the proof of its equal footing with euclidean plane geometry, is presented here in terms acces sible to anyone with a good background in high school mathematics. The development, however, is especially directed to college students who may become secondary teachers. For that reason, the treatment is de signed to emphasize those aspects of hyperbolic plane geometry which contribute to the skills, knowledge, and insights needed to teach eucli dean geometry with some mastery.

"From nothing I have created a new different world," wrote János Bolyai to his father, Wolgang Bolyai, on November 3, 1823, to let him know his discovery of non-Euclidean geometry, as we call it today. The results of Bolyai and the co-discoverer, the Russian Lobachevskii, changed the course of mathematics, opened the way for modern physical theories of the twentieth century, and had an impact on the history of human culture. The papers in this volume, which commemorates the 200th anniversary of the birth of János Bolyai, were written by leading scientists of non-Euclidean geometry, its history, and its applications. Some of the papers present new discoveries about the life and works of János Bolyai and the history of non-Euclidean geometry, others deal with geometrical axiomatics; polyhedra; fractals; hyperbolic, Riemannian and discrete geometry; tilings; visualization;

and applications in physics.
Noneuclidean Geometry focuses on the principles, methodologies, approaches, and importance of noneuclidean geometry in the study of mathematics. The book first offers information on proofs and definitions and Hilbert's system of axioms, including axioms of connection, order, congruence, and continuity and the axiom of parallels. The publication also ponders on lemmas, as well as pencil of circles, inversion, and cross ratio. The text examines the elementary theorems of hyperbolic geometry, particularly noting the value of hyperbolic geometry in noneuclidian geometry, use of the Poincaré model, and numerical principles in proving hyperparallels. The publication also tackles the issue of construction in the Poincaré model, verifying the relations of sides and angles of a plane through trigonometry, and the principles involved in elliptic geometry. The publication is a valuable source of data for mathematicians interested in the principles and applications of noneuclidean geometry.
Neither general relativity (which revealed that gravity is merely manifestation of the non-Euclidean geometry of spacetime) nor modern cosmology would have been possible without the almost simultaneous and independent discovery of non-Euclidean geometry in the 19th century by three great mathematicians - Nikolai Ivanovich Lobachevsky, János Bolyai and Carl Friedrich Gauss (whose ideas were later further developed by Georg Friedrich Bernhard Riemann).This volume contains three works by Lobachevsky on the foundations of geometry and non-Euclidean geometry: "Geometry",

"Geometrical investigations on the theory of parallel lines" and "Pangeometry". It will be of interest not only to experts and students in mathematics, physics, history and philosophy of science, but also to anyone who is not intimidated by the magnitude of one of the greatest discoveries of our civilization and would attempt to follow (and learn from) Lobachevsky's line of thought, helpfully illustrated by over 130 figures, that led him to the discovery.

Based on the latest historical research, Worlds Out of Nothing is the first book to provide a course on the history of geometry in the 19th century. Topics covered in the first part of the book are projective geometry, especially the concept of duality, and non-Euclidean geometry. The book then moves on to the study of the singular points of algebraic curves (Plücker's equations) and their role in resolving a paradox in the theory of duality; to Riemann's work on differential geometry; and to Beltrami's role in successfully establishing non-Euclidean geometry as a rigorous mathematical subject. The final part of the book considers how projective geometry rose to prominence, and looks at Poincaré's ideas about non-Euclidean geometry and their physical and philosophical significance. Three chapters are devoted to writing and assessing work in the history of mathematics, with examples of sample questions in the subject, advice on how to write essays, and comments on what instructors should be looking for.

Need some serious help solving equations? Totally frustrated by polynomials, parabolas and that dreaded little x? THE MATH DUDE IS HERE TO HELP! Jason

Marshall, popular podcast host known to his fans as The Math Dude, understands that algebra can cause agony. But he's determined to show you that you can solve those confusing, scream-inducing math problems--and it won't be as hard as you think! Jason kicks things off with a basic-training boot camp to help you review the essential math you'll need to truly "get" algebra. The basics covered, you'll be ready to tackle the concepts that make up the core of algebra. You'll get step-by-step instructions and tutorials to help you finally understand the problems that stump you the most, including loads of tips on: - Working with fractions, decimals, exponents, radicals, functions, polynomials and more - Solving all kinds of equations, from basic linear problems to the quadratic formula and beyond - Using graphs and understanding why they make solving complex algebra problems easier Learning algebra doesn't have to be a form of torture, and with The Math Dude's Quick and Dirty Guide to Algebra, it won't be. Packed with tons of fun features including "secret agent math-libs," and "math brain games," and full of quick and dirty tips that get right to the point, this book will have even the biggest math-o-phobes basking in a-ha moments and truly understanding algebra in a way that will stick for years (and tests) to come. Whether you're a student who needs help passing algebra class, a parent who wants to help their child meet that goal, or somebody who wants to brush up on their algebra skills for a new job or maybe even just for fun, look no further. Sit back, relax, and let this guide take you on a trip through the world of algebra. This classic text provides overview of both classic and hyperbolic geometries, placing the work of key mathematicians/ philosophers in historical context. Coverage includes geometric transformations, models of the hyperbolic planes, and pseudospheres.

Euclid was a mathematician from the Greek city of Alexandria who lived during the 4th and 3rd century B.C. and is often referred to as the "father of geometry." Within his foundational treatise "Elements," Euclid presents the results of earlier mathematicians and includes many of his own theories in a systematic, concise book that utilized a brief set of axioms and meticulous proofs to solidify his deductions. In addition to its easily referenced geometry, "Elements" also includes number theory and other mathematical considerations. For centuries, this work was a primary textbook of mathematics, containing the only framework for geometry known by mathematicians until the development of "non-Euclidian" geometry in the late 19th century. The extent to which Euclid's "Elements" is of his own original authorship or borrowed from previous scholars is unknown, however despite this fact it was his collation of these basic mathematical principles for which most of the world would come to the study of geometry. Today, Euclid's "Elements" is acknowledged as one of the most influential mathematical texts in history. This volume includes all thirteen books of Euclid's "Elements," is printed on premium acid-free paper, and follows the translation of Thomas Heath.

Foundation of Euclidean and Non-Euclidean Geometries according to F. Klein aims to remedy the deficiency in geometry so that the ideas of F. Klein obtain the place

they merit in the literature of mathematics. This book discusses the axioms of betweenness, lattice of linear subspaces, generalization of the notion of space, and coplanar Desargues configurations. The central collineations of the plane, fundamental theorem of projective geometry, and lines perpendicular to a proper plane are also elaborated. This text likewise covers the axioms of motion, basic projective configurations, properties of triangles, and theorem of duality in projective space. Other topics include the point-coordinates in an affine space and consistency of the three geometries. This publication is beneficial to mathematicians and students learning geometry.
There are many technical and popular accounts, both in Russian and in other languages, of the non-Euclidean geometry of Lobachevsky and Bolyai, a few of which are listed in the Bibliography. This geometry, also called hyperbolic geometry, is part of the required subject matter of many mathematics departments in universities and teachers' colleges-a reflec tion of the view that familiarity with the elements of hyperbolic geometry is a useful part of the background of future high school teachers. Much attention is paid to hyperbolic geometry by school mathematics clubs. Some mathematicians and educators concerned with reform of the high school curriculum believe that the required part of the curriculum should include elements of hyperbolic geometry, and that the optional part of the curriculum should include a topic related to hyperbolic geometry. I The broad interest in hyperbolic geometry is not surprising. This interest has little to do with mathematical and scientific applications of

hyperbolic geometry, since the applications (for instance, in the theory of automorphic functions) are rather specialized, and are likely to be encountered by very few of the many students who conscientiously study (and then present to examiners) the definition of parallels in hyperbolic geometry and the special features of configurations of lines in the hyperbolic plane. The principal reason for the interest in hyperbolic geometry is the important fact of "non-uniqueness" of geometry; of the existence of many geometric systems.

This book gives a rigorous treatment of the fundamentals of plane geometry: Euclidean, spherical, elliptical and hyperbolic.

Examines various attempts to prove Euclid's parallel postulate — by the Greeks, Arabs, and Renaissance mathematicians. It considers forerunners and founders such as Saccheri, Lambert, Legendre, W. Bolyai, Gauss, others. Includes 181 diagrams.