PROOF AND THE ART OF MATHEMATICS

JOEL DAVID HAMKINS

[PDF] Proof And The Art Of Mathematics

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Proof and the Art of Mathematics-Joel David Hamkins 2021-02-23 How to write mathematical proofs, shown in fully-worked out examples. This is a companion volume Joel Hamkins's Proof and the Art of Mathematics, providing fully worked-out solutions to all of the odd-numbered exercises as well as a few of the even-numbered exercises. In many cases, the solutions go beyond the exercise question itself to the natural extensions of the ideas, helping readers learn how to approach a mathematical investigation. As Hamkins asks, "Once you have solved a problem, why not push the ideas harder to see what further you can prove with them?" These solutions offer readers examples of how to write a mathematical proofs. The mathematical development of this text follows the main book, with the same chapter topics in the same order, and all theorem and exercise numbers in this text refer to the corresponding statements of the main text.

The Art of Proof-Matthias Beck 2010-08-17 The Art of Proof is designed for a one-semester or two-quarter course. A typical student will have studied calculus (perhaps also linear algebra) with reasonable success. With an artful mixture of chatty style and interesting examples, the student's previous intuitive knowledge is placed on solid intellectual ground. The topics covered include: integers, induction, algorithms, real numbers, rational numbers, modular arithmetic, limits, and uncountable sets. Methods, such as axiom, theorem and proof, are taught while discussing the mathematics rather than in abstract isolation. The book ends with short essays on further topics suitable for seminar-style presentation by small teams of students, either in class or in a mathematics club setting.

These include: continuity, cryptography, groups, complex numbers, ordinal number, and generating functions.

Proofs that Really Count: The Art of Combinatorial Proof-Arthur T. Benjamin 2003-11-13 Recipient of the Mathematical Association of America's Beckenbach Book Prize in 2006! Mathematics is the science of patterns, and mathematicians attempt to understand these patterns and discover new ones using a variety of tools. In Proofs That Really Count, award-winning math professors Arthur Benjamin and Jennifer Quinn demonstrate that many number patterns, even very complex ones, can be understood by simple counting arguments. The book emphasizes numbers that are often not thought of as numbers that count: Fibonacci Numbers, Lucas Numbers, Continued Fractions, and Harmonic Numbers, to name a few. Numerous hints and references are given for all chapter exercises and many chapters end with a list of identities in need of combinatorial proof. The extensive appendix of identities will be a valuable resource. This book should appeal to readers of all levels, from high school math students to professional mathematicians.

Proofs from THE BOOK-Martin Aigner 2013-06-29 According to the great mathematician Paul Erdös, God maintains perfect mathematical proofs in The Book. This book presents the authors candidates for such "perfect proofs," those which contain brilliant ideas, clever connections, and wonderful observations, bringing new insight and surprising perspectives to problems from number theory, geometry, analysis, combinatorics, and graph theory. As a result, this book will be fun reading for anyone with an interest in mathematics.

How to Prove It-Daniel J. Velleman 2006-01-16 Many students have trouble the first time they take a mathematics course in which proofs play a significant role. This new edition of Velleman's successful text will prepare students to make the transition from solving problems to proving theorems by teaching them the techniques needed to read and write proofs. The book begins with the basic concepts of logic and set theory, to familiarize students with the language of mathematics and how it is interpreted. These concepts are used as the basis for a step-by-step breakdown of the most important techniques used in constructing proofs. The author shows how complex proofs are built up from these smaller steps, using detailed 'scratch work' sections to expose the machinery of proofs about the natural numbers, relations, functions, and infinite sets. To give students the opportunity to construct their own proofs, this new edition contains over 200 new exercises, selected solutions, and an introduction to Proof Designer software. No background beyond standard high school mathematics is assumed. This book will be useful to anyone interested in logic and proofs: computer scientists, philosophers, linguists, and of course mathematicians.

Robot-Proof-Joseph E. Aoun 2017-08-25 How to educate the next generation of college students to invent, to create, and to discover—filling needs that even the most sophisticated robot cannot. Driverless cars are hitting the road, powered by artificial intelligence. Robots can climb stairs, open doors, win Jeopardy, analyze stocks, work in factories, find parking spaces, advise oncologists. In the past, automation was considered a threat to low-skilled labor. Now, many high-skilled functions, including interpreting medical images, doing legal research, and analyzing data, are within the skill sets of machines. How can higher education prepare students for their professional lives when professions themselves are disappearing? In Robot-Proof, Northeastern University president Joseph Aoun proposes a way to educate the next generation of college students to invent, to create, and to discover—to fill needs in society that even the most sophisticated artificial intelligence agent cannot. A "robot-proof" education, Aoun argues, is not concerned solely with topping up students' minds with high-octane facts. Rather, it calibrates them with a creative mindset and the mental elasticity to invent,

discover, or create something valuable to society—a scientific proof, a hip-hop recording, a web comic, a cure for cancer. Aoun lays out the framework for a new discipline, humanics, which builds on our innate strengths and prepares students to compete in a labor market in which smart machines work alongside human professionals. The new literacies of Aoun's humanics are data literacy, technological literacy, and human literacy. Students will need data literacy to manage the flow of big data, and technological literacy to know how their machines work, but human literacy—the humanities, communication, and design—to function as a human being. Life-long learning opportunities will support their ability to adapt to change. The only certainty about the future is change. Higher education based on the new literacies of humanics can equip students for living and working through change.

The Art of Proving Binomial Identities-Michael Z. Spivey 2019-05-10 The book has two goals: (1) Provide a unified treatment of the binomial coefficients, and (2) Bring together much of the undergraduate mathematics curriculum via one theme (the binomial coefficients). The binomial coefficients arise in a variety of areas of mathematics: combinatorics, of course, but also basic algebra (binomial theorem), infinite series (Newton's binomial series), differentiation (Leibniz's generalized product rule), special functions (the beta and gamma functions), probability, statistics, number theory, finite difference calculus, algorithm analysis, and even statistical mechanics.

Proof-Norton Simon Museum (Pasadena, Calif.) 2011 Published in conjunction with an exhibition held at the Norton Simon Museum, Pasadena, Calif., Oct. 1, 2011-Apr. 2, 2012.

Legal Evidence and Proof-Henry Prakken 2016-04-22 As a result of recent scandals concerning evidence and proof in the administration of criminal justice - ranging from innocent people on death row in the United States to misuse of statistics leading to wrongful convictions in The Netherlands and elsewhere - inquiries into the logic of evidence and proof have taken on a new urgency both in an academic and practical sense. This study presents a broad perspective on logic by focusing

on inference not just in isolation but as embedded in contexts of procedure and investigation. With special attention being paid to recent developments in Artificial Intelligence and the Law, specifically related to evidentiary reasoning, this book provides clarification of problems of logic and argumentation in relation to evidence and proof. As the vast majority of legal conflicts relate to contested facts, rather than contested law, this volume concerning facts as prime determinants of legal decisions presents an important contribution to the field for both scholars and practitioners.

Proof-Adam Rogers 2014 A spirited, history-rich narrative on the art and science of alcohol discusses everything from fermentation and distillation to traditions and the effects of alcohol on the body and brain. 25,000 first printing.

Proof-David Auburn 2001 Melbourne Theatre Company Programs.

Q.E.D.-Burkard Polster 2004-05-01 Q.E.D. presents some of the most famous mathematical proofs in a charming book that will appeal to nonmathematicians and math experts alike. Grasp in an instant why Pythagoras's theorem must be correct. Follow the ancient Chinese proof of the volume formula for the frustrating frustum, and Archimedes' method for finding the volume of a sphere. Discover the secrets of pi and why, contrary to popular belief, squaring the circle really is possible. Study the subtle art of mathematical domino tumbling, and find out how slicing cones helped save a city and put a man on the moon.

Proofs and Theories-Louise Gluck 1995-12-01 Winner of the 1993 PEN/Martha Albrand Award for First Non-Fiction, Proofs and Theories is an illuminating collection of essays by Louise Glück, whose most recent book of poems, The Wild Iris, was awarded the Pulitzer Prize. Glück brings to her prose the same precision of language, the same incisiveness and insight that distinguish her poetry. The force of her thought is evident everywhere in these essays, from her explorations of other poets' work to her skeptical contemplation of current literary critical notions such as "sincerety" and "courage." Here also are Glück's revealing reflections on her own

education and life as a poet, and a tribute to her teacher and mentor, Stanley Kunitz. Proofs and Theories is the testament of a major poet.

Godel's Proof-Ernest Nagel 2012-11-12 The first book to present a readable explanation of Godel's theorem to both scholars and non-specialists, this is a gripping combination of science and accessibility, offering those with a taste for logic and philosophy the chance to satisfy their intellectual curiosity.

Lectures on the Philosophy of Mathematics-Joel David Hamkins 2021-02-02 An introduction to the philosophy of mathematics grounded in mathematics and motivated by mathematical inquiry and practice. In this book, Joel David Hamkins offers an introduction to the philosophy of mathematics that is grounded in mathematics and motivated by mathematical inquiry and practice. He treats philosophical issues as they arise organically in mathematics, discussing such topics as platonism, realism, logicism, structuralism, formalism, infinity, and intuitionism in mathematical contexts. He organizes the book by mathematical themes-- numbers, rigor, geometry, proof, computability, incompleteness, and set theory--that give rise again and again to philosophical considerations.

99 Variations on a Proof-Philip Ording 2019-02-05 An exploration of mathematical style through 99 different proofs of the same theorem This book offers a multifaceted perspective on mathematics by demonstrating 99 different proofs of the same theorem. Each chapter solves an otherwise unremarkable equation in distinct historical, formal, and imaginative styles that range from Medieval, Topological, and Doggerel to Chromatic, Electrostatic, and Psychedelic. With a rare blend of humor and scholarly aplomb, Philip Ording weaves these variations into an accessible and wide-ranging narrative on the nature and practice of mathematics. Inspired by the experiments of the Paris-based writing group known as the Oulipo—whose members included Raymond Queneau, Italo Calvino, and Marcel Duchamp—Ording explores new ways to examine the aesthetic possibilities of mathematical activity. 99 Variations on a Proof is a mathematical take on Queneau's Exercises in Style, a collection of 99 retellings of the same story, and it draws unexpected connections to

everything from mysticism and technology to architecture and sign language. Through diagrams, found material, and other imagery, Ording illustrates the flexibility and creative potential of mathematics despite its reputation for precision and rigor. Readers will gain not only a bird's-eye view of the discipline and its major branches but also new insights into its historical, philosophical, and cultural nuances. Readers, no matter their level of expertise, will discover in these proofs and accompanying commentary surprising new aspects of the mathematical landscape.

How to Do Math Proofs-Noah Ras 2014-12-23 This book has been teaching students how to do proofs for over 25 years. This text provides an excellent approach for teaching students how to read, understand, and do proofs. The various examples and techniques explains when each technique is likely to be used, based on certain key words that appear in the problem under consideration. Doing so enables students to choose a technique based on the form of the problem. The goal is to enable students to learn advanced mathematics on their own.

Proof-Peter Galassi 2020-02-25 A glimpse inside the darkroom--and into the strategies of renowned photographers

Proof of God Within & Beyond Science-Charles De Silva 2021-02-12 While extending a strong challenge to the superstition of atheism, the principal aim of this book is to demonstrate the fact that the major scientific discoveries that have been made so far, distinctively and expressly reveal the existence of an intelligent and omnipotent Designer who has thoughtfully and intentionally instituted all universal laws with stark precision and accuracy. In this discussion I have also emphasized the incapability of science to stand alone as a final deciding instrument on matters that extend beyond the natural realm. Hence no proof of the Divine Existence can be established by reference to science alone, but through logical reasoning based on obvious and explicit facts. I have also highlighted the reality that most scientific phenomena cannot be explained without recourse to the role of a Supernatural Power.

Type Theory and Formal Proof-Rob Nederpelt 2014-11-06 Type theory is a fast-evolving field at the crossroads of logic, computer science and mathematics. This gentle step-by-step introduction is ideal for graduate students and researchers who need to understand the ins and outs of the mathematical machinery, the role of logical rules therein, the essential contribution of definitions and the decisive nature of well-structured proofs. The authors begin with untyped lambda calculus and proceed to several fundamental type systems, including the well-known and powerful Calculus of Constructions. The book also covers the essence of proof checking and proof development, and the use of dependent type theory to formalise mathematics. The only prerequisite is a basic knowledge of undergraduate mathematics. Carefully chosen examples illustrate the theory throughout. Each chapter ends with a summary of the content, some historical context, suggestions for further reading and a selection of exercises to help readers familiarise themselves with the material.

Art Gallery Theorems and Algorithms-Joseph O'Rourke 1987 Art gallery theorems and algorithms are so called because they relate to problems involving the visibility of geometrical shapes and their internal surfaces. This book explores generalizations and specializations in these areas. Among the presentations are recently discovered theorems on orthogonal polygons, polygons with holes, exterior visibility, visibility graphs, and visibility in three dimensions. The author formulates many open problems and offers several conjectures, providing arguments which may be followed by anyone familiar with basic graph theory and algorithms. This work may be applied to robotics and artificial intelligence as well as other fields, and will be especially useful to computer scientists working with computational and combinatorial geometry.

Proof of Heaven?-Coleman Luck 2013-04 Neurosurgeon, Dr. Eben Alexander, was brain dead for seven days. During that period he believes that he went through death's door and experienced the incredible beauty of Heaven. While he was there, he was given a message to bring back to the world. For him, the vision was life-changing. From being a scientist and a secular materialist, his worldview was transformed. Because of what happened to him,

he now believes in the miraculous and in a life beyond death. But did he experience reality? Was the message that he was given true? Coleman Luck has spent decades studying illusions and the paranormal, both as a professional writer in Hollywood where illusion is the stock-in-trade, and as a mentalist and member of the Academy of Magical Arts at the world-famous Magic Castle in Hollywood. Also, he is a student of the Bible, educated at the Moody Bible Institute in Chicago. From this unique perspective Coleman examines the profound visions and truth-claims presented in Proof of Heaven. Coleman's other books include Angel Fall and The Mentalist Prophecies - Book One: Dagon's Illusion.

Proof Positive-Neil Nedley 1999 A must for all wanting to use natural means for preventing or treating high blood pressure, blocked arteries, cancer, chronic fatigue, diabetes, osteoporosis, and many other afflictions. Provides information that minimizes the use of prescription drugs, diet fads, and their accompanying side effects. Highly illustrated in full color, this tome of information is designed to be readable and easy-to-understand. Singular case studies, which can be misleading, are not used. Instead, the results of a host of scientific studies conducted around the world are cited, many of which involve large groups of individuals with widely varying lifestyles. Many topics are covered such as how to strengthen the immune system, overcome addictions, increase reasoning ability, cope with stress, and enhance children's mental and physical potential.

Hope Returns-Carolyn Digh Griffin 2008-07 On the heels of her mother's death, Hope Logan reluctantly returned to her grandparents' home place in search of a journal that revealed explosive crimes and atrocities of the past that had haunted her grandma for nearly sixty-five years. Bitterness, unforgiveness, and anger consumed her as she set out to solve the mystery that surrounded her grandma's life. The dark evil secret that was contained in the journal only deepened her resentment of God. Because of her quest, she came in contact with many strong believers, especially a handsome young pastor and three senior citizens. In that small town in the foothills of the mountains of North Carolina, Hope's bitterness, unforgiveness, and anger slowly began to fade in the light of the strong faith of the young pastor and three senior

citizens. She discovered the true meaning of faith and hope in Christ in the midst of adversity. Carolyn Digh Griffin, a native North Carolinian, resides in Waxhaw, North Carolina, with her husband, Hoyle. She is retired from Union County Public Schools where she was an Administrative Assistant to the Assistant Superintendent. She has two daughters and four grandchildren who also reside in the Old North State.

One Hundred Proofs That the Earth Is Not a Globe-William Carpenter 2019-11-19 "One Hundred Proofs That the Earth Is Not a Globe" by William Carpenter. Published by Good Press. Good Press publishes a wide range of titles that encompasses every genre. From well-known classics & literary fiction and non-fiction to forgotten−or yet undiscovered gems−of world literature, we issue the books that need to be read. Each Good Press edition has been meticulously edited and formatted to boost readability for all e-readers and devices. Our goal is to produce eBooks that are user-friendly and accessible to everyone in a high-quality digital format.

The Robot-Proof Recruiter-Katrina Collier 2019-08-03 FINALIST: Business Book Awards 2020 - HR & Management Category In a world of work where recruiters are constantly hearing that their role is at risk from AI, robotics and chatbots, it has never been more important to effectively attract and recruit the right people. Leveraging the power of social media and digital sourcing strategies is only part of the solution, and simply posting a job or sending a LinkedIn InMail is no longer enough. The Robot-Proof Recruiter shows you how to use the tools that reveal information that can be used to grab a potential candidate's attention among the overwhelming volume of material online. Full of expert guidance and practical tips, this book explains what works, what doesn't, and how you can stand out and recruit effectively in a world of technology overload. The Robot-Proof Recruiter will enable you to become the recruiter that candidates trust and the one they want to talk to. It contains essential guidance on overcoming obstacles - including how to recruit without an existing online presence, how to work effectively with hiring managers to improve the candidate experience, and how to use technology to support the candidate's journey from initial outreach, to

application, to employee, and through to alumnus. This is an indispensable book for all recruitment professionals and HR practitioners who want to recruit the right people for their organization.

The Art of Loving-Erich Fromm 2013-02-26 The landmark bestseller that changed the way we think about love: "Every line is packed with common sense, compassion, and realism" (Fortune). The Art of Loving is a rich and detailed guide to love—an achievement reached through maturity, practice, concentration, and courage. In the decades since the book's release, its words and lessons continue to resonate. Erich Fromm, a celebrated psychoanalyst and social psychologist, clearly and sincerely encourages the development of our capacity for and understanding of love in all of its facets. He discusses the familiar yet misunderstood romantic love, the all-encompassing brotherly love, spiritual love, and many more. A challenge to traditional Western notions of love, The Art of Loving is a modern classic about taking care of ourselves through relationships with others by the New York Times–bestselling author of To Have or To Be? and Escape from Freedom. This ebook features an illustrated biography of Erich Fromm including rare images and never-before-seen documents from the author's estate.

The Psychology of Proof-Lance J. Rips 1994 In this provocative book, Lance Rips describes a unified theory of natural deductive reasoning and fashions a working model of deduction, with strong experimental support, that is capable of playing a central role in mental life.Rips argues that certain inference principles are so central to our notion of intelligence and rationality that they deserve serious psychological investigation to determine their role in individuals' beliefs and conjectures. Asserting that cognitive scientists should consider deductive reasoning as a basis for thinking, Rips develops a theory of natural reasoning abilities and shows how it predicts mental successes and failures in a range of cognitive tasks.In parts I and II of the book Rips builds insights from cognitive psychology, logic, and artificial intelligence into a unified theoretical structure. He defends the idea that deduction depends on the ability to construct mental proofs - actual memory units that link given information to conclusions it warrants. From this base Rips develops a computational

model of deduction based on two cognitive skills: the ability to make suppositions or assumptions and the ability to posit sub-goals for conclusions. A wide variety of original experiments support this model, including studies of human subjects evaluating logical arguments as well as following and remembering proofs. Unlike previous theories of mental proof, this one handles names and variables in a general way. This capability enables deduction to play a crucial role in other thought processes,such as classifying and problem solving.In part III Rips compares the theory to earlier approaches in psychology which confined the study of deduction to a small group of tasks, and examines whether the theory is too rational or too irrational in its mode of thought.Lance J. Rips is Professor of Psychology at Northwestern University.

How to Read and Do Proofs-Daniel Solow 1991-12-05 This straightforward guide describes the main methods used to prove mathematical theorems. Shows how and when to use each technique such as the contrapositive, induction and proof by contradiction. Each method is illustrated by step-by-step examples. The Second Edition features new chapters on nested quantifiers and proof by cases, and the number of exercises has been doubled with answers to odd-numbered exercises provided. This text will be useful as a supplement in mathematics and logic courses. Prerequisite is high-school algebra.

Living Proof-John Capecci 2012 The first comprehensive guide to telling a personal story as an advocate or spokesperson for a cause or organization.

Mistakes Are Proof That You Are Trying-Samantha Snyder 2015-06-06 An Adult Coloring Art Book For All Ages--Fun, Inspiration, and Relaxation. Mistakes Are Proof That You Are Trying shares 50 doodle art images of inspiring sayings, quotes, and words printed on one side of the page for all ages to color. Quotes from famous authors include Aristotle, Ralph Waldo Emerson, Benjamin Franklin, Florence Nightingale, William Shakespeare, Walt Whitman, and more. The book also includes sayings and words from Discover and It takes a big heart to shape little minds to Remain Curious and To teach is to touch a life forever. Each doodle art image has been carefully selected to

provide plenty of enjoyment, inspiration, and relaxation. Coloring isn't just for the kids anymore! There is something for everyone, so take a minute, explore the magic of it all, and live a colorful life! Explore the Magic of Doodle Art.

Dead Innocent-T. J. Bleakley 2015-01-12 An employee of your firm is dead, killed in a motoring accident. It was sudden, of course, and it came as a shock to you. You don't know how to deal with it at first - he was also a friend - and then you learn that two children were in the rear of the van, both of which had been recently abducted. However bad it looks, you know that he's innocent . . . He isn't that type of man. You knew him. He wasn't like that. Business owner, Seth Allen, sets out to prove the innocence of the recently deceased by uncovering the truth behind the child abductions, but the people involved in an incident that happened nearly two decades ago come back on the scene, some of which are there to help, some of which are looking for revenge . . . Seth is pulled in to a world of crime, lies and murder, all in the effort to clear a man's name, but when a five-year-old girl goes missing, there's more on the line than simply saving the reputation of a man he once helped to rebuild his life.

Fractal Art Adult Coloring Book-Tabz Jones 2016-02-26 Twenty five highly detailed grayscale coloring pages feature the fantasy fractal artwork of Tabz Jones. Fractal art is a definite product of the modern age. Where else could you use mathmatical algorithms to create images? The repeating patterns of the equations are manipulated using a software program to change color, form, and shape to create a final artwork that is a one of a kind.

The Art of Logic-Eugenia Cheng 2018-07-05 Emotions are powerful. In newspaper headlines and on social media, they have become the primary way of understanding the world. But strong feelings make it more difficult to see the reality behind the rhetoric. In The Art of Logic, Eugenia Cheng shows how mathematical logic can help us see things more clearly - and know when politicians and companies are trying to mislead us. First Cheng explains how to use black-and-white logic to illuminate the world around us, giving us new insight into thorny political questions like public healthcare, Black

Lives Matter and Brexit. Then she explains how logic and emotions, used side-by-side, can help us not only to be more rational individuals, but also to live more thoughtfully. Clear-sighted, revelatory and filled with useful real-life examples of logic and illogic at work, The Art of Logic is an essential guide to decoding modern life.

Once Upon a Christmas-Christy Newton 2016-09-15 Theia North never believed in writer's block until after her first romance novel was on the NYT Best Sellers List. Pressure mounted and she couldn't seem to find the words for her next book. On a deadline, and with her sister's encouragement, Theia rents out a cabin in Montana for solitude and inspiration. Elliot Asher has no idea Theia's an author when he sees her wandering around the snowy woods talking to herself. Curious he follows the beautiful, but quite possibly insane woman without being seen. Her words of romance and love strike something deep inside his shielded heart. Fascinated with her, Elliot intends to find out if the woman is truly mad by taking on the role of her imaginary man. When Theia meets the very real and very alive hero from inside her head, she doesn't know whether to embrace the phenomenon or check herself into therapy. It will be a Christmas that neither will ever forget.

The Art and Craft of Cover Design-Gene Stirm 2010-08 Learn how to create your own dazzling Book Cover with this Comprehensive Guide by Veteran Cover Desinger Gene Stirm. Every book deserves a great cover, it is the number one marketing tool for Self-Publishers

Coloring Mania-Cindy Thomas 2015-08-19 Coloring Mania: Adult Coloring Books - Kaleidoscope Mandala Art Therapy Designs for Adults to Color (Volume 2). Coloring is fun and it helps to relieve stress while you enjoy the peace and pleasures of adult coloring books. Art therapy gives you a lovely calming effect as you color your worries away. This adult coloring book offers over 50 art designs for you to color with your coloring pencils, markers, gel pens, etc. You'll find patterns, mandalas, and kaleidoscopes with designs ranging in complexity. Designs are printed on one side of the page only to prevent bleeding through and lets you be able to frame your coloring creations if you wish to.

The Art of Blending and Compounding Liquors and Wines-Joseph Fleischman 2008-02-01 Joseph Fleischman's 1885 work gives readers an understanding of how wines and spirits are made, and provides recipes so that readers can create these beverages in their own homes.

Logic for the Million; a Familiar Exposition

of the Art of Reasoning-James William Gilbart 1857

Logic for the Million: a familiar exposition of the art of reasoning. By a Fellow of the Royal Society J. W. Gilbart-James William GILBART 1857