linear algebra done right

Linear Algebra Done Right: Your Comprehensive Guide to Mastering the Fundamentals

Introduction:

Are you struggling to grasp the elegance and power of linear algebra? Do textbooks leave you feeling lost in a sea of abstract concepts and confusing notation? You're not alone. Many students find linear algebra challenging, but it's a crucial foundation for numerous fields, from machine learning and computer graphics to physics and engineering. This comprehensive guide, "Linear Algebra Done Right," aims to demystify the subject, providing you with a clear, intuitive, and practical understanding of the core principles. We'll explore key concepts, offer practical examples, and equip you with the tools you need to succeed. This post covers everything from vector spaces to linear transformations, offering a roadmap for mastering this essential mathematical discipline. Prepare to see linear algebra in a whole new light!

Chapter 1: Vector Spaces – The Foundation of Linear Algebra

Linear algebra revolves around the concept of vector spaces. A vector space is a collection of objects (vectors) that can be added together and multiplied by scalars (usually real or complex numbers) while satisfying specific axioms. These axioms ensure consistency and allow us to develop powerful theorems and techniques. Understanding these axioms is paramount. We'll delve into:

Defining Vector Spaces: A rigorous examination of the axioms that define a vector space. We'll look at both abstract definitions and concrete examples, like Rn (the set of all n-tuples of real numbers) and the space of polynomials.
Subspaces: Learning to identify subspaces—subsets of a vector space that themselves form vector spaces—is crucial for understanding the structure of larger vector spaces. We'll cover techniques for verifying whether a given subset is a subspace.
Linear Independence and Dependence: Understanding linear independence and dependence is fundamental to many concepts in linear algebra. We'll explore methods for determining whether a set of vectors is linearly independent or dependent and the implications of each.
Bases and Dimension: A basis is a minimal set of vectors that spans the entire vector space. We'll explore the concept of a basis, how to find one, and the crucial concept of dimension (the number of vectors in a basis).

Chapter 2: Linear Transformations – Mapping Between Vector Spaces

Linear transformations are functions that map vectors from one vector space to another while preserving the linear structure. They are the workhorses of linear algebra, enabling us to analyze and manipulate vector spaces effectively. We'll explore:

Definition and Properties: A precise definition of a linear transformation, along with its key properties, including linearity and preservation of vector addition and scalar multiplication.
Matrix Representation: The powerful connection between linear transformations and matrices will be thoroughly explained. We'll learn how to represent linear transformations using matrices and vice versa.
Null Space and Range: Understanding the null space (kernel) and range (image) of a linear transformation is vital for analyzing its properties and determining its rank and nullity.
Isomorphisms and Invertible Transformations: We'll investigate isomorphisms – bijective linear transformations that establish a one-to-one correspondence between vector spaces. This concept is crucial for understanding the equivalence of different vector spaces.

Chapter 3: Inner Product Spaces – Geometry in Linear Algebra

Inner product spaces extend the concept of vector spaces by introducing the notion of an inner product, a generalization of the dot product. This allows us to define concepts like length, angle, and orthogonality, bringing geometric intuition into the abstract world of vector spaces. We'll cover:

Defining Inner Products: We'll rigorously define inner products and examine their properties, including positivity, linearity, and symmetry.
Norms and Orthogonality: The inner product allows us to define the length (norm) of a vector and the concept of orthogonality (perpendicularity). We'll explore their significance and applications.
Gram-Schmidt Process: This important algorithm allows us to construct orthonormal bases from arbitrary bases, a fundamental tool in many linear algebra applications.
Orthogonal Projections: Projecting vectors onto subspaces is a key application of inner product spaces. We'll explore the method of orthogonal projection and its uses.

Chapter 4: Eigenvalues and Eigenvectors – Understanding Linear Transformations

Eigenvalues and eigenvectors provide crucial insights into the behavior of linear transformations. They reveal fundamental properties of the transformation and are essential in many applications. We'll explore:

Definition and Calculation: We'll define eigenvalues and eigenvectors and explore techniques for calculating them, including solving characteristic equations.
Diagonalization: Diagonalizing a matrix (representing a linear transformation) simplifies many computations and reveals crucial information about the transformation's properties.

Complex Eigenvalues and Eigenvectors: We'll extend our understanding to include complex eigenvalues and eigenvectors, essential for handling certain types of linear transformations.
Applications: We'll discuss applications of eigenvalues and eigenvectors, such as solving systems of differential equations and analyzing dynamical systems.

Chapter 5: Advanced Topics and Applications

This chapter will briefly touch upon more advanced concepts and applications of linear algebra, providing a glimpse into its broader scope. Topics may include:

Singular Value Decomposition (SVD): A powerful factorization technique with applications in data analysis and dimensionality reduction.
Linear Programming: Applying linear algebra to optimization problems.
Applications in Computer Graphics: How linear algebra is used to perform transformations in 3D graphics.
Applications in Machine Learning: The fundamental role of linear algebra in machine learning algorithms.

Book Outline: "Linear Algebra Demystified"

I. Introduction:
What is Linear Algebra and Why is it Important?
Overview of the Book's Structure and Approach

II. Vector Spaces:
Axioms of Vector Spaces
Subspaces
Linear Independence and Spanning Sets
Bases and Dimension
Examples of Vector Spaces

III. Linear Transformations:
Definition and Properties of Linear Transformations
Matrix Representation of Linear Transformations
Null Space and Range
Isomorphisms and Invertible Transformations

IV. Inner Product Spaces:
Inner Products and their Properties
Norms and Orthogonality
Gram-Schmidt Process
Orthogonal Projections

V. Eigenvalues and Eigenvectors:

Definition and Calculation of Eigenvalues and Eigenvectors
Diagonalization
Complex Eigenvalues and Eigenvectors
Applications of Eigenvalues and Eigenvectors

VI. Advanced Topics and Applications:
Singular Value Decomposition (SVD)
Linear Programming
Applications in Computer Graphics and Machine Learning
Further Study and Resources

VII. Conclusion:
Summary of Key Concepts
Encouragement for Further Learning

Detailed Explanation of Outline Points:

Each chapter in the proposed book would delve deeply into the topics outlined above. For example, the "Vector Spaces" chapter would rigorously define vector spaces, providing numerous examples and counterexamples to solidify understanding. It would then proceed to subspaces, exploring their properties and how to determine if a subset is a subspace. The chapter on linear transformations would cover matrix representation in detail, showing how to translate between linear transformations and matrices and explaining how to use matrix multiplication to compose linear transformations. Similarly, the chapter on eigenvalues and eigenvectors would delve into their computation, focusing on both real and complex cases. The final chapter would provide a broader perspective on the applications of linear algebra in various fields. Each chapter would include numerous solved problems and exercises to reinforce the concepts presented.

9 Unique FAQs:

1. What is the difference between a vector and a matrix? A vector is a one-dimensional array of numbers, while a matrix is a two-dimensional array. Vectors can be thought of as special cases of matrices.

1. Why is linear independence important? Linear independence ensures that a set of vectors provides a unique representation of any vector in the subspace they span. Linearly dependent vectors contain redundant information.

1. What is the significance of the determinant of a matrix? The determinant provides information about the invertibility of a matrix and the volume scaling factor of a linear transformation. A zero determinant indicates the matrix is singular (non-invertible).

1. How are eigenvalues and eigenvectors used in solving systems of differential equations? Eigenvalues and eigenvectors provide the solutions to homogeneous linear systems of differential equations.

1. What is the purpose of the Gram-Schmidt process? The Gram-Schmidt process converts a basis into an orthonormal basis, which simplifies many computations and provides a useful representation for various applications.

1. What are the applications of singular value decomposition (SVD)? SVD has broad applications in dimensionality reduction, data compression, recommendation systems, and image processing.

1. What is the relationship between linear algebra and machine learning? Linear algebra forms the mathematical foundation of many machine learning algorithms, including linear regression, principal component analysis, and support vector machines.

1. How can I improve my understanding of linear algebra? Consistent practice, solving problems, and working through examples are key. Using visual aids and software can also help with understanding.

1. Are there online resources available to help me learn linear algebra? Yes, many excellent online resources exist, including online courses, tutorials, and interactive learning platforms.

9 Related Articles:

1. Linear Algebra for Machine Learning: Explores the specific applications of linear algebra in machine learning algorithms.

1. Introduction to Vector Spaces: A more beginner-friendly introduction to the concept of vector spaces.

1. Understanding Linear Transformations: A deeper dive into the properties and applications of linear transformations.

1. Eigenvalues and Eigenvectors: A Practical Guide: A tutorial focused on calculating and interpreting eigenvalues and eigenvectors.

1. The Gram-Schmidt Process Explained: A step-by-step explanation of the Gram-Schmidt orthonormalization process.

1. Singular Value Decomposition (SVD) and its Applications: A detailed explanation of SVD and its use cases.

1. Linear Algebra in Computer Graphics: Illustrates how linear algebra is used in 3D graphics transformations.

1. Linear Algebra and Differential Equations: Explores the connection between linear algebra and the solution of differential equations.

1. Top 5 Linear Algebra Textbooks for Beginners: Recommends five excellent linear algebra textbooks for students of varying levels.

linear algebra done right: Linear Algebra Done Right Sheldon Axler, 1997-07-18 This text for a second course in linear algebra, aimed at math majors and graduates, adopts a novel approach by banishing determinants to the end of the book and focusing on understanding the structure of linear operators on vector spaces. The author has taken unusual care to motivate concepts and to simplify proofs. For example, the book presents - without having defined determinants - a clean proof that every linear operator on a finite-dimensional complex vector space has an eigenvalue. The book starts by discussing vector spaces, linear independence, span, basics, and dimension. Students are introduced to inner-product spaces in the first half of the book and shortly thereafter to the finite- dimensional spectral theorem. A variety of interesting exercises in each chapter helps students understand and manipulate the objects of linear algebra. This second edition features new chapters on diagonal matrices, on linear functionals and adjoints, and on the spectral theorem; some sections, such as those on self-adjoint and normal operators, have been entirely rewritten; and hundreds of minor improvements have been made throughout the text.

linear algebra done right: *Measure, Integration & Real Analysis* Sheldon Axler, 2019-11-29 This open access textbook welcomes students into the fundamental theory of measure, integration, and real analysis. Focusing on an accessible approach, Axler lays the foundations for further study by promoting a deep understanding of key results. Content is carefully curated to suit a single course, or two-semester sequence of courses, creating a versatile entry point for graduate studies in all areas of pure and applied mathematics. Motivated by a brief review of Riemann integration and its deficiencies, the text begins by immersing students in the concepts of measure and integration. Lebesgue measure and abstract measures are developed together, with each providing key insight into the main ideas of the other approach. Lebesgue integration links into results such as the Lebesgue Differentiation Theorem. The development of products of abstract measures leads to Lebesgue measure on Rn. Chapters on Banach spaces, Lp spaces, and Hilbert spaces showcase major results such as the Hahn–Banach Theorem, Hölder’s Inequality, and the Riesz Representation Theorem. An in-depth study of linear maps on Hilbert spaces culminates in the Spectral Theorem and Singular Value Decomposition for compact operators, with an optional interlude in real and complex measures. Building on the Hilbert space material, a chapter on Fourier analysis provides an invaluable introduction to Fourier series and the Fourier transform. The final chapter offers a taste of probability. Extensively class tested at multiple universities and written by an award-winning mathematical expositor, Measure, Integration & Real Analysis is an ideal resource for students at the start of their journey into graduate mathematics. A prerequisite of elementary undergraduate real analysis is assumed; students and instructors looking to reinforce these ideas will appreciate the electronic Supplement for Measure, Integration & Real Analysis that is freely available online. For errata and updates, visit https://measure.axler.net/

linear algebra done right: *Linear Algebra Problem Book* Paul R. Halmos, 1995-12-31 Linear Algebra Problem Book can be either the main course or the dessert for someone who needs linear algebraand today that means every user of mathematics. It can be used as the basis of either an official course or a program of private study. If used as a course, the book can stand by itself, or if so desired, it can be stirred in with a standard linear algebra course as the seasoning that provides the interest, the challenge, and the motivation that is needed by experienced scholars as much as by

beginning students. The best way to learn is to do, and the purpose of this book is to get the reader to DO linear algebra. The approach is Socratic: first ask a question, then give a hint (if necessary), then, finally, for security and completeness, provide the detailed answer.

linear algebra done right: Linear Algebra Georgi? Evgen?evich Shilov, 1977-06-01 Covers determinants, linear spaces, systems of linear equations, linear functions of a vector argument, coordinate transformations, the canonical form of the matrix of a linear operator, bilinear and quadratic forms, Euclidean spaces, unitary spaces, quadratic forms in Euclidean and unitary spaces, finite-dimensional space. Problems with hints and answers.

linear algebra done right: Precalculus Sheldon Axler, 2017-08-21 Sheldon Axler's Precalculus: A Prelude to Calculus, 3rd Edition focuses only on topics that students actually need to succeed in calculus. This book is geared towards courses with intermediate algebra prerequisites and it does not assume that students remember any trigonometry. It covers topics such as inverse functions, logarithms, half-life and exponential growth, area, e, the exponential function, the natural logarithm and trigonometry.

linear algebra done right: *Introduction to Applied Linear Algebra* Stephen Boyd, Lieven Vandenberghe, 2018-06-07 A groundbreaking introduction to vectors, matrices, and least squares for engineering applications, offering a wealth of practical examples.

linear algebra done right: *Linear Algebra Via Exterior Products* Sergei Winitzki, 2009-07-30 This is a pedagogical introduction to the coordinate-free approach in basic finite-dimensional linear algebra. The reader should be already exposed to the array-based formalism of vector and matrix calculations. This book makes extensive use of the exterior (anti-commutative, wedge) product of vectors. The coordinate-free formalism and the exterior product, while somewhat more abstract, provide a deeper understanding of the classical results in linear algebra. Without cumbersome matrix calculations, this text derives the standard properties of determinants, the Pythagorean formula for multidimensional volumes, the formulas of Jacobi and Liouville, the Cayley-Hamilton theorem, the Jordan canonical form, the properties of Pfaffians, as well as some generalizations of these results.

linear algebra done right: *Algebra and Trigonometry* Sheldon Axler, 2011-03-08 Axler Algebra & Trigonometry is written for the two semester course. The text provides students with the skill and understanding needed for their coursework and for participating as an educated citizen in a complex society. Axler Algebra & Trigonometry focuses on depth, not breadth of topics by exploring necessary topics in greater detail. Readers will benefit from the straightforward definitions and plentiful examples of complex concepts. The Student Solutions Manual is integrated at the end of every section. The proximity of the solutions encourages students to go back and read the main text as they are working through the problems and exercises. The inclusion of the manual also saves students money. Axler Algebra & Trigonometry is available with WileyPLUS; an innovative, research-based, online environment for effective teaching and learning. WileyPLUS sold separately from text.

linear algebra done right: Linear Algebra Jim Hefferon, 2015 This text covers a standard first course : Gauss's method, vector spaces, linear maps and matrices, determinants, and eigenvalues and eigenvectors. In addition, each chapter ends with some topics such as brief applications. What sets it apart is careful motivation, many examples, and extensive exercise sets. Together these help each student master the material of this course, and also help an instructor develop that student's level of mathematical maturity. This book has been available online for many years and is widely used, both in classrooms and for self-study. It is supported by worked answers for all exercises, beamer slides for classroom use, and a lab manual of computer work--Page 4 of cover.

linear algebra done right: Calculus Gilbert Strang, Edwin Prine Herman, 2016-03-07 Published by OpenStax College, Calculus is designed for the typical two- or three-semester general calculus course, incorporating innovative features to enhance student learning. The book guides students through the core concepts of calculus and helps them understand how those concepts apply to their lives and the world around them. Due to the comprehensive nature of the material, we are

offering the book in three volumes for flexibility and efficiency. Volume 2 covers integration, differential equations, sequences and series, and parametric equations and polar coordinates.--BC Campus website.

linear algebra done right: *A Course in Linear Algebra* David B. Damiano, John B. Little, 2011-01-01 Suitable for advanced undergraduates and graduate students, this text introduces basic concepts of linear algebra. Each chapter contains an introduction, definitions, and propositions, in addition to multiple examples, lemmas, theorems, corollaries, andproofs. Each chapter features numerous supplemental exercises, and solutions to selected problems appear at the end. 1988 edition--

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linear algebra done right: Linear Algebra in Action Harry Dym, 2023-07-18 This book is based largely on courses that the author taught at the Feinberg Graduate School of the Weizmann Institute. It conveys in a user-friendly way the basic and advanced techniques of linear algebra from the point of view of a working analyst. The techniques are illustrated by a wide sample of applications and examples that are chosen to highlight the tools of the trade. In short, this is material that the author has found to be useful in his own research and wishes that he had been exposed to as a graduate student. Roughly the first quarter of the book reviews the contents of a basic course in linear algebra, plus a little. The remaining chapters treat singular value decompositions, convexity, special classes of matrices, projections, assorted algorithms, and a number of applications. The applications are drawn from vector calculus, numerical analysis, control theory, complex analysis, convex optimization, and functional analysis. In particular, fixed point theorems, extremal problems, best approximations, matrix equations, zero location and eigenvalue location problems, matrices with nonnegative entries, and reproducing kernels are discussed. This new edition differs significantly from the second edition in both content and style. It includes a number of topics that did not appear in the earlier edition and excludes some that did. Moreover, most of the material that has been adapted from the earlier edition has been extensively rewritten and reorganized.

linear algebra done right: *Harmonic Function Theory* Sheldon Axler, Paul Bourdon, Ramey Wade, 2013-11-11 This book is about harmonic functions in Euclidean space. This new edition contains a completely rewritten chapter on spherical harmonics, a new section on extensions of Bochers Theorem, new exercises and proofs, as well as revisions throughout to improve the text. A unique software package supplements the text for readers who wish to explore harmonic function theory on a computer.

linear algebra done right: Linear Algebra Kenneth Hoffman, Ray Alden Kunze, 2015

linear algebra done right: *Linear Algebra* Kuldeep Singh, 2013-10 This book is intended for first- and second-year undergraduates arriving with average mathematics grades ... The strength of the text is in the large number of examples and the step-by-step explanation of each topic as it is introduced. It is compiled in a way that allows distance learning, with explicit solutions to all of the set problems freely available online http://www.oup.co.uk/companion/singh -- From preface.

linear algebra done right: Introduction to Linear Algebra Serge Lang, 2012-12-06 This is a short text in linear algebra, intended for a one-term course. In the first chapter, Lang discusses the relation between the geometry and the algebra underlying the subject, and gives concrete examples of the notions which appear later in the book. He then starts with a discussion of linear equations, matrices and Gaussian elimination, and proceeds to discuss vector spaces, linear maps, scalar products, determinants, and eigenvalues. The book contains a large number of exercises, some of the routine computational type, while others are conceptual.

linear algebra done right: A First Course in Linear Algebra Kenneth Kuttler, Ilijas Farah, 2020 A First Course in Linear Algebra, originally by K. Kuttler, has been redesigned by the Lyryx editorial team as a first course for the general students who have an understanding of basic high

school algebra and intend to be users of linear algebra methods in their profession, from business & economics to science students. All major topics of linear algebra are available in detail, as well as justifications of important results. In addition, connections to topics covered in advanced courses are introduced. The textbook is designed in a modular fashion to maximize flexibility and facilitate adaptation to a given course outline and student profile. Each chapter begins with a list of student learning outcomes, and examples and diagrams are given throughout the text to reinforce ideas and provide guidance on how to approach various problems. Suggested exercises are included at the end of each section, with selected answers at the end of the textbook.--BCcampus website.

linear algebra done right: *Abstract Algebra* Dan Saracino, 2008-09-02 The Second Edition of this classic text maintains the clear exposition, logical organization, and accessible breadth of coverage that have been its hallmarks. It plunges directly into algebraic structures and incorporates an unusually large number of examples to clarify abstract concepts as they arise. Proofs of theorems do more than just prove the stated results; Saracino examines them so readers gain a better impression of where the proofs come from and why they proceed as they do. Most of the exercises range from easy to moderately difficult and ask for understanding of ideas rather than flashes of insight. The new edition introduces five new sections on field extensions and Galois theory, increasing its versatility by making it appropriate for a two-semester as well as a one-semester course.

linear algebra done right: *Problems and Theorems in Linear Algebra* Viktor Vasil_evich Prasolov, 1994-06-13 There are a number of very good books available on linear algebra. However, new results in linear algebra appear constantly, as do new, simpler, and better proofs of old results. Many of these results and proofs obtained in the past thirty years are accessible to undergraduate mathematics majors, but are usually ignored by textbooks. In addition, more than a few interesting old results are not covered in many books. In this book, the author provides the basics of linear algebra, with an emphasis on new results and on nonstandard and interesting proofs. The book features about 230 problems with complete solutions. It can serve as a supplementary text for an undergraduate or graduate algebra course.

linear algebra done right: Deep Learning for Coders with fastai and PyTorch Jeremy Howard, Sylvain Gugger, 2020-06-29 Deep learning is often viewed as the exclusive domain of math PhDs and big tech companies. But as this hands-on guide demonstrates, programmers comfortable with Python can achieve impressive results in deep learning with little math background, small amounts of data, and minimal code. How? With fastai, the first library to provide a consistent interface to the most frequently used deep learning applications. Authors Jeremy Howard and Sylvain Gugger, the creators of fastai, show you how to train a model on a wide range of tasks using fastai and PyTorch. You'll also dive progressively further into deep learning theory to gain a complete understanding of the algorithms behind the scenes. Train models in computer vision, natural language processing, tabular data, and collaborative filtering Learn the latest deep learning techniques that matter most in practice Improve accuracy, speed, and reliability by understanding how deep learning models work Discover how to turn your models into web applications Implement deep learning algorithms from scratch Consider the ethical implications of your work Gain insight from the foreword by PyTorch cofounder, Soumith Chintala

linear algebra done right: The Linear Algebra a Beginning Graduate Student Ought to Know Jonathan S. Golan, 2007-04-05 This book rigorously deals with the abstract theory and, at the same time, devotes considerable space to the numerical and computational aspects of linear algebra. It features a large number of thumbnail portraits of researchers who have contributed to the development of linear algebra as we know it today and also includes over 1,000 exercises, many of which are very challenging. The book can be used as a self-study guide; a textbook for a course in advanced linear algebra, either at the upper-class undergraduate level or at the first-year graduate level; or as a reference book.

linear algebra done right: A (Terse) Introduction to Linear Algebra Yitzhak Katznelson, Yonatan R. Katznelson, 2008 Linear algebra is the study of vector spaces and the linear maps

between them. It underlies much of modern mathematics and is widely used in applications.

linear algebra done right: *A Second Course in Linear Algebra* Stephan Ramon Garcia, Roger A. Horn, 2017-05-11 A second course in linear algebra for undergraduates in mathematics, computer science, physics, statistics, and the biological sciences.

linear algebra done right: *Holomorphic Spaces* Sheldon Jay Axler, John E. McCarthy, Donald Sarason, 1998-05-28 Expository articles describing the role Hardy spaces, Bergman spaces, Dirichlet spaces, and Hankel and Toeplitz operators play in modern analysis.

linear algebra done right: A Transition to Advanced Mathematics Douglas Smith, Maurice Eggen, Richard St. Andre, 2010-06-01 A TRANSITION TO ADVANCED MATHEMATICS helps students make the transition from calculus to more proofs-oriented mathematical study. The most successful text of its kind, the 7th edition continues to provide a firm foundation in major concepts needed for continued study and guides students to think and express themselves mathematically to analyze a situation, extract pertinent facts, and draw appropriate conclusions. The authors place continuous emphasis throughout on improving students' ability to read and write proofs, and on developing their critical awareness for spotting common errors in proofs. Concepts are clearly explained and supported with detailed examples, while abundant and diverse exercises provide thorough practice on both routine and more challenging problems. Students will come away with a solid intuition for the types of mathematical reasoning they'll need to apply in later courses and a better understanding of how mathematicians of all kinds approach and solve problems. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

linear algebra done right: Coding the Matrix Philip N. Klein, 2013-07 An engaging introduction to vectors and matrices and the algorithms that operate on them, intended for the student who knows how to program. Mathematical concepts and computational problems are motivated by applications in computer science. The reader learns by doing, writing programs to implement the mathematical concepts and using them to carry out tasks and explore the applications. Examples include: error-correcting codes, transformations in graphics, face detection, encryption and secret-sharing, integer factoring, removing perspective from an image, PageRank (Google's ranking algorithm), and cancer detection from cell features. A companion web site, codingthematrix.com provides data and support code. Most of the assignments can be auto-graded online. Over two hundred illustrations, including a selection of relevant xkcd comics. Chapters: The Function, The Field, The Vector, The Vector Space, The Matrix, The Basis, Dimension, Gaussian Elimination, The Inner Product, Special Bases, The Singular Value Decomposition, The Eigenvector, The Linear Program A new edition of this text, incorporating corrections and an expanded index, has been issued as of September 4, 2013, and will soon be available on Amazon.

linear algebra done right: Matrices and Linear Algebra Hans Schneider, George Phillip Barker, 2012-06-08 Linear algebra is one of the central disciplines in mathematics. A student of pure mathematics must know linear algebra if he is to continue with modern algebra or functional analysis. Much of the mathematics now taught to engineers and physicists requires it. This well-known and highly regarded text makes the subject accessible to undergraduates with little mathematical experience. Written mainly for students in physics, engineering, economics, and other fields outside mathematics, the book gives the theory of matrices and applications to systems of linear equations, as well as many related topics such as determinants, eigenvalues, and differential equations. Table of Contents: l. The Algebra of Matrices 2. Linear Equations 3. Vector Spaces 4. Determinants 5. Linear Transformations 6. Eigenvalues and Eigenvectors 7. Inner Product Spaces 8. Applications to Differential Equations For the second edition, the authors added several exercises in each chapter and a brand new section in Chapter 7. The exercises, which are both true-false and multiple-choice, will enable the student to test his grasp of the definitions and theorems in the chapter. The new section in Chapter 7 illustrates the geometric content of Sylvester's Theorem by means of conic sections and quadric surfaces. 6 line drawings. lndex. Two prefaces. Answer section.

linear algebra done right: Which One Doesn't Belong? Christopher Danielson, 2019-02-12

Talking math with your child is simple and even entertaining with this better approach to shapes! Written by a celebrated math educator, this innovative inquiry encourages critical thinking and sparks memorable mathematical conversations. Children and their parents answer the same question about each set of four shapes: Which one doesn't belong? There's no one right answer--the important thing is to have a reason why. Kids might describe the shapes as squished, smooshed, dented, or even goofy. But when they justify their thinking, they're talking math! Winner of the Mathical Book Prize for books that inspire children to see math all around them. This is one shape book that will both challenge readers' thinking and encourage them to think outside the box.--Kirkus Reviews, STARRED review

linear algebra done right: 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.

linear algebra done right: A First Course in Calculus Serge Lang, 2012-09-17 This fifth edition of Lang's book covers all the topics traditionally taught in the first-year calculus sequence. Divided into five parts, each section of A FIRST COURSE IN CALCULUS contains examples and applications relating to the topic covered. In addition, the rear of the book contains detailed solutions to a large number of the exercises, allowing them to be used as worked-out examples -- one of the main improvements over previous editions.

linear algebra done right: *A Glimpse at Hilbert Space Operators* Sheldon Axler, Peter Rosenthal, Donald Sarason, 2011-04-13 Paul Richard Halmos, who lived a life of unbounded devotion to mathematics and to the mathematical community, died at the age of 90 on October 2, 2006. This volume is a memorial to Paul by operator theorists he inspired. Paul’sinitial research,beginning with his 1938Ph.D. thesis at the University of Illinois under Joseph Doob, was in probability, ergodic theory, and measure theory. A shift occurred in the 1950s when Paul’s interest in foundations led him to invent a subject he termed algebraic logic, resulting in a succession of papers on that subject appearing between 1954 and 1961, and the book Algebraic Logic, published in 1962. Paul’s ?rst two papers in pure operator theory appeared in 1950. After 1960 Paul’s research focused on Hilbert space operators, a subject he viewed as enc- passing ?nite-dimensional linear algebra. Beyond his research, Paul contributed to mathematics and to its community in manifold ways: as a renowned expositor, as an innovative teacher, as a tireless editor, and through unstinting service to the American Mathematical Society and to the Mathematical Association of America. Much of Paul’s in?uence ?owed at a personal level. Paul had a genuine, uncalculating interest in people; he developed an enormous number of friendships over the years, both with mathematicians and with nonmathematicians. Many of his mathematical friends, including the editors ofthisvolume,whileabsorbingabundantquantitiesofmathematicsatPaul’sknee, learned from his advice and his example what it means to be a mathematician.

linear algebra done right: Linear Algebra Elizabeth S. Meckes, Mark W. Meckes, 2018-05-24 Linear Algebra offers a unified treatment of both matrix-oriented and theoretical approaches to the course, which will be useful for classes with a mix of mathematics, physics, engineering, and computer science students. Major topics include singular value decomposition, the spectral theorem, linear systems of equations, vector spaces, linear maps, matrices, eigenvalues and eigenvectors, linear independence, bases, coordinates, dimension, matrix factorizations, inner products, norms,

and determinants.

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