

vakil algebraic geometry

Unveiling the Mysteries: A Deep Dive into Vakil's Algebraic Geometry

Introduction:

Are you intrigued by the elegant interplay between algebra and geometry? Do you yearn to understand the sophisticated machinery that underpins modern algebraic geometry? Then you've come to the right place. This comprehensive guide delves into the world of Vakil's *The Rising Sea: Foundations of Algebraic Geometry*, a renowned and widely-used textbook transforming how algebraic geometry is taught. We'll explore its structure, content, approach, and why it's considered a game-changer for aspiring algebraic geometers. Whether you're a seasoned mathematician or just beginning your journey into this captivating field, this post will provide you with a solid foundation and invaluable insights into Vakil's masterpiece. Prepare to navigate the intricacies of schemes, sheaves, and more, all while gaining a deeper appreciation for the beauty and power of algebraic geometry.

What Makes Vakil's Approach Unique?

Vakil's *The Rising Sea* departs significantly from traditional algebraic geometry textbooks. Its innovative approach prioritizes intuition and conceptual understanding over rigorous formalism, particularly in the early stages. Instead of overwhelming the reader with abstract definitions and theorems upfront, Vakil gradually builds the necessary concepts, using carefully chosen examples and intuitive explanations to illuminate complex ideas. This approach makes the subject far more accessible to a wider audience, including undergraduates and those transitioning from other mathematical disciplines.

Key Features of Vakil's Algebraic Geometry:

Intuitive Exposition: Vakil masterfully weaves together geometric intuition with the underlying algebraic structures. He avoids unnecessary technical jargon and prioritizes clear, concise explanations, making even challenging concepts more graspable.

Emphasis on Examples: Throughout the book, Vakil employs numerous illustrative examples to solidify understanding. These examples serve as crucial bridges between abstract concepts and their concrete manifestations, facilitating a deeper appreciation of the subject matter.

Gradual Progression: The text follows a carefully planned progression, building upon fundamental concepts gradually. This measured approach allows readers to develop a solid understanding before moving on to more advanced topics. It's like climbing a mountain – each step carefully placed, ensuring a safe and rewarding ascent.

Modern Perspective: Vakil incorporates contemporary viewpoints and techniques, showcasing the dynamism and ongoing evolution of algebraic geometry. This ensures the text remains relevant and engaging for students pursuing advanced studies in the field.

Extensive Exercises: The book is complemented by a rich collection of exercises ranging from straightforward problems to challenging explorations, fostering deeper understanding and independent learning. Solving these exercises is crucial for solidifying one's grasp of the concepts.

Online Resources: The availability of online resources, including errata and supplementary materials, further enhances the learning experience. This added support is invaluable for students navigating the complexities of the subject matter.

Exploring the Structure of Vakil's Textbook:

Vakil's book is structured to facilitate a gradual understanding of algebraic geometry. The topics are thoughtfully arranged, building upon previously introduced concepts in a logical and progressive manner. The book doesn't shy away from challenging topics, but the careful pacing and clear explanations make it a remarkably accessible text. The structure often emphasizes the motivation and

intuition behind the concepts, making the learning process engaging and less daunting.

A Detailed Outline of Vakil's "The Rising Sea":

Name: The Rising Sea: Foundations of Algebraic Geometry

Contents:

Introduction: Sets the stage, explaining the goals and approach of the book. It highlights the importance of geometric intuition and the gradual development of the subject matter. It also provides a roadmap for the reader, outlining the major topics to be covered.

Chapter 1: Foundations: This chapter covers fundamental concepts such as sets, rings, fields, and basic algebraic structures necessary for understanding the subsequent material. It also introduces the notion of affine varieties, laying the groundwork for more abstract concepts to follow.

Chapter 2: Schemes: Here, the central concept of schemes is introduced. This is a crucial component of modern algebraic geometry, generalizing the notion of algebraic varieties. Vakil employs careful exposition to guide the reader through the intricacies of this fundamental object.

Chapter 3: Sheaves and Cohomology: Sheaves are introduced as tools to understand the local-to-global behavior of functions and other structures on geometric spaces. Cohomology, a powerful technique, is introduced, giving insights into the global properties of schemes.

Chapter 4: Advanced Topics: This section delves into more advanced aspects, such as moduli spaces, intersection theory, and advanced techniques in sheaf cohomology.

Conclusion: Summarizes key concepts and highlights the vast landscape of algebraic geometry, encouraging further exploration and research.

Detailed Explanation of Outline Points:

1. Introduction: This sets the tone and establishes the book's pedagogical approach, emphasizing the gradual introduction of concepts and the significance of intuitive understanding. It aims to dispel the often-held notion that algebraic geometry is an impenetrable subject.
1. Chapter 1: Foundations: This chapter lays the necessary groundwork in algebra, introducing key concepts such as rings, ideals, and varieties. It establishes the connection between algebraic objects and geometric spaces, gradually building towards the more abstract notions to come. The emphasis here is on establishing a solid foundational understanding.
1. Chapter 2: Schemes: This is a pivotal chapter. Schemes, a far-reaching generalization of algebraic varieties, are meticulously introduced. Vakil guides the reader through the definition and properties of schemes, illustrating with numerous examples to enhance understanding. This section often requires considerable patience and repeated study.
1. Chapter 3: Sheaves and Cohomology: The concepts of sheaves and cohomology are fundamental to modern algebraic geometry. Sheaves provide a way to study functions and other structures locally, while cohomology gives insights into the global structure. Vakil carefully explains these intricate concepts, emphasizing their geometric significance.

1. Chapter 4: Advanced Topics: This section introduces more advanced topics, building upon the foundational material previously established. The depth of exploration in this section can vary, depending on the specific edition or course adopting the book.

1. Conclusion: The conclusion isn't just a summary; it serves to inspire further study and exploration. It showcases the breadth and depth of algebraic geometry, highlighting its ongoing development and wide-ranging applications.

Frequently Asked Questions (FAQs):

1. Is Vakil's book suitable for undergraduates? Yes, with a solid foundation in algebra, undergraduates can successfully use this book. The intuitive approach makes it more accessible than many traditional texts.

1. What prerequisites are needed to study Vakil's book? A strong background in abstract algebra (rings, fields, modules) and some familiarity with point-set topology is helpful.

1. How does Vakil's book compare to other algebraic geometry textbooks? Vakil's book is praised for its intuitive approach and emphasis on geometric intuition, making it more accessible than many traditional texts that prioritize formal rigor.

1. Is the book self-contained? While it aims for self-containment, some familiarity with abstract algebra and basic topology is beneficial.

1. What are the best resources to supplement Vakil's book? Online notes, supplementary materials, and discussions with peers can greatly enhance understanding.

1. Are solutions to the exercises available? While not always officially published, solutions and discussions can often be found online in various forums and communities.

1. How long does it typically take to work through Vakil's book? The time needed depends on the reader's background and pace. It can range from a few months to several years for a thorough understanding.

1. Is the book suitable for self-study? Yes, with sufficient dedication and perseverance, the book is well-suited for self-study.

1. What are the career prospects after mastering the concepts in Vakil's book? A strong grasp of algebraic geometry opens doors to various academic and research positions, as well as roles in

related fields such as theoretical physics and computer science.

Related Articles:

1. Introduction to Schemes: Explores the basic definition and properties of schemes, building a foundational understanding.
1. Sheaf Theory in Algebraic Geometry: A detailed exploration of sheaves, their properties, and their applications in algebraic geometry.
1. Cohomology and its Applications: Focuses on cohomology theory and its use in solving geometric problems.
1. Affine and Projective Varieties: Differentiates between affine and projective varieties and their properties.
1. Singularities in Algebraic Geometry: A study of singularities in algebraic varieties and their resolution techniques.

1. Moduli Spaces in Algebraic Geometry: Examines moduli spaces, which parametrize geometric objects with certain properties.

1. Intersection Theory in Algebraic Geometry: Focuses on the intersection theory of algebraic varieties and its applications.

1. Riemann Surfaces and Algebraic Curves: Explores the connection between Riemann surfaces and algebraic curves.

1. Applications of Algebraic Geometry in Physics: Explores the significant applications of algebraic geometry in modern physics, particularly string theory.

vakil algebraic geometry: *The Rising Sea* Ravi Vakil, 2025-12-16 An accessible, motivated introduction to one of the most dynamic areas of mathematics Decades ago, Mumford wrote that algebraic geometry seems to have acquired the reputation of being esoteric, exclusive, and very abstract, with adherents who are secretly plotting to take over all the rest of mathematics. The revolution has now fully come to pass and has fundamentally changed how we think about many fields of mathematics. This book provides a thorough foundation in the powerful ideas that now shape the landscape, with an informal yet rigorous exposition that builds intuition for the formidable machinery. It begins with a discussion of categorical thinking and sheaves and then develops the notion of schemes and varieties as examples of geometric spaces before discussing their specific aspects. The book goes on to cover topics such as dimension and smoothness, vector bundles and their natural generalizations, and important cohomological tools and their applications. Important

optional topics are included in starred sections. A comprehensive introduction certain to become the standard book on the subject Features a wealth of exercises that enable students to learn by doing Requires few prerequisites, developing the tools students need to succeed, from category theory and sheaf theory to commutative and homological algebra Uses an example-driven approach that builds mathematical intuition A self-contained textbook for graduate students and an essential reference for researchers

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Complex analysis is a classic and central area of mathematics, which is studied and exploited in a range of important fields, from number theory to engineering. Introduction to Complex Analysis was first published in 1985, and for this much awaited second edition the text has been considerably expanded, while retaining the style of the original. More detailed presentation is given of elementary topics, to reflect the knowledge base of current students. Exercise sets have been substantially revised and enlarged, with carefully graded exercises at the end of each chapter. This is the latest addition to the growing list of Oxford undergraduate textbooks in mathematics, which includes: Biggs: Discrete Mathematics 2nd Edition, Cameron: Introduction to Algebra, Needham: Visual Complex Analysis, Kaye and Wilson: Linear Algebra, Acheson: Elementary Fluid Dynamics, Jordan and Smith: Nonlinear Ordinary Differential Equations, Smith: Numerical Solution of Partial Differential Equations, Wilson: Graphs, Colourings and the Four-Colour Theorem, Bishop: Neural Networks for Pattern Recognition, Gelman and Nolan: Teaching Statistics.

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2006-04-06 Grothendieck's beautiful theory of schemes permeates modern algebraic geometry and underlies its applications to number theory, physics, and applied mathematics. This simple account of that theory emphasizes and explains the universal geometric concepts behind the definitions. In the book, concepts are illustrated with fundamental examples, and explicit calculations show how the constructions of scheme theory are carried out in practice.

vakil algebraic geometry: Undergraduate Algebraic Geometry Miles Reid, Miles A. Reid,

1988-12-15 Algebraic geometry is, essentially, the study of the solution of equations and occupies a central position in pure mathematics. This short and readable introduction to algebraic geometry will be ideal for all undergraduate mathematicians coming to the subject for the first time. With the minimum of prerequisites, Dr Reid introduces the reader to the basic concepts of algebraic geometry including: plane conics, cubics and the group law, affine and projective varieties, and non-singularity and dimension. He is at pains to stress the connections the subject has with commutative algebra as well as its relation to topology, differential geometry, and number theory. The book arises from an undergraduate course given at the University of Warwick and contains numerous examples and exercises illustrating the theory.

vakil algebraic geometry: Algebraic Geometry Ulrich Görtz, Torsten Wedhorn, 2010-08-06

This book introduces the reader to modern algebraic geometry. It presents Grothendieck's technically demanding language of schemes that is the basis of the most important developments in the last fifty years within this area. A systematic treatment and motivation of the theory is emphasized, using concrete examples to illustrate its usefulness. Several examples from the realm of Hilbert modular surfaces and of determinantal varieties are used methodically to discuss the covered techniques. Thus the reader experiences that the further development of the theory yields an ever better understanding of these fascinating objects. The text is complemented by many exercises that serve to check the comprehension of the text, treat further examples, or give an outlook on further results. The volume at hand is an introduction to schemes. To get started, it requires only basic knowledge in abstract algebra and topology. Essential facts from commutative algebra are assembled in an appendix. It will be complemented by a second volume on the cohomology of schemes.

vakil algebraic geometry: Algebraic Geometry Robin Hartshorne, 2013-06-29 An

introduction to abstract algebraic geometry, with the only prerequisites being results from commutative algebra, which are stated as needed, and some elementary topology. More than 400

exercises distributed throughout the book offer specific examples as well as more specialised topics not treated in the main text, while three appendices present brief accounts of some areas of current research. This book can thus be used as textbook for an introductory course in algebraic geometry following a basic graduate course in algebra. Robin Hartshorne studied algebraic geometry with Oscar Zariski and David Mumford at Harvard, and with J.-P. Serre and A. Grothendieck in Paris. He is the author of *Residues and Duality*, *Foundations of Projective Geometry*, *Ample Subvarieties of Algebraic Varieties*, and numerous research titles.

vakil algebraic geometry: *Algebraic Geometry and Arithmetic Curves* Qing Liu, Reinie Erne, 2006-06-29 This book is a general introduction to the theory of schemes, followed by applications to arithmetic surfaces and to the theory of reduction of algebraic curves. The first part introduces basic objects such as schemes, morphisms, base change, local properties (normality, regularity, Zariski's Main Theorem). This is followed by the more global aspect: coherent sheaves and a finiteness theorem for their cohomology groups. Then follows a chapter on sheaves of differentials, dualizing sheaves, and Grothendieck's duality theory. The first part ends with the theorem of Riemann-Roch and its application to the study of smooth projective curves over a field. Singular curves are treated through a detailed study of the Picard group. The second part starts with blowing-ups and desingularisation (embedded or not) of fibered surfaces over a Dedekind ring that leads on to intersection theory on arithmetic surfaces. Castelnuovo's criterion is proved and also the existence of the minimal regular model. This leads to the study of reduction of algebraic curves. The case of elliptic curves is studied in detail. The book concludes with the fundamental theorem of stable reduction of Deligne-Mumford. The book is essentially self-contained, including the necessary material on commutative algebra. The prerequisites are therefore few, and the book should suit a graduate student. It contains many examples and nearly 600 exercises.

vakil algebraic geometry: *Fields and Galois Theory* John M. Howie, 2007-10-11 A modern and student-friendly introduction to this popular subject: it takes a more natural approach and develops the theory at a gentle pace with an emphasis on clear explanations. Features plenty of worked examples and exercises, complete with full solutions, to encourage independent study. Previous books by Howie in the SUMS series have attracted excellent reviews.

vakil algebraic geometry: *Mirror Symmetry* Kentaro Hori, 2003 This thorough and detailed exposition is the result of an intensive month-long course on mirror symmetry sponsored by the Clay Mathematics Institute. It develops mirror symmetry from both mathematical and physical perspectives with the aim of furthering interaction between the two fields. The material will be particularly useful for mathematicians and physicists who wish to advance their understanding across both disciplines. Mirror symmetry is a phenomenon arising in string theory in which two very different manifolds give rise to equivalent physics. Such a correspondence has significant mathematical consequences, the most familiar of which involves the enumeration of holomorphic curves inside complex manifolds by solving differential equations obtained from a "mirror" geometry. The inclusion of D-brane states in the equivalence has led to further conjectures involving calibrated submanifolds of the mirror pairs and new (conjectural) invariants of complex manifolds: the Gopakumar-Vafa invariants. This book gives a single, cohesive treatment of mirror symmetry. Parts 1 and 2 develop the necessary mathematical and physical background from "scratch". The treatment is focused, developing only the material most necessary for the task. In Parts 3 and 4 the physical and mathematical proofs of mirror symmetry are given. From the physics side, this means demonstrating that two different physical theories give isomorphic physics. Each physical theory can be described geometrically, and thus mirror symmetry gives rise to a "pairing" of geometries. The proof involves applying circle duality to the phases of the fields in the gauged linear sigma model. The mathematics proof develops Gromov-Witten theory in the algebraic setting, beginning with the moduli spaces of curves and maps, and uses localization techniques to show that certain hypergeometric functions encode the Gromov-Witten invariants in genus zero, as is predicted by mirror symmetry. Part 5 is devoted to advanced topics. This one-of-a-kind book is suitable for graduate students and research mathematicians interested in mathematics and mathematical and

theoretical physics.

vakil algebraic geometry: Toric Varieties David A. Cox, John B. Little, Henry K. Schenck, 2024-06-25 Toric varieties form a beautiful and accessible part of modern algebraic geometry. This book covers the standard topics in toric geometry; a novel feature is that each of the first nine chapters contains an introductory section on the necessary background material in algebraic geometry. Other topics covered include quotient constructions, vanishing theorems, equivariant cohomology, GIT quotients, the secondary fan, and the minimal model program for toric varieties. The subject lends itself to rich examples reflected in the 134 illustrations included in the text. The book also explores connections with commutative algebra and polyhedral geometry, treating both polytopes and their unbounded cousins, polyhedra. There are appendices on the history of toric varieties and the computational tools available to investigate nontrivial examples in toric geometry. Readers of this book should be familiar with the material covered in basic graduate courses in algebra and topology, and to a somewhat lesser degree, complex analysis. In addition, the authors assume that the reader has had some previous experience with algebraic geometry at an advanced undergraduate level. The book will be a useful reference for graduate students and researchers who are interested in algebraic geometry, polyhedral geometry, and toric varieties.

vakil algebraic geometry: Linear Algebra and Geometry Igor R. Shafarevich, Alexey O. Remizov, 2012-08-23 This book on linear algebra and geometry is based on a course given by renowned academician I.R. Shafarevich at Moscow State University. The book begins with the theory of linear algebraic equations and the basic elements of matrix theory and continues with vector spaces, linear transformations, inner product spaces, and the theory of affine and projective spaces. The book also includes some subjects that are naturally related to linear algebra but are usually not covered in such courses: exterior algebras, non-Euclidean geometry, topological properties of projective spaces, theory of quadrics (in affine and projective spaces), decomposition of finite abelian groups, and finitely generated periodic modules (similar to Jordan normal forms of linear operators). Mathematical reasoning, theorems, and concepts are illustrated with numerous examples from various fields of mathematics, including differential equations and differential geometry, as well as from mechanics and physics.

vakil algebraic geometry: Algebraic Spaces and Stacks Martin Olsson, 2016-05-13 This book is an introduction to the theory of algebraic spaces and stacks intended for graduate students and researchers familiar with algebraic geometry at the level of a first-year graduate course. The first several chapters are devoted to background material including chapters on Grothendieck topologies, descent, and fibered categories. Following this, the theory of algebraic spaces and stacks is developed. The last three chapters discuss more advanced topics including the Keel-Mori theorem on the existence of coarse moduli spaces, gerbes and Brauer groups, and various moduli stacks of curves. Numerous exercises are included in each chapter ranging from routine verifications to more difficult problems, and a glossary of necessary category theory is included as an appendix.

vakil algebraic geometry: Algebraic Geometry and Commutative Algebra Siegfried Bosch, 2022-04-22 Algebraic Geometry is a fascinating branch of Mathematics that combines methods from both Algebra and Geometry. It transcends the limited scope of pure Algebra by means of geometric construction principles. Putting forward this idea, Grothendieck revolutionized Algebraic Geometry in the late 1950s by inventing schemes. Schemes now also play an important role in Algebraic Number Theory, a field that used to be far away from Geometry. The new point of view paved the way for spectacular progress, such as the proof of Fermat's Last Theorem by Wiles and Taylor. This book explains the scheme-theoretic approach to Algebraic Geometry for non-experts, while more advanced readers can use it to broaden their view on the subject. A separate part presents the necessary prerequisites from Commutative Algebra, thereby providing an accessible and self-contained introduction to advanced Algebraic Geometry. Every chapter of the book is preceded by a motivating introduction with an informal discussion of its contents and background. Typical examples, and an abundance of exercises illustrate each section. Therefore the book is an excellent companion for self-studying or for complementing skills that have already been acquired. It can just

as well serve as a convenient source for (reading) course material and, in any case, as supplementary literature. The present edition is a critical revision of the earlier text.

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vakil algebraic geometry: *The Red Book of Varieties and Schemes* David Mumford, 2004-02-21 Mumford's famous Red Book gives a simple, readable account of the basic objects of algebraic geometry, preserving as much as possible their geometric flavor and integrating this with the tools of commutative algebra. It is aimed at graduates or mathematicians in other fields wishing to quickly learn about algebraic geometry. This new edition includes an appendix that gives an overview of the theory of curves, their moduli spaces and their Jacobians -- one of the most exciting fields within algebraic geometry.

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Mumford's Volume I is, together with its predecessor the red book of varieties and schemes, now as before one of the most excellent and profound primers of modern algebraic geometry. Both books are just true classics! Zentralblatt

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vakil algebraic geometry: Algebraic Curves and Riemann Surfaces Rick Miranda, 1995 In this book, Miranda takes the approach that algebraic curves are best encountered for the first time over the complex numbers, where the reader's classical intuition about surfaces, integration, and other concepts can be brought into play. Therefore, many examples of algebraic curves are presented in the first chapters. In this way, the book begins as a primer on Riemann surfaces, with complex charts and meromorphic functions taking centre stage. But the main examples come from projective curves, and slowly but surely the text moves toward the algebraic category. Proofs of the Riemann-Roch and Serre Duality Theorems are presented in an algebraic manner, via an adaptation of the adelic proof, expressed completely in terms of solving a Mittag-Leffler problem. Sheaves and cohomology are introduced as a unifying device in the later chapters, so that their utility and naturalness are immediately obvious. Requiring a background of one term of complex variable theory and a year of abstract algebra, this is an excellent graduate textbook for a second-term course in complex variables or a year-long course in algebraic geometry.

vakil algebraic geometry: Intersection Theory W. Fulton, 2013-06-29 From the ancient origins of algebraic geometry in the solution of polynomial equations, through the triumphs of algebraic geometry during the last two centuries, intersection theory has played a central role. Since its role in foundational crises has been no less prominent, the lack of a complete modern treatise on intersection theory has been something of an embarrassment. The aim of this book is to develop the foundations of intersection theory, and to indicate the range of classical and modern applications. Although a comprehensive history of this vast subject is not attempted, we have tried to point out some of the striking early appearances of the ideas of intersection theory. Recent improvements in our understanding not only yield a stronger and more useful theory than previously available, but also make it possible to develop the subject from the beginning with fewer prerequisites from algebra and algebraic geometry. It is hoped that the basic text can be read by one equipped with a first course in algebraic geometry, with occasional use of the two appendices. Some of the examples, and a few of the later sections, require more specialized knowledge. The text is designed so that one who understands the constructions and grants the main theorems of the first six chapters can read other chapters separately. Frequent parenthetical references to previous sections are included for such readers. The summaries which begin each chapter should facilitate use as a reference.

vakil algebraic geometry: Using Algebraic Geometry David A. Cox, John Little, DONALD OSHEA, 2013-04-17 An illustration of the many uses of algebraic geometry, highlighting the more recent applications of Groebner bases and resultants. Along the way, the authors provide an introduction to some algebraic objects and techniques more advanced than typically encountered in a first course. The book is accessible to non-specialists and to readers with a diverse range of

backgrounds, assuming readers know the material covered in standard undergraduate courses, including abstract algebra. But because the text is intended for beginning graduate students, it does not require graduate algebra, and in particular, does not assume that the reader is familiar with modules.

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vakil algebraic geometry: Sheaves on Manifolds Masaki Kashiwara, Pierre Schapira, 2013-03-14 Sheaf Theory is modern, active field of mathematics at the intersection of algebraic topology, algebraic geometry and partial differential equations. This volume offers a comprehensive and self-contained treatment of Sheaf Theory from the basis up, with emphasis on the microlocal point of view. From the reviews: Clearly and precisely written, and contains many interesting ideas: it describes a whole, largely new branch of mathematics. -Bulletin of the L.M.S.

vakil algebraic geometry: Mathematical Studies on Human Disease Dynamics Abba B. Gumel, Carlos Castillo-Chávez, Ronald E. Mickens, Dominic P. Clemence, 2006 This volume contains the proceedings of the AMS-SIAM-IMS Joint Summer Research Conference on Modeling the Dynamics of Human Diseases: Emerging Paradigms and Challenges, held in Snowbird, Utah, July 17-21, 2005. The goal of the conference was to bring together leading and upcoming researchers to discuss the latest advances and challenges associated with the modeling of the dynamics of emerging and re-emerging diseases, and to explore various control strategies. The articles included in this book are devoted to some of the significant recent advances, trends, and challenges associated with the mathematical modeling and analysis of the dynamics and control of some diseases of public health importance. In addition to illustrating many of the diverse prevailing epidemiological challenges, together with the diversity of mathematical approaches needed to address them, this book provides insights on a number of topical modeling issues such as the modeling and control of mosquito-borne diseases, respiratory diseases, animal diseases (such as foot-and-mouth disease), cancer and tumor growth modeling, influenza, HIV, HPV, rotavirus, etc. This book also touches upon other important topics such as the use of modeling i

vakil algebraic geometry: An Invitation to Arithmetic Geometry Dino Lorenzini, 2021-12-23 Extremely carefully written, masterfully thought out, and skillfully arranged introduction ... to the arithmetic of algebraic curves, on the one hand, and to the algebro-geometric aspects of number theory, on the other hand. ... an excellent guide for beginners in arithmetic geometry, just as an interesting reference and methodical inspiration for teachers of the subject ... a highly welcome addition to the existing literature. —Zentralblatt MATH The interaction between number theory and algebraic geometry has been especially fruitful. In this volume, the author gives a unified presentation of some of the basic tools and concepts in number theory, commutative algebra, and algebraic geometry, and for the first time in a book at this level, brings out the deep analogies between them. The geometric viewpoint is stressed throughout the book. Extensive examples are given to illustrate each new concept, and many interesting exercises are given at the end of each chapter. Most of the important results in the one-dimensional case are proved, including Bombieri's proof of the Riemann Hypothesis for curves over a finite field. While the book is not intended to be an introduction to schemes, the author indicates how many of the geometric notions introduced in the book relate to schemes, which will aid the reader who goes to the next level of this rich subject.

vakil algebraic geometry: A Concise Introduction to Algebraic Varieties Brian Osserman, 2021-12-06

vakil algebraic geometry: *Algebraic Geometry II* David Mumford, Tadao Oda, 2015 Several generations of students of algebraic geometry have learned the subject from David Mumford's fabled

Red Book containing notes of his lectures at Harvard University. This book contains what Mumford had intended to be Volume II. It covers the material in the Red Book in more depth with several more topics added.

vakil algebraic geometry: Basic Algebraic Geometry 2 Igor Rostislavovich Shafarevich, 1994 The second volume of Shafarevich's introductory book on algebraic geometry focuses on schemes, complex algebraic varieties and complex manifolds. As with Volume 1 the author has revised the text and added new material, e.g. a section on real algebraic curves. Although the material is more advanced than in Volume 1 the algebraic apparatus is kept to a minimum making the book accessible to non-specialists. It can be read independently of Volume 1 and is suitable for beginning graduate students in mathematics as well as in theoretical physics.

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Algebra: Chapter 0 is a self-contained introduction to the main topics of algebra, suitable for a first sequence on the subject at the beginning graduate or upper undergraduate level. The primary distinguishing feature of the book, compared to standard textbooks in algebra, is the early introduction of categories, used as a unifying theme in the presentation of the main topics. A second feature consists of an emphasis on homological algebra: basic notions on complexes are presented as soon as modules have been introduced, and an extensive last chapter on homological algebra can form the basis for a follow-up introductory course on the subject. Approximately 1,000 exercises both provide adequate practice to consolidate the understanding of the main body of the text and offer the opportunity to explore many other topics, including applications to number theory and algebraic geometry. This will allow instructors to adapt the textbook to their specific choice of topics and provide the independent reader with a richer exposure to algebra. Many exercises include substantial hints, and navigation of the topics is facilitated by an extensive index and by hundreds of cross-references.

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Constructible and perverse sheaves are the algebraic counterpart of the decomposition of a singular space into smooth manifolds. This introduction to the subject can be regarded as a textbook on modern algebraic topology, treating the cohomology of spaces with sheaf (as opposed to constant) coefficients. The author helps readers progress quickly from the basic theory to current research questions, thoroughly supported along the way by examples and exercises.

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