

linear algebra crash course

Linear Algebra Crash Course: Conquer the Fundamentals in Record Time

Introduction:

Feeling overwhelmed by the sheer mention of linear algebra? Do matrices and vectors send shivers down your spine? You're not alone! Many students find linear algebra challenging, but with the right approach, it can become surprisingly intuitive and even enjoyable. This comprehensive crash course breaks down the core concepts of linear algebra into digestible chunks, making it perfect for students needing a quick refresher, those starting their linear algebra journey, or anyone who wants to understand the underlying principles behind this fundamental branch of mathematics. We'll cover everything from vectors and matrices to eigenvalues and eigenvectors, equipping you with the essential knowledge needed to tackle more advanced topics. Get ready to conquer linear algebra!

I. Vectors: The Building Blocks of Linear Algebra

Linear algebra is built upon the foundation of vectors. Think of a vector as a directed arrow in space. It possesses both magnitude (length) and direction. We'll explore:

Vector Representation: How vectors are represented using coordinates (e.g., in two or three dimensions). We'll delve into column vectors and row vectors and their notations.

Vector Operations: We'll cover addition, subtraction, scalar multiplication, and the dot product (inner product) of vectors and their geometric interpretations.

Linear Combinations and Span: Understanding how to combine vectors using scalar multiplication and addition to create new vectors. The concept of the span of a set of vectors will be introduced.

Linear Independence: Determining whether a set of vectors can be expressed as linear combinations of each other. We'll introduce the concept of linearly independent and linearly dependent vectors and their importance.

II. Matrices: Organized Collections of Numbers

Matrices are rectangular arrays of numbers. They are powerful tools for representing linear transformations and solving systems of equations. This section will cover:

Matrix Notation and Types: Different types of matrices (square, diagonal, identity, etc.) and their notations.

Matrix Operations: We'll explore matrix addition, subtraction, scalar multiplication, and the crucial operation of matrix multiplication. We'll explain why matrix multiplication isn't commutative.

Matrix Transpose and Inverse: Understanding how to find the transpose of a matrix and, importantly, when and how to find the inverse of a matrix. We'll connect the inverse to

solving systems of equations.

Determinants and their Significance: Calculating the determinant of a matrix and its connection to invertibility. We'll explore the geometric interpretation of the determinant.

III. Systems of Linear Equations:

Solving systems of linear equations is a core application of linear algebra. This section will cover:

Representing Systems as Matrices: Learning to represent systems of linear equations in matrix form ($Ax = b$).

Gaussian Elimination and Row Reduction: Mastering the technique of Gaussian elimination to solve systems of linear equations efficiently.

Matrix Inverses and Solving Systems: Using matrix inverses to solve systems of linear equations (when the inverse exists).

Homogeneous Systems: Understanding the special case of homogeneous systems ($Ax = 0$) and their solutions.

IV. Vector Spaces and Subspaces:

This section introduces the abstract concept of vector spaces, which generalizes the notion of vectors.

Definition of a Vector Space: Understanding the axioms that define a vector space.

Subspaces: Exploring the concept of subspaces as subsets of vector spaces that are themselves vector spaces.

Basis and Dimension: Defining a basis for a vector space and understanding the concept of the dimension of a vector space.

Linear Transformations: Introducing the concept of linear transformations, which map vectors from one vector space to another.

V. Eigenvalues and Eigenvectors: Understanding Transformations

Eigenvalues and eigenvectors are crucial concepts in linear algebra, revealing fundamental properties of linear transformations.

Definition of Eigenvalues and Eigenvectors: Understanding what eigenvalues and eigenvectors represent.

Finding Eigenvalues and Eigenvectors: Learning the methods for calculating eigenvalues and eigenvectors of a matrix.

Eigenspaces: Exploring the concept of eigenspaces and their significance.

Diagonalization: Understanding when and how a matrix can be diagonalized and its applications.

VI. Applications of Linear Algebra

This section briefly explores some real-world applications of linear algebra to showcase its relevance.

Computer Graphics: How linear algebra is used in transformations and rendering in computer graphics.

Machine Learning: The use of linear algebra in algorithms like linear regression and principal component analysis.

Data Analysis: Applications in data analysis, such as dimensionality reduction.

Physics and Engineering: The role of linear algebra in solving systems of differential equations and modeling physical phenomena.

A Sample Linear Algebra Textbook Outline:

Title: Linear Algebra Demystified

Introduction: What is linear algebra? Why is it important?

Chapter 1: Vectors and Vector Spaces: Vector operations, linear combinations, linear independence, spanning sets, basis, dimension.

Chapter 2: Matrices and Matrix Operations: Matrix addition, subtraction, multiplication, transpose, inverse, determinants.

Chapter 3: Systems of Linear Equations: Gaussian elimination, row reduction, matrix inverses, homogeneous systems.

Chapter 4: Vector Spaces and Subspaces: Definition of a vector space, subspaces, basis, dimension, linear transformations.

Chapter 5: Eigenvalues and Eigenvectors: Definition, calculation, eigenspaces, diagonalization.

Chapter 6: Applications of Linear Algebra: Examples in computer science, engineering, and other fields.

Conclusion: Review of key concepts and further learning resources.

(Note: The following sections expand upon the points in the above outline. Due to the length constraint, detailed mathematical explanations are omitted, focusing instead on conceptual clarity and SEO-friendly content.)

Chapter 1: Vectors and Vector Spaces (Expanded): This chapter lays the groundwork. We will start with basic vector notation and operations, moving into more abstract concepts like vector spaces, subspaces, basis vectors, and dimensionality. The geometric interpretations of these concepts will be emphasized to build intuition. We will use plenty of visual examples to enhance understanding. Key terms like linear independence and span will be thoroughly explained with illustrative examples.

Chapter 2: Matrices and Matrix Operations (Expanded): This chapter introduces matrices as a powerful tool for organizing and manipulating data. We delve into matrix addition, subtraction, and especially matrix multiplication – emphasizing why it differs from scalar multiplication. We'll also cover the concepts of matrix transpose and the crucial concept of the inverse matrix, its existence conditions, and how it relates to solving systems of

equations. Calculating determinants will be covered, along with their geometric significance.

Chapter 3: Systems of Linear Equations (Expanded): This chapter shows how to use matrices to solve systems of linear equations efficiently. We'll teach Gaussian elimination and row reduction—a practical method to solve these systems—step-by-step. The connection between Gaussian elimination, matrix inverses, and solving systems of equations will be highlighted. Special attention will be paid to homogeneous systems and their unique characteristics.

Chapter 4: Vector Spaces and Subspaces (Expanded): This chapter introduces the more abstract concept of vector spaces. We will define a vector space axiomatically, which helps formalize the ideas we've been using intuitively. We'll then delve into subspaces, building upon the foundational knowledge of vectors. The concepts of basis and dimension will provide a way to characterize vector spaces. We'll introduce linear transformations as functions that preserve vector space structure.

Chapter 5: Eigenvalues and Eigenvectors (Expanded): This is where things get interesting. Eigenvalues and eigenvectors are key to understanding how linear transformations work. We explain how to find them using characteristic equations and introduce the concept of eigenspaces, which are subspaces associated with specific eigenvalues. Diagonalization, a powerful technique for simplifying matrices, will be explained, along with its limitations.

Chapter 6: Applications of Linear Algebra (Expanded): This chapter provides a glimpse into the real-world power of linear algebra. We'll give a brief overview of how linear algebra underpins algorithms in computer graphics (transformations, rotations, projections), machine learning (linear regression, principal component analysis), and data analysis (dimensionality reduction). We'll also touch upon its importance in physics and engineering for modeling physical systems.

Conclusion: This crash course aims to provide a solid foundation in linear algebra. Remember, consistent practice is key. Work through example problems, and don't hesitate to consult additional resources. The world of linear algebra is vast, and this is just the beginning.

FAQs:

1. What is the prerequisite for learning linear algebra? A strong foundation in algebra and some familiarity with basic trigonometry are helpful.
2. Is linear algebra hard? It can be challenging, but with consistent effort and the right approach, it's manageable.
3. What are the real-world applications of linear algebra? Countless! From computer

graphics and machine learning to physics and engineering.

4. What is the best way to learn linear algebra? A combination of textbooks, online resources, and practice problems is most effective.
5. Are there any online resources available for learning linear algebra? Yes, many excellent online courses and tutorials are available, including Khan Academy, Coursera, and edX.
6. How long does it take to learn linear algebra? The time required depends on your background and learning style, but a solid understanding can be gained in several weeks or months of dedicated study.
7. What software can be used for linear algebra calculations? MATLAB, Python with NumPy, and R are commonly used.
8. What are eigenvalues and eigenvectors used for? They provide essential information about the behavior of linear transformations.
9. What is the difference between a row vector and a column vector? They are the same set of numbers arranged differently—row vectors are horizontally arranged while column vectors are vertically arranged.

Related Articles:

1. Linear Algebra for Beginners: A gentle introduction to the core concepts, focusing on intuitive explanations.
2. Solving Systems of Linear Equations Using Matrices: A detailed guide on Gaussian elimination and row reduction techniques.
3. Understanding Vector Spaces and Subspaces: A deeper dive into the abstract concepts of vector spaces and their subspaces.
4. Eigenvalues and Eigenvectors: A Comprehensive Guide: An in-depth exploration of these critical concepts.
5. Linear Algebra Applications in Machine Learning: How linear algebra enables various machine learning algorithms.
6. Linear Algebra in Computer Graphics: How linear algebra drives transformations and rendering in 3D graphics.
7. Introduction to Linear Transformations: A clear explanation of linear transformations and their properties.
8. The Determinant of a Matrix: Calculation and Interpretation: A focused guide on

understanding and computing determinants.

9. Linear Algebra Cheat Sheet: A handy reference sheet summarizing key formulas and concepts.

linear algebra crash course: Basics of Linear Algebra for Machine Learning Jason Brownlee, 2018-01-24 Linear algebra is a pillar of machine learning. You cannot develop a deep understanding and application of machine learning without it. In this laser-focused Ebook, you will finally cut through the equations, Greek letters, and confusion, and discover the topics in linear algebra that you need to know. Using clear explanations, standard Python libraries, and step-by-step tutorial lessons, you will discover what linear algebra is, the importance of linear algebra to machine learning, vector, and matrix operations, matrix factorization, principal component analysis, and much more.

linear algebra crash course: Linear Algebra Robert J. Valenza, 1999-02-01 Based on lectures given at Claremont McKenna College, this text constitutes a substantial, abstract introduction to linear algebra. The presentation emphasizes the structural elements over the computational - for example by connecting matrices to linear transformations from the outset - and prepares the student for further study of abstract mathematics. Uniquely among algebra texts at this level, it introduces group theory early in the discussion, as an example of the rigorous development of informal axiomatic systems.

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

linear algebra crash course: No Bullshit Guide to Linear Algebra Ivan Savov, 2020-10-25 This textbook covers the material for an undergraduate linear algebra course: vectors, matrices, linear transformations, computational techniques, geometric constructions, and theoretical foundations. The explanations are given in an informal conversational tone. The book also contains 100+ problems and exercises with answers and solutions. A special feature of this textbook is the prerequisites chapter that covers topics from high school math, which are necessary for learning linear algebra. The presence of this chapter makes the book suitable for beginners and the general audience-readers need not be math experts to read this book. Another unique aspect of the book are the applications chapters (Ch 7, 8, and 9) that discuss applications of linear algebra to engineering, computer science, economics, chemistry, machine learning, and even quantum mechanics.

linear algebra crash course: Mathematics for Machine Learning Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020-04-23 The fundamental mathematical tools needed to understand machine learning include linear algebra, analytic geometry, matrix decompositions, vector calculus, optimization, probability and statistics. These topics are traditionally taught in disparate courses, making it hard for data science or computer science students, or professionals, to efficiently learn the mathematics. This self-contained textbook bridges the gap between mathematical and machine learning texts, introducing the mathematical concepts with a minimum of prerequisites. It uses these concepts to derive four central machine learning methods: linear regression, principal component analysis, Gaussian mixture models and support vector machines. For students and others with a mathematical background, these derivations provide a starting point to machine learning texts. For those learning the mathematics for the first time, the methods help build intuition and practical experience with applying mathematical concepts. Every chapter includes worked examples and exercises to test understanding. Programming tutorials are offered on the book's web site.

linear algebra crash course: *Introduction to Linear Algebra* Gilbert Strang, 2016-08-11 Linear algebra is something all mathematics undergraduates and many other students, in subjects ranging from engineering to economics, have to learn. The fifth edition of this hugely successful textbook retains all the qualities of earlier editions, while at the same time seeing numerous minor improvements and major additions. The latter include: • A new chapter on singular values and singular vectors, including ways to analyze a matrix of data • A revised chapter on computing in linear algebra, with professional-level algorithms and code that can be downloaded for a variety of languages • A new section on linear algebra and cryptography • A new chapter on linear algebra in probability and statistics. A dedicated and active website also offers solutions to exercises as well as new exercises from many different sources (including practice problems, exams, and development of textbook examples), plus codes in MATLAB®, Julia, and Python.

linear algebra crash course: *The Manga Guide to Linear Algebra* Shin Takahashi, Iroha Inoue, Co Ltd Trend, 2012-05-01 Reiji wants two things in life: a black belt in karate and Misa, the girl of his dreams. Luckily, Misa's big brother is the captain of the university karate club and is ready to strike a deal: Reiji can join the club if he tutors Misa in linear algebra. Follow along in *The Manga Guide to Linear Algebra* as Reiji takes Misa from the absolute basics of this tricky subject through mind-bending operations like performing linear transformations, calculating determinants, and finding eigenvectors and eigenvalues. With memorable examples like miniature golf games and karate tournaments, Reiji transforms abstract concepts into something concrete, understandable, and even fun. As you follow Misa through her linear algebra crash course, you'll learn about: -Basic vector and matrix operations such as addition, subtraction, and multiplication -Linear dependence, independence, and bases -Using Gaussian elimination to calculate inverse matrices -Subspaces, dimension, and linear span -Practical applications of linear algebra in fields like computer graphics, cryptography, and engineering But Misa's brother may get more than he bargained for as sparks start to fly between student and tutor. Will Reiji end up with the girl—or just a pummeling from her oversized brother? Real math, real romance, and real action come together like never before in *The Manga Guide to Linear Algebra*.

linear algebra crash course: *Linear Algebra* Kenneth Hoffman, Ray Alden Kunze, 2015

linear algebra crash course: *Math: a Crash Course* Brian/Morris Peet Clegg, Peet Morris, 2019-07-30 It's a sad truth that math has the reputation of being difficult. Part of the problem is that many of us simply don't speak the language. To a mathematician, an equation is a compact, efficient way to put across a relationship that would be far less comprehensible in words. But to many of us, the merest sign of an x, y, or symbol is an impenetrable mess that our eyes bounce off. This book provides an engaging overview of what math is and what it can do, without having to solve simultaneous equations or prove geometric theorems, far more of us might get the point of it. It is divided into four chapters, each covering a major developmental route in the topic, from Arithmetic & Numbers to Geometry and from Algebra & Calculus to Applied Mathematics.

linear algebra crash course: *Linear Algebra: Theory, Intuition, Code* Mike X. Cohen, 2021-02 Linear algebra is perhaps the most important branch of mathematics for computational sciences, including machine learning, AI, data science, statistics, simulations, computer graphics, multivariate analyses, matrix decompositions, signal processing, and so on. The way linear algebra is presented in traditional textbooks is different from how professionals use linear algebra in computers to solve real-world applications in machine learning, data science, statistics, and signal processing. For example, the determinant of a matrix is important for linear algebra theory, but should you actually use the determinant in practical applications? The answer may surprise you! If you are interested in learning the mathematical concepts linear algebra and matrix analysis, but also want to apply those concepts to data analyses on computers (e.g., statistics or signal processing), then this book is for you. You'll see all the math concepts implemented in MATLAB and in Python. Unique aspects of this book: - Clear and comprehensible explanations of concepts and theories in linear algebra. - Several distinct explanations of the same ideas, which is a proven technique for learning. - Visualization using graphs, which strengthens the geometric intuition of

linear algebra. - Implementations in MATLAB and Python. Com'on, in the real world, you never solve math problems by hand! You need to know how to implement math in software! - Beginner to intermediate topics, including vectors, matrix multiplications, least-squares projections, eigendecomposition, and singular-value decomposition. - Strong focus on modern applications-oriented aspects of linear algebra and matrix analysis. - Intuitive visual explanations of diagonalization, eigenvalues and eigenvectors, and singular value decomposition. - Codes (MATLAB and Python) are provided to help you understand and apply linear algebra concepts on computers. - A combination of hand-solved exercises and more advanced code challenges. Math is not a spectator sport!

linear algebra crash course: Linear Algebra for Economists Fuad Aleskerov, Hasan Ersel, Dmitri Piontkovski, 2011-08-18 This textbook introduces students of economics to the fundamental notions and instruments in linear algebra. Linearity is used as a first approximation to many problems that are studied in different branches of science, including economics and other social sciences. Linear algebra is also the most suitable to teach students what proofs are and how to prove a statement. The proofs that are given in the text are relatively easy to understand and also endow the student with different ways of thinking in making proofs. Theorems for which no proofs are given in the book are illustrated via figures and examples. All notions are illustrated appealing to geometric intuition. The book provides a variety of economic examples using linear algebraic tools. It mainly addresses students in economics who need to build up skills in understanding mathematical reasoning. Students in mathematics and informatics may also be interested in learning about the use of mathematics in economics.

linear algebra crash course: AP® Calculus AB & BC Crash Course, 2nd Ed., Book + Online J. Rosebush, Flavia Banu, 2016-10-06 REA's Crash Course® for the AP® Calculus AB & BC Exams - Gets You a Higher Advanced Placement® Score in Less Time 2nd Edition - Updated for the 2017 Exams The REA Crash Course is the top choice for the last-minute studier, or any student who wants a quick refresher on the subject. Are you crunched for time? Have you started studying for your Advanced Placement® Calculus AB & BC exams yet? How will you memorize everything you need to know before the tests? Do you wish there was a fast and easy way to study for the exams and boost your score? If this sounds like you, don't panic. REA's Crash Course for AP® Calculus AB & BC is just what you need. Go with America's No. 1 quick-review prep for AP® exams to get these outstanding features: Targeted, Focused Review - Study Only What You Need to Know The REA Crash Course is based on an in-depth analysis of the AP® Calculus AB & BC course description outline and actual AP® test questions. It covers only the information tested on the exams, so you can make the most of your valuable study time. Written by experienced AP® Calculus instructors, the targeted review chapters prepare students for the test by only focusing on the topics tested on the AP® Calculus AB & BC exams. Our easy-to-read format gives students a quick but strategic course in AP® Calculus AB & BC and covers functions, graphs, units, derivatives, integrals, and polynomial approximations and series. Expert Test-taking Strategies Our author shares detailed question-level strategies and explain the best way to answer AP® questions you'll find on the exams. By following this expert tips and advice, you can boost your overall point score! Take REA's Practice Exams After studying the material in the Crash Course, go to the online REA Study Center and test what you've learned. Our online practice exams (one for Calculus AB, one for Calculus BC) feature timed testing, detailed explanations of answers, and automatic scoring analysis. Each exam is balanced to include every topic and type of question found on the actual AP® exam, so you know you're studying the smart way. Whether you're cramming for the test at the last minute, looking for an extra edge, or want to study on your own in preparation for the exams - this is the quick-review study guide every AP® Calculus AB & BC student should have. When it's crunch time and your Advanced Placement® exam is just around the corner, you need REA's Crash Course® for AP® Calculus AB & BC! About the Authors Joan Marie Rosebush teaches calculus courses at the University of Vermont. Ms. Rosebush has taught mathematics to elementary, middle school, high school, and college students. She taught AP® Calculus via satellite television to high school students scattered throughout

Vermont. Ms. Rosebush earned her Bachelor of Arts degree in elementary education, with a concentration in mathematics, at the University of New York in Cortland, N.Y. She received her Master's Degree in education from Saint Michael's College, Colchester, Vermont. Flavia Banu graduated from Queens College of the City University of New York with a B.A. in Pure Mathematics and an M.A. in Pure Mathematics in 1997. Ms. Banu was an adjunct professor at Queens College where she taught Algebra and Calculus II. Currently, she teaches mathematics at Bayside High School in Bayside, New York, and coaches the math team for the school. Her favorite course to teach is AP® Calculus because it requires "the most discipline, rigor and creativity." About Our Editor and Technical Accuracy Checker Stu Schwartz has been teaching mathematics since 1973. For 35 years he taught in the Wissahickon School District, in Ambler, Pennsylvania, specializing in AP® Calculus AB and BC and AP® Statistics. Mr. Schwartz received his B.S. degree in Mathematics from Temple University, Philadelphia. Mr. Schwartz was a 2002 recipient of the Presidential Award for Excellence in Mathematics Teaching and also won the 2007 Outstanding Educator of the Year Award for the Wissahickon School District. Mr. Schwartz's website, www.mastermathmentor.com, is geared toward helping educators teach AP® Calculus, AP® Statistics, and other math courses. Mr. Schwartz is always looking for ways to provide teachers with new and innovative teaching materials, believing that it should be the goal of every math teacher not only to teach students mathematics, but also to find joy and beauty in math as well.

linear algebra crash course: Foundations of Data Science Avrim Blum, John Hopcroft, Ravindran Kannan, 2020-01-23 This book provides an introduction to the mathematical and algorithmic foundations of data science, including machine learning, high-dimensional geometry, and analysis of large networks. Topics include the counterintuitive nature of data in high dimensions, important linear algebraic techniques such as singular value decomposition, the theory of random walks and Markov chains, the fundamentals of and important algorithms for machine learning, algorithms and analysis for clustering, probabilistic models for large networks, representation learning including topic modelling and non-negative matrix factorization, wavelets and compressed sensing. Important probabilistic techniques are developed including the law of large numbers, tail inequalities, analysis of random projections, generalization guarantees in machine learning, and moment methods for analysis of phase transitions in large random graphs. Additionally, important structural and complexity measures are discussed such as matrix norms and VC-dimension. This book is suitable for both undergraduate and graduate courses in the design and analysis of algorithms for data.

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linear algebra crash course: The Complete Idiot's Guide to Algebra W. Michael Kelley, 2004 The complete hands-on, how-to guide to engineering an outstanding customer experience! Beyond Disney and Harley-Davidson - Practical, start-to-finish techniques to be used right now, whatever is sold. Leverages the latest neuroscience to help readers assess, audit, design, implement and steward any customer experience. By Lou Carbone, CEO of Experience Engineering, Inc., the world's #1 customer experience consultancy.

linear algebra crash course: All of Statistics Larry Wasserman, 2013-12-11 Taken literally, the title All of Statistics is an exaggeration. But in spirit, the title is apt, as the book does cover a much broader range of topics than a typical introductory book on mathematical statistics. This book is for people who want to learn probability and statistics quickly. It is suitable for graduate or advanced undergraduate students in computer science, mathematics, statistics, and related disciplines. The book includes modern topics like non-parametric curve estimation, bootstrapping, and classification, topics that are usually relegated to follow-up courses. The reader is presumed to know calculus and a little linear algebra. No previous knowledge of probability and statistics is required. Statistics, data mining, and machine learning are all concerned with collecting and analysing data.

linear algebra crash course: Data Science from Scratch Joel Grus, 2015-04-14 Data science libraries, frameworks, modules, and toolkits are great for doing data science, but they're also a good way to dive into the discipline without actually understanding data science. In this book, you'll learn how many of the most fundamental data science tools and algorithms work by implementing them from scratch. If you have an aptitude for mathematics and some programming skills, author Joel Grus will help you get comfortable with the math and statistics at the core of data science, and with hacking skills you need to get started as a data scientist. Today's messy glut of data holds answers to questions no one's even thought to ask. This book provides you with the know-how to dig those answers out. Get a crash course in Python Learn the basics of linear algebra, statistics, and probability—and understand how and when they're used in data science Collect, explore, clean, munge, and manipulate data Dive into the fundamentals of machine learning Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees, neural networks, and clustering Explore recommender systems, natural language processing, network analysis, MapReduce, and databases

linear algebra crash course: Basic Linear Algebra T.S. Blyth, E.F. Robertson, 2013-12-01 Basic Linear Algebra is a text for first year students leading from concrete examples to abstract theorems, via tutorial-type exercises. More exercises (of the kind a student may expect in examination papers) are grouped at the end of each section. The book covers the most important basics of any first course on linear algebra, explaining the algebra of matrices with applications to analytic geometry, systems of linear equations, difference equations and complex numbers. Linear equations are treated via Hermite normal forms which provides a successful and concrete explanation of the notion of linear independence. Another important highlight is the connection between linear mappings and matrices leading to the change of basis theorem which opens the door to the notion of similarity. This new and revised edition features additional exercises and coverage of

Cramer's rule (omitted from the first edition). However, it is the new, extra chapter on computer assistance that will be of particular interest to readers: this will take the form of a tutorial on the use of the LinearAlgebra package in MAPLE 7 and will deal with all the aspects of linear algebra developed within the book.

linear algebra crash course: *Introduction to Algebraic Geometry* Steven Dale Cutkosky, 2018-06-01 This book presents a readable and accessible introductory course in algebraic geometry, with most of the fundamental classical results presented with complete proofs. An emphasis is placed on developing connections between geometric and algebraic aspects of the theory. Differences between the theory in characteristic and positive characteristic are emphasized. The basic tools of classical and modern algebraic geometry are introduced, including varieties, schemes, singularities, sheaves, sheaf cohomology, and intersection theory. Basic classical results on curves and surfaces are proved. More advanced topics such as ramification theory, Zariski's main theorem, and Bertini's theorems for general linear systems are presented, with proofs, in the final chapters. With more than 200 exercises, the book is an excellent resource for teaching and learning introductory algebraic geometry.

linear algebra crash course: *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

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