

## Direct Proofs

The product of two odd numbers is odd.

**Proof**      $x = 2m+1, y = 2n+1$   
 $xy = (2m+1)(2n+1)$   
 $= 4mn + 2m + 2n + 1$   
 $= 2(2mn+m+n) + 1.$

If  $m$  and  $n$  are perfect square, then  $m+n+2\sqrt{mn}$  is a perfect square.

**Proof**      $m = a^2$  and  $n = b^2$  for some integers  $a$  and  $b$   
Then  $m + n + 2\sqrt{mn} = a^2 + b^2 + 2ab$   
 $= (a + b)^2$   
So  $m + n + 2\sqrt{mn}$  is a perfect square.

# Discrete Mathematics With Proof

**Kevin Ferland**



## **Discrete Mathematics With Proof:**

**Discrete Mathematics with Proof** Eric Gossett, 2009-06-22 A Trusted Guide to Discrete Mathematics with Proof Now in a Newly Revised Edition Discrete mathematics has become increasingly popular in recent years due to its growing applications in the field of computer science Discrete Mathematics with Proof Second Edition continues to facilitate an up to date understanding of this important topic exposing readers to a wide range of modern and technological applications The book begins with an introductory chapter that provides an accessible explanation of discrete mathematics Subsequent chapters explore additional related topics including counting finite probability theory recursion formal models in computer science graph theory trees the concepts of functions and relations Additional features of the Second Edition include An intense focus on the formal settings of proofs and their techniques such as constructive proofs proof by contradiction and combinatorial proofs New sections on applications of elementary number theory multidimensional induction counting tulips and the binomial distribution Important examples from the field of computer science presented as applications including the Halting problem Shannon s mathematical model of information regular expressions XML and Normal Forms in relational databases Numerous examples that are not often found in books on discrete mathematics including the deferred acceptance algorithm the Boyer Moore algorithm for pattern matching Sierpinski curves adaptive quadrature the Josephus problem and the five color theorem Extensive appendices that outline supplemental material on analyzing claims and writing mathematics along with solutions to selected chapter exercises Combinatorics receives a full chapter treatment that extends beyond the combinations and permutations material by delving into non standard topics such as Latin squares finite projective planes balanced incomplete block designs coding theory partitions occupancy problems Stirling numbers Ramsey numbers and systems of distinct representatives A related Web site features animations and visualizations of combinatorial proofs that assist readers with comprehension In addition approximately 500 examples and over 2 800 exercises are presented throughout the book to motivate ideas and illustrate the proofs and conclusions of theorems Assuming only a basic background in calculus Discrete Mathematics with Proof Second Edition is an excellent book for mathematics and computer science courses at the undergraduate level It is also a valuable resource for professionals in various technical fields who would like an introduction to discrete mathematics

*Discrete Mathematics with Proof* Eric Gossett, 2003 Write Your Own Proofs Amy Babich, Laura Person, 2019-08-14 Written by a pair of math teachers and based on their classroom notes and experiences this introductory treatment of theory proof techniques and related concepts is designed for undergraduate courses No knowledge of calculus is assumed making it a useful text for students at many levels The focus is on teaching students to prove theorems and write mathematical proofs so that others can read them Since proving theorems takes lots of practice this text is designed to provide plenty of exercises The authors break the theorems into pieces and walk readers through examples encouraging them to use mathematical notation and write proofs themselves Topics include propositional

logic set notation basic set theory proofs relations functions induction countability and some combinatorics including a small amount of probability The text is ideal for courses in discrete mathematics or logic and set theory and its accessibility makes the book equally suitable for classes in mathematics for liberal arts students or courses geared toward proof writing in mathematics

Discrete Mathematics R. C. Penner, 1999 This book offers an introduction to mathematical proofs and to the fundamentals of modern mathematics No real prerequisites are needed other than a suitable level of mathematical maturity The text is divided into two parts the first of which constitutes the core of a one semester course covering proofs predicate calculus set theory elementary number theory relations and functions and the second of which applies this material to a more advanced study of selected topics in pure mathematics applied mathematics and computer science specifically cardinality combinatorics finite state automata and graphs In both parts deeper and more interesting material is treated in optional sections and the text has been kept flexible by allowing many different possible courses or emphases based upon different paths through the volume

Introduction to Discrete Mathematics via Logic and Proof Calvin Jongsma, 2019-11-08 This textbook introduces discrete mathematics by emphasizing the importance of reading and writing proofs Because it begins by carefully establishing a familiarity with mathematical logic and proof this approach suits not only a discrete mathematics course but can also function as a transition to proof Its unique deductive perspective on mathematical logic provides students with the tools to more deeply understand mathematical methodology an approach that the author has successfully classroom tested for decades Chapters are helpfully organized so that as they escalate in complexity their underlying connections are easily identifiable Mathematical logic and proofs are first introduced before moving onto more complex topics in discrete mathematics Some of these topics include Mathematical and structural induction Set theory Combinatorics Functions relations and ordered sets Boolean algebra and Boolean functions Graph theory

Introduction to Discrete Mathematics via Logic and Proof will suit intermediate undergraduates majoring in mathematics computer science engineering and related subjects with no formal prerequisites beyond a background in secondary mathematics

**Discrete Mathematics** R. C. Penner, 1999

**Discrete Mathematics** Douglas E. Ensley, J. Winston Crawley, 2005-10-07 These active and well known authors have come together to create a fresh innovative and timely approach to Discrete Math One innovation uses several major threads to help weave core topics into a cohesive whole Throughout the book the application of mathematical reasoning is emphasized to solve problems while the authors guide the student in thinking about reading and writing proofs in a wide variety of contexts Another important content thread as the sub title implies is the focus on mathematical puzzles games and magic tricks to engage students

Discrete Mathematics Gary Chartrand, Ping Zhang, 2011-03-31 Chartrand and Zhangs Discrete Mathematics presents a clearly written student friendly introduction to discrete mathematics The authors draw from their background as researchers and educators to offer lucid discussions and descriptions fundamental to the subject of discrete mathematics Unique among discrete mathematics textbooks for its treatment of proof techniques and

graph theory topics discussed also include logic relations and functions especially equivalence relations and bijective functions algorithms and analysis of algorithms introduction to number theory combinatorics counting the Pascal triangle and the binomial theorem discrete probability partially ordered sets lattices and Boolean algebras cryptography and finite state machines This highly versatile text provides mathematical background used in a wide variety of disciplines including mathematics and mathematics education computer science biology chemistry engineering communications and business Some of the major features and strengths of this textbook Numerous carefully explained examples and applications facilitate learning More than 1 600 exercises ranging from elementary to challenging are included with hints answers to all odd numbered exercises Descriptions of proof techniques are accessible and lively Students benefit from the historical discussions throughout the textbook

**Discrete Mathematics** Rowan Garnier, John Taylor, 2009-11-09 Taking an approach to the subject that is suitable for a broad readership Discrete Mathematics Proofs Structures and Applications Third Edition provides a rigorous yet accessible exposition of discrete mathematics including the core mathematical foundation of computer science The approach is comprehensive yet maintains an easy to follow progression from the basic mathematical ideas to the more sophisticated concepts examined later in the book This edition preserves the philosophy of its predecessors while updating and revising some of the content New to the Third Edition In the expanded first chapter the text includes a new section on the formal proof of the validity of arguments in propositional logic before moving on to predicate logic This edition also contains a new chapter on elementary number theory and congruences This chapter explores groups that arise in modular arithmetic and RSA encryption a widely used public key encryption scheme that enables practical and secure means of encrypting data This third edition also offers a detailed solutions manual for qualifying instructors Exploring the relationship between mathematics and computer science this text continues to provide a secure grounding in the theory of discrete mathematics and to augment the theoretical foundation with salient applications It is designed to help readers develop the rigorous logical thinking required to adapt to the demands of the ever evolving discipline of computer science

A Logical Approach to Discrete Math David Gries, Fred B. Schneider, 2013-03-14 This text attempts to change the way we teach logic to beginning students Instead of teaching logic as a subject in isolation we regard it as a basic tool and show how to use it We strive to give students a skill in the propositional and predicate calculi and then to exercise that skill thoroughly in applications that arise in computer science and discrete mathematics We are not logicians but programming methodologists and this text reflects that perspective We are among the first generation of scientists who are more interested in using logic than in studying it With this text we hope to empower further generations of computer scientists and mathematicians to become serious users of logic Logic is the glue Logic is the glue that binds together methods of reasoning in all domains The traditional proof methods for example proof by assumption contradiction mutual implication and induction have their basis in formal logic Thus whether proofs are to be presented formally or informally a study of logic can

provide understanding     Discrete Mathematics Oscar Levin,2015-08-15 This open source textbook is being used at the University of Northern Colorado in a discrete mathematics course taken primarily by math majors many of whom plan to become secondary teachers This text can also be used in a bridge course or introduction to proofs The major topics are introduced with Investigate activities designed to get students more actively involved and suitable for inquiry based learning Table of Contents Introduction Counting Sequences Logic and Proofs Graph Theory Additional Topics Generating Functions Introduction to Number Theory     *Discrete Mathematics: Mathematical Reasoning and Proof with Puzzles, Patterns, and Games, 1e with Student Solutions Manual Set* Douglas E. Ensley,J. Winston Crawley,2006-05 Math problems applied to real world situations Proofs graph theory and discrete probability are all explored in Discrete Mathematics The text and student manual innovatively address these topics as well as mathematical writing abstract structures and counting Concepts are reinforced through games puzzles patterns magic tricks and problems related to everyday circumstances The Student Solutions Manual offers detailed solutions to selected text problems     DISCRETE MATHEMATICS WITH PROOF, 2ND ED Eric Gossett,2010-08-01 Market\_Desc As a textbook for discrete mathematics courses at the sophomore and or junior level for both mathematics and computer science majors and academic libraries A prerequisite for this book includes completion of the introductory calculus sequence Special Features Emphasizes proof combinatorial and non combinatorial throughout in the text and exercises and homework problems have been designed to reinforce the book s main concepts Contains many examples that are not present in most discrete mathematics books including the deferred acceptance algorithm the Boyer Moore algorithm for pattern matching Sierpinski curves Persian rugs adaptive quadrature the Josephus problem the five color theorem and relational databases Features of the new edition include an increased use of combinatorial proofs many new exercises an extended discussion on elementary number theory a complete reorganization of the definitions and theorems among others Supplemented with an Instructor s Manual containing detailed solutions to every exercise available upon request to the Publisher Detailed solutions are also available in the back of the book for selected exercises Includes Quick Check problems at critical points in the reading and it is intended for these problems to be solved before moving on to the next section in the chapter Also many worked examples can be found throughout which are used to motivate the presented theorems and illustrate the conclusion of a theorem Features many important examples from the field of computer science including the Halting problem Shannon s mathematical model of information XML and Normal Forms in relational databases About The Book Discrete mathematics has become increasingly popular in recent years due to its growing applications in the field of computer science Discrete Mathematics with Proof Second Edition continues to facilitate an up to date understanding of this important topic exposing readers to a wide range of modern and technological applications The book begins with an introductory chapter that provides an accessible explanation of discrete mathematics Subsequent chapters explore additional related topics including counting finite probability theory recursion formal models in

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Discrete Mathematics and Its Applications Kenneth H. Rosen, 2003 Discrete Mathematics and its Applications is a focused introduction to the primary themes in a discrete mathematics course as introduced through extensive applications expansive discussion and detailed exercise sets These themes include mathematical reasoning combinatorial analysis discrete structures algorithmic thinking and enhanced problem solving skills through modeling Its intent is to demonstrate the relevance and practicality of discrete mathematics to all students The Fifth Edition includes a more thorough and linear presentation of logic proof types and proof writing and mathematical reasoning This enhanced coverage will provide students with a solid understanding of the material as it relates to their immediate field of study and other relevant subjects The inclusion of applications and examples to key topics has been significantly addressed to add clarity to every subject True to the Fourth Edition the text specific web site supplements the subject matter in meaningful ways offering additional material for students and instructors Discrete math is an active subject with new discoveries made every year The continual growth and updates to the web site reflect the active nature of the topics being discussed The book is appropriate for a one or two term introductory discrete mathematics course to be taken by students in a wide variety of majors including computer science mathematics and engineering College Algebra is the only explicit prerequisite

*Discrete Mathematics: Mathematical Reasoning and Proof with Puzzles, Patterns, and Games, 1e Student Solutions Manual* Douglas E. Ensley, J. Winston Crawley, 2009-01-20 Did you know that games and puzzles have given birth to many of today's deepest mathematical subjects Now with Douglas Ensley and Winston Crawley's Introduction to Discrete Mathematics you can explore mathematical writing abstract structures counting discrete probability and graph theory through games puzzles patterns magic tricks and real world problems You will discover how new mathematical topics can be applied to everyday situations learn how to work with proofs and develop your problem solving skills along the way Online applications help improve your mathematical reasoning Highly intriguing interactive Flash based applications illustrate key mathematical concepts and help you develop your ability to reason mathematically solve problems and work with proofs Explore More icons in the text direct you to online activities at [www.wiley.com/college/ensley](http://www.wiley.com/college/ensley) Improve your grade with the Student Solutions Manual A supplementary Student Solutions Manual contains more detailed solutions to selected exercises in the text

**Discrete Mathematics** Kevin Ferland, 2008-12-31 DISCRETE MATHEMATICS INTERNATIONAL EDITION combines a balance of theory and applications with mathematical rigor and an accessible writing style The author uses a range of examples to teach core concepts while corresponding exercises allow students to apply what

they learn Throughout the text engaging anecdotes and topics of interest inform as well as motivate learners The text is ideal for one or two semester courses and for students who are typically mathematics mathematics education or computer science majors Part I teaches student how to write proofs Part II focuses on computation and problem solving The second half of the book may also be suitable for introductory courses in combinatorics and graph theory

*Discrete Mathematics and the Art of Proof* David Reimer, 2004-08-28

*A Beginner's Guide to Discrete Mathematics* W.D. Wallis, 2011-10-07

Wallis's book on discrete mathematics is a resource for an introductory course in a subject fundamental to both mathematics and computer science a course that is expected not only to cover certain specific topics but also to introduce students to important modes of thought specific to each discipline Lower division undergraduates through graduate students Choice reviews Review of the First Edition Very appropriately entitled as a beginner's guide this textbook presents itself as the first exposure to discrete mathematics and rigorous proof for the mathematics or computer science student Zentralblatt Math Review of the First Edition This second edition of *A Beginner's Guide to Discrete Mathematics* presents a detailed guide to discrete mathematics and its relationship to other mathematical subjects including set theory probability cryptography graph theory and number theory This textbook has a distinctly applied orientation and explores a variety of applications Key Features of the second edition Includes a new chapter on the theory of voting as well as numerous new examples and exercises throughout the book Introduces functions vectors matrices number systems scientific notations and the representation of numbers in computers Provides examples which then lead into easy practice problems throughout the text and full exercise at the end of each chapter Full solutions for practice problems are provided at the end of the book This text is intended for undergraduates in mathematics and computer science however featured special topics and applications may also interest graduate students

*Discrete Mathematics* Jean Gallier, 2011-02-01 This book gives an introduction to discrete mathematics for beginning undergraduates One of original features of this book is that it begins with a presentation of the rules of logic as used in mathematics Many examples of formal and informal proofs are given With this logical framework firmly in place the book describes the major axioms of set theory and introduces the natural numbers The rest of the book is more standard It deals with functions and relations directed and undirected graphs and an introduction to combinatorics There is a section on public key cryptography and RSA with complete proofs of Fermat's little theorem and the correctness of the RSA scheme as well as explicit algorithms to perform modular arithmetic The last chapter provides more graph theory Eulerian and Hamiltonian cycles are discussed Then we study flows and tensions and state and prove the max flow min cut theorem We also discuss matchings covering bipartite graphs

*Discrete Mathematics, Instructor's Solutions Manual* Douglas E. Ensley, J. Winston Crawley, 2006-01-24

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