Introduction To Topological Manifolds

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Introduction to Geometry and Topology Werner Ballmann 2018-07-18 This book provides an introduction to topology, differential topology, and differential geometry. It is based on manuscripts refined through use in a variety of lecture courses. The first chapter covers elementary results and concepts from point-set topology. An exception is the Jordan Curve Theorem, which is proved for polygonal paths and is intended to give students a first glimpse into the nature of deeper topological problems. The second chapter of the book introduces manifolds and Lie groups, and examines a wide assortment of examples. Further discussion explores tangent bundles, vector bundles, differentials, vector fields, and Lie brackets of vector fields. This discussion is deepened and expanded in the third chapter, which introduces the de Rham cohomology and the oriented integral and gives proofs of the Brouwer Fixed-Point Theorem, the Jordan-Brouwer Separation Theorem, and Stokes's integral formula. The fourth and final chapter is devoted to the fundamentals of differential geometry and traces the development of ideas from curves to submanifolds of Euclidean spaces. Along the way, the book discusses connections and curvature--the central concepts of differential geometry. The discussion culminates with the Gauß equations and the version of Gauß's theorema egregium for submanifolds of arbitrary dimension and codimension. This book is primarily aimed at advanced undergraduates in mathematics and physics and is intended as the template for a one- or two-semester bachelor's course.

Differential Topology David B. Gauld 2013-07-24 This text covers topological spaces and properties, some advanced calculus, differentiable manifolds, orientability, submanifolds and an embedding theorem, tangent spaces, vector fields and integral curves, Whitney's embedding theorem, more. Includes 88 helpful illustrations. 1982 edition.

Riemannian Manifolds John M. Lee 2006-04-06 This text focuses on developing an intimate acquaintance with the geometric meaning of curvature and thereby introduces and demonstrates all the main technical tools needed for a more advanced course on Riemannian manifolds. It covers proving the four most fundamental theorems relating curvature and topology: the Gauss-Bonnet Theorem, the Cartan-Hadamard Theorem, Bonnet’s Theorem, and a special case of the Cartan-Ambrose-Hicks Theorem.

An Introduction to Differential Manifolds Jacques Lafontaine 2015-07-29 This book is an introduction to differential manifolds. It gives solid preliminaries for more advanced topics: Riemannian manifolds, differential topology, Lie theory. It presupposes little background: the reader is only expected to master basic differential calculus, and a little point-set topology. The book covers the main topics of differential geometry: manifolds, tangent space, vector fields, differential forms, Lie groups, and a few more sophisticated topics such as de Rham cohomology, degree theory and the Gauss-Bonnet theorem for surfaces. Its ambition is to give solid foundations. In particular, the introduction of “abstract” notions such as manifolds or differential forms is motivated via questions and examples from mathematics or theoretical physics. More than 150 exercises, some of them easy and classical, some others more sophisticated, will help the beginner as well as the more expert reader. Solutions are provided for most of them. The book should be of interest to various readers: undergraduate and graduate students for a first contact to differential manifolds, mathematicians from other fields and physicists who wish to acquire some feeling about this beautiful theory. The original French text Introduction aux variétés différentielles has been a best-seller in its category in France for many years. Jacques Lafontaine was successively assistant Professor at Paris Diderot University and Professor at the University of Montpellier, where he is presently emeritus. His main research interests are Riemannian and pseudo-Riemannian geometry, including some aspects of mathematical relativity. Besides his personal research articles, he was involved in several textbooks and research monographs.

Introduction to Topological Manifolds John Lee 2010-12-28 This book is an introduction to manifolds at the beginning graduate level, and accessible to any student who has completed a solid undergraduate degree in mathematics. It contains the essential topological ideas that are needed for the further study of manifolds, particularly in the context of differential geometry, algebraic topology, and related fields. Although this second edition has the same basic structure as the first edition, it has been extensively revised and clarified; not a single page has been left untouched. The major changes include a new introduction to CW complexes (replacing most of the material on simplicial complexes in Chapter 5); expanded treatments of manifolds with boundary, local compactness, group actions, and proper maps; and a new section on paracompactness.

An Introduction to Manifolds Loring W. Tu 2010-10-05 Manifolds, the higher-dimensional analogs of smooth curves and surfaces, are fundamental objects in modern mathematics. Combining aspects of algebra, topology, and analysis, manifolds have also been applied to classical mechanics, general relativity, and quantum field theory. In this streamlined introduction to the subject, the theory of manifolds is presented with the aim of helping the reader achieve a rapid mastery of the essential topics. By the end of the book the reader should be able to compute, at least for simple spaces, one of the most basic topological invariants of a manifold, its de Rham cohomology. Along the way, the reader acquires the knowledge and skills necessary for further study of geometry and topology. The requisite point-set topology is included in an appendix of twenty pages; other appendices review facts from real analysis and linear algebra. Hints and solutions are provided to many of the exercises and problems. This work may be used as the text for a one-semester graduate or advanced undergraduate course, as well as by students engaged in self-study. Requiring only minimal undergraduate prerequisites, 'Introduction to Manifolds' is also an excellent foundation for Springer's GTM 82, 'Differential Forms in Algebraic Topology'.

Topology from the Differentiable Viewpoint John Milnor 1997-12-14 This elegant book by distinguished mathematician John Milnor, provides a clear and succinct introduction to one of the most important subjects in modern mathematics. Beginning with basic concepts such as diffeomorphisms and smooth manifolds, he goes on to examine tangent spaces, oriented manifolds, and vector fields. Key concepts such as homotopy, the index number of a map, and the Pontryagin construction are discussed. The author presents proofs of Sard's theorem and the Hopf theorem.

An Introduction to Geometric Topology Bruno Martelli 2016-10-26 This book provides a self-contained introduction to the topology and geometry of surfaces and three-manifolds. The main goal is to describe Thurston's geometrisation of three-manifolds, proved by Perelman in 2002. The book is divided into three parts: the first is devoted to hyperbolic geometry, the second to surfaces, and the third to three-manifolds. It contains complete proofs of Mostow's rigidity, the thick-thin decomposition, Thurston's classification of the diffeomorphisms of surfaces (via Bonahon's geodesic currents), the prime and JSJ decomposition, the topological and geometric classification of Seifert manifolds, and Thurston's hyperbolic Dehn filling Theorem.

Introduction to Riemannian Manifolds John M. Lee 2019-01-02 This text focuses on developing an intimate acquaintance with the geometric meaning of curvature and thereby introduces and demonstrates all the main technical tools needed for a more advanced course on Riemannian manifolds. It covers proving the four most fundamental theorems relating curvature and topology: the Gauss-Bonnet Theorem, the Cartan-Hadamard Theorem, Bonnet’s Theorem, and a special case of the Cartan-Ambrose-Hicks Theorem.

Topology Through Inquiry Michael Starbird 2020-09-10 Topology Through Inquiry is a comprehensive introduction to point-set, algebraic, and geometric topology, designed to support inquiry-based learning (IBL) courses for upper-division undergraduate or beginning graduate students. The book presents an enormous amount of topology, allowing an instructor to choose which topics to treat. The point-set material contains many interesting topics well beyond the basic core, including continua and metrizability. Geometric and algebraic topology topics include the classification of 2-manifolds, the fundamental group, covering spaces, and homology (simplicial and singular). A unique feature of the introduction to homology is to convey a clear geometric motivation by starting with mod 2 coefficients. The authors are acknowledged masters of IBL-style teaching. This book gives students joy-filled, manageable challenges that incrementally develop their knowledge and skills. The exposition includes insightful framing of fruitful points of view as well as advice on effective thinking and learning. The text presumes only a modest level of mathematical maturity to begin, but students who work their way through this text will grow from mathematics students into mathematicians. Michael Starbird is a University of Texas Distinguished Teaching Professor of Mathematics. Among his works are two other co-authored books in the Mathematical Association of America's (MAA) Textbook series. Francis Su is the Benediktsson-Karwa Professor of Mathematics at Harvey Mudd College and a past president of the MAA. Both authors are award-winning teachers, including each having received the MAA's Haimo Award for distinguished teaching. Starbird and Su are, jointly and individually, on lifelong missions to make learning—of mathematics and beyond—joyful, effective, and available to everyone. This book invites topology students and teachers to join in the adventure.

An Illustrated Introduction to Topology and Homotopy Solutions Manual for Part 1 Topology Sasho Kalajdzievski 2020-08-13 This solution manual accompanies the first part of the book An Illustrated Introduction toTopology and Homotopy by the same author. Except for a small number of exercises inthe first few sections, we provide solutions of the (228) odd-numbered problemsappearing in first part of the book (Topology). The primary targets of this manual are thestudents of topology. This set is not disjoint from the set of instructors of topologycourses, who may also find this manual useful as a source of examples, exam problems,etc.

Axiomatic Geometry John M. Lee 2013-04-10 The story of geometry is the story of mathematics itself: Euclidean geometry was the first branch of mathematics to be systematically studied and placed on a firm logical foundation, and it is the prototype for the axiomatic method that lies at the foundation of modern mathematics. It has been taught to students for more than two millennia as a mode of logical thought. This book tells the story of how the axiomatic method has progressed from Euclid's time to ours, as a way of understanding what mathematics is, how we read and evaluate mathematical arguments, and why mathematics has achieved the level of certainty it has. It is designed primarily for advanced undergraduates who plan to teach secondary school geometry, but it should also provide something of interest to anyone who wishes to understand geometry and the axiomatic method better. It introduces a modern, rigorous, axiomatic treatment of Euclidean and (to a lesser extent) non-Euclidean geometries, offering students ample opportunities to practice reading and writing proofs while at the same time developing most of the concrete geometric relationships that secondary teachers will need to know in the classroom. -- P. [4] of cover.

Introduction to Topological Manifolds John M. Lee 2000 In this book the author motivates what is to follow in the book by explaining the roles manifolds play in topology, geometry, complex analysis, algebra & classical mechanics with a final pass at general relativity. The book begins with the basics of general topology & gently moves to manifolds, the fundamental group, & covering spaces.

Introduction to Differential Topology T. Bröcker 1982-09-16 This book is intended as an elementary introduction to differential manifolds. The authors concentrate on the intuitive geometric aspects and explain not only the basic properties but also teach how to do the basic geometrical constructions. An integral part of the work are the many diagrams which illustrate the proofs. The text is liberally supplied with exercises and will be welcomed by students with some basic knowledge of analysis and topology.

Manifolds and Differential Geometry Jeffrey Marc Lee 2009 Differential geometry began as the study of curves and surfaces using the methods of calculus. In time, the notions of curve and surface were generalized along with associated notions such as length, volume, and curvature. At the same time the topic has become closely allied with developments in topology. The basic object is a smooth manifold, to which some extra structure has been attached, such as a Riemannian metric, a symplectic form, a distinguished group of symmetries, or a connection on the tangent bundle. This book is a graduate-level introduction to the tools and structures of modern differential geometry. Included are the topics usually found in a course on differentiable manifolds, such as vector bundles, tensors, differential forms, de Rham cohomology, the Frobenius theorem and basic Lie group theory. The book also contains material on the general theory of connections on vector bundles and an in-depth chapter on semi-Riemannian geometry that covers basic material about Riemannian manifolds and Lorentz manifolds. An unusual feature of the book is the inclusion of an early chapter on the differential geometry of hyper-surfaces in Euclidean space. There is also a section that derives the exterior calculus version of Maxwell's equations. The first chapters of the book are suitable for a one-semester course on manifolds. There is more than enough material for a year-long course on manifolds and geometry.

Geometry and Topology of Manifolds: Surfaces and Beyond Vicente Muñoz 2020-10-21 This book represents a novel approach to differential topology. Its main focus is to give a comprehensive introduction to the classification of manifolds, with special attention paid to the case of surfaces, for which the book provides a complete classification from many points of view: topological, smooth, constant curvature, complex, and conformal. Each chapter briefly revisits basic results usually known to graduate students from an alternative perspective, focusing on surfaces. We provide full proofs of some remarkable results that sometimes are missed in basic courses (e.g., the construction of triangulations on surfaces, the classification of surfaces, the Gauss-Bonnet theorem, the degree-genus formula for complex plane curves, the existence of constant curvature metrics on conformal surfaces), and we give hints to questions about higher dimensional manifolds. Many examples and remarks are scattered through the book. Each chapter ends with an exhaustive collection of problems and a list of topics for further study. The book is primarily addressed to graduate students who did take standard introductory courses on algebraic topology, differential and Riemannian geometry, or algebraic geometry, but have not seen their deep interconnections, which permeate a modern approach to geometry and topology of manifolds.

Topology and Geometry Glen E. Bredon 2013-03-09 This book offers an introductory course in algebraic topology. Starting with general topology, it discusses differentiable manifolds, cohomology, products and duality, the fundamental group, homology theory, and homotopy theory. From the reviews: "An interesting and original graduate text in topology and geometry...a good lecturer can use this text to create a fine course....A beginning graduate student can use this text to learn a great deal of mathematics."—- MATHEMATICAL REVIEWS

Elements of Homology Theory Viktor Vasil︡evich Prasolov 2007 The book is a continuation of the previous book by the author (Elements of Combinatorial and Differential Topology, Graduate Studies in

Mathematics, Volume 74, American Mathematical Society, 2006). It starts with the definition of simplicial homology and cohomology, with many examples and applications. Then the Kolmogorov-Alexander multiplication in cohomology is introduced. A significant part of the book is devoted to applications of simplicial homology and cohomology to obstruction theory, in particular, to characteristic classes of vector bundles. The later chapters are concerned with singular homology and cohomology, and Cech and de Rham cohomology. The book ends with various applications of homology to the topology of manifolds, some of which might be of interest to experts in the area. The book contains many problems; almost all of them are provided with hints or complete solutions.

Geometry and Topology Martin A. Mccrory 2020-12-18 This book discusses topics ranging from traditional areas of topology, such as knot theory and the topology of manifolds, to areas such as differential and algebraic geometry. It also discusses other topics such as three-manifolds, group actions, and algebraic varieties.

Differential Geometry Loring W. Tu 2017-06-01 This text presents a graduate-level introduction to differential geometry for mathematics and physics students. The exposition follows the historical development of the concepts of connection and curvature with the goal of explaining the Chern–Weil theory of characteristic classes on a principal bundle. Along the way we encounter some of the high points in the history of differential geometry, for example, Gauss' Theorema Egregium and the Gauss–Bonnet theorem. Exercises throughout the book test the reader’s understanding of the material and sometimes illustrate extensions of the theory. Initially, the prerequisites for the reader include a passing familiarity with manifolds. After the first chapter, it becomes necessary to understand and manipulate differential forms. A knowledge of de Rham cohomology is required for the last third of the text. Prerequisite material is contained in author's text An Introduction to Manifolds, and can be learned in one semester. For the benefit of the reader and to establish common notations, Appendix A recalls the basics of manifold theory. Additionally, in an attempt to make the exposition more self-contained, sections on algebraic constructions such as the tensor product and the exterior power are included. Differential geometry, as its name implies, is the study of geometry using differential calculus. It dates back to Newton and Leibniz in the seventeenth century, but it was not until the nineteenth century, with the work of Gauss on surfaces and Riemann on the curvature tensor, that differential geometry flourished and its modern foundation was laid. Over the past one hundred years, differential geometry has proven indispensable to an understanding of the physical world, in Einstein's general theory of relativity, in the theory of gravitation, in gauge theory, and now in string theory. Differential geometry is also useful in topology, several complex variables, algebraic geometry, complex manifolds, and dynamical systems, among other fields. The field has even found applications to group theory as in Gromov's work and to probability theory as in Diaconis's work. It is not too far-fetched to argue that differential geometry should be in every mathematician's arsenal.

Conformal Field Theory and Topology Toshitake Kohno 2002 The aim of this book is to provide the reader with an introduction to conformal field theory and its applications to topology. The author starts with a description of geometric aspects of conformal field theory based on loop groups. By means of the holonomy of conformal field theory he defines topological invariants for knots and 3-manifolds. He also gives a brief treatment of Chern-Simons perturbation theory.

Calculus on Manifolds Michael Spivak 1965 This book uses elementary versions of modern methods found in sophisticated mathematics to discuss portions of "advanced calculus" in which the subtlety of the concepts and methods makes rigor difficult to attain at an elementary level.

Introduction to Topological Manifolds John M. Lee 2011-03-30

Foundational Essays on Topological Manifolds, Smoothings, and Triangulations Robion C. Kirby 1977-05-21 Since Poincaré's time, topologists have been most concerned with three species of manifold. The most primitive of these--the TOP manifolds--remained rather mysterious until 1968, when Kirby discovered his now famous torus unfurling device. A period of rapid progress with TOP manifolds ensued, including, in 1969, Siebenmann's refutation of the Hauptvermutung and the Triangulation Conjecture. Here is the first connected account of Kirby's and Siebenmann's basic research in this area. The five sections of this book are introduced by three articles by the authors that initially appeared between 1968 and 1970. Appendices provide a full discussion of the classification of homotopy tori, including Casson's unpublished work and a consideration of periodicity in topological surgery.

The Topology of Stiefel Manifolds I. M. James 1976 Stiefel manifolds are an interesting family of spaces much studied by algebraic topologists. These notes, which originated in a course given at Harvard University, describe the state of knowledge of the subject, as well as the outstanding problems. The emphasis throughout is on applications (within the subject) rather than on theory. However, such theory as is required is summarized and references to the literature are given, thus making the book accessible to non-specialists and particularly graduate students. Many examples are given and further problems suggested.

Introduction to 3-Manifolds Jennifer Schultens 2014-05-21 This book grew out of a graduate course on 3-manifolds and is intended for a mathematically experienced audience that is new to low-dimensional topology. The exposition begins with the definition of a manifold, explores possible additional structures on manifolds, discusses the classification of surfaces, introduces key foundational results for 3-manifolds, and provides an overview of knot theory. It then continues with more specialized topics by briefly considering triangulations of 3-manifolds, normal surface theory, and Heegaard splittings. The book finishes with a discussion of topics relevant to viewing 3-manifolds via the curve complex. With about 250 figures and more than 200 exercises, this book can serve as an excellent overview and starting point for the study of 3-manifolds.

Differential Topology Morris W. Hirsch 2012-12-06 "A very valuable book. In little over 200 pages, it presents a well-organized and surprisingly comprehensive treatment of most of the basic material in differential topology, as far as is accessible without the methods of algebraic topology....There is an abundance of exercises, which supply many beautiful examples and much interesting additional information, and help the reader to become thoroughly familiar with the material of the main text." —MATHEMATICAL REVIEWS

Introduction to Topological Manifolds John M. Lee 2006-04-06 Manifolds play an important role in topology, geometry, complex analysis, algebra, and classical mechanics. Learning manifolds differs from most other introductory mathematics in that the subject matter is often completely unfamiliar. This introduction guides readers by explaining the roles manifolds play in diverse branches of mathematics and physics. The book begins with the basics of general topology and gently moves to manifolds, the fundamental group, and covering spaces.

A Geometric Introduction to Topology Charles Terence Clegg Wall 1993 First course in algebraic topology for advanced undergraduates. Homotopy theory, the duality theorem, relation of topological ideas to other branches of pure mathematics. Exercises and problems. 1972 edition.

Algebraic Topology Edwin H. Spanier 2012-12-06 This book surveys the fundamental ideas of algebraic topology. The first part covers the fundamental group, its definition and application in the study of covering spaces. The second part turns to homology theory including cohomology, cup products, cohomology operations and topological manifolds. The final part is devoted to Homotropy theory, including basic facts about homotropy groups and applications to obstruction theory.

Lectures on the Topology of 3-Manifolds Nikolai Saveliev 1999-01-01

Introduction to Topology V. A. Vasil□ev 2001 This English translation of a Russian book presents the basic notions of differential and algebraic topology, which are indispensable for specialists and useful for research mathematicians and theoretical physicists. In particular, ideas and results are introduced related to manifolds, cell spaces, coverings and fibrations, homotopy groups, intersection index, etc. The author notes, ``The lecture note origins of the book left a significant imprint on its style. It contains very few detailed proofs: I tried to give as many illustrations as possible and to show what really occurs in topology, not always explaining why it occurs." He concludes, ``As a rule, only those proofs (or sketches of proofs) that are interesting per se and have important generalizations are presented."

Introduction to Topological Manifolds John M. Lee 2000 Manifolds play an important role in topology, geometry, complex analysis, algebra, and classical mechanics. Learning manifolds differs from most other introductory mathematics in that the subject matter is often completely unfamiliar. This introduction guides readers by explaining the roles manifolds play in diverse branches of mathematics and physics. The book begins with the basics of general topology and gently moves to manifolds, the fundamental group, and covering spaces.

Introduction to Smooth Manifolds John M. Lee 2013-03-09 Author has written several excellent Springer books.; This book is a sequel to Introduction to Topological Manifolds; Careful and illuminating explanations, excellent diagrams and exemplary motivation; Includes short preliminary sections before each section explaining what is ahead and why

Lectures on Differential Topology Riccardo Benedetti 2021-10-27 This book gives a comprehensive introduction to the theory of smooth manifolds, maps, and fundamental associated structures with an emphasis on “bare hands” approaches, combining differential-topological cut-and-paste procedures and applications of transversality. In particular, the smooth cobordism cup-product is defined from scratch and used as the main tool in a variety of settings. After establishing the fundamentals, the book proceeds to a broad range of more advanced topics in differential topology, including degree theory, the Poincaré-Hopf index theorem, bordism-characteristic numbers, and the Pontryagin-Thom construction. Cobordism intersection forms are used to classify compact surfaces; their quadratic enhancements are developed and applied to studying the homotopy groups of spheres, the bordism group of immersed surfaces in a 3-manifold, and congruences mod 16 for the signature of intersection forms of 4-manifolds. Other topics include the high-dimensional h h-cobordism theorem stressing the role of the “Whitney trick”, a determination of the singleton bordism modules in low dimensions, and proofs of parallelizability of orientable 3-manifolds and the Lickorish-Wallace theorem. Nash manifolds and Nash's questions on the existence of real algebraic models are also discussed. This book will be useful as a textbook for beginning masters and doctoral students interested in differential topology, who have finished a standard undergraduate mathematics curriculum. It emphasizes an active learning approach, and exercises are included within the text as part of the flow of ideas. Experienced readers may use this book as a source of alternative, constructive approaches to results commonly presented in more advanced contexts with specialized techniques.

Introduction to Topology Solomon Lefschetz 2015-12-08 In this book, which may be used as a self-contained text for a beginning course, Professor Lefschetz aims to give the reader a concrete working knowledge of the central concepts of modern combinatorial topology: complexes, homology groups, mappings in spheres, homotopy, transformations and their fixed points, manifolds and duality theorems. Each chapter ends with a group of problems. Originally published in 1949. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

Introduction to Geometry of Manifolds with Symmetry V.V. Trofimov 2013-04-17 One ofthe most important features of the development of physical and mathematical sciences in the beginning of the 20th century was the demolition of prevailing views of the three-dimensional Euclidean space as the only possible mathematical description of real physical space. Apriorization of geometrical notions and identification of physical 3 space with its mathematical modelIR were characteristic for these views. The discovery of non-Euclidean geometries led mathematicians to the understanding that Euclidean geometry is nothing more than one of many logically admissible geometrical systems. Relativity theory amended our understanding of the problem of space by amalgamating space and time into an integral four-dimensional manifold. One of the most important problems, lying at the crossroad of natural sciences and philosophy is the problem of the structure of the world as a whole. There are a lot of possibilities for the topology offour dimensional space-time, and at first sight a lot of possibilities arise in cosmology. In principle, not only can the global topology of the universe be complicated, but also smaller scale topological structures can be very nontrivial. One can imagine two "usual" spaces connected with a "throat", making the topology of the union complicated.

Introduction to Topological Manifolds John Lee 2010-12-25 This book is an introduction to manifolds at the beginning graduate level, and accessible to any student who has completed a solid undergraduate degree in mathematics. It contains the essential topological ideas that are needed for the further study of manifolds, particularly in the context of differential geometry, algebraic topology, and related fields. Although this second edition has the same basic structure as the first edition, it has been extensively revised and clarified; not a single page has been left untouched. The major changes include a new introduction to CW complexes (replacing most of the material on simplicial complexes in Chapter 5); expanded treatments of manifolds with boundary, local compactness, group actions, and proper maps; and a new section on paracompactness.

Introduction to Smooth Manifolds John Lee 2012-08-27 This book is an introductory graduate-level textbook on the theory of smooth manifolds. Its goal is to familiarize students with the tools they will need in order to use manifolds in mathematical or scientific research--- smooth structures, tangent vectors and covectors, vector bundles, immersed and embedded submanifolds, tensors, differential forms, de Rham cohomology, vector fields, flows, foliations, Lie derivatives, Lie groups, Lie algebras, and more. The approach is as concrete as possible, with pictures and intuitive discussions of how one should think geometrically about the abstract concepts, while making full use of the powerful tools that modern mathematics has to offer. This second edition has been extensively revised and clarified, and the topics have been substantially rearranged. The book now introduces the two most important analytic tools, the rank theorem and the fundamental theorem on flows, much earlier so that they can be used throughout the book. A few new topics have been added, notably Sard's theorem and transversality, a proof that infinitesimal Lie group actions generate global group actions, a more thorough study of first-order partial differential equations, a brief treatment of degree theory for smooth maps between compact manifolds, and an introduction to contact structures. Prerequisites include a solid acquaintance with general topology, the fundamental group, and covering spaces, as well as basic undergraduate linear algebra and real analysis.

An Introduction To Differential Manifolds Barden Dennis 2003-03-12 This invaluable book, based on the many years of teaching experience of both authors, introduces the reader to the basic ideas in differential topology. Among the topics covered are smooth manifolds and maps, the structure of the tangent bundle and its associates, the calculation of real cohomology groups using differential forms (de Rham theory), and applications such as the Poincaré-Hopf theorem relating the Euler number of a manifold and the index of a vector field. Each chapter contains exercises of varying difficulty for which solutions are provided. Special features include examples drawn from geometric manifolds in dimension 3 and Brieskorn varieties in dimensions 5 and 7, as well as detailed calculations for the cohomology groups of spheres and tori.