

Solution:

Let $P(n) := \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \frac{1}{n(n+1)} = \frac{n}{n+1}$. Substituting the value of $n = 1$, in the statement we get, $P(1) = \frac{1}{1.2} = \frac{1}{2}$. Hence, $P(1)$ is true. Let us assume that the statement is true for $n = k$. Then

$$P(k) = \frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \frac{1}{k(k+1)} = \frac{k}{k+1}.$$

We need to show that $P(k+1)$ is true. Consider,

$$\begin{aligned} P(k+1) &= \underbrace{\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \frac{1}{k(k+1)}}_1 + \frac{1}{(k+1)(k+2)} \\ &= P(k) + \frac{1}{(k+1)(k+2)} \\ &= \frac{k}{k+1} + \frac{1}{(k+1)(k+2)} \\ &= \frac{1}{k+1} \left(\frac{k}{1} + \frac{1}{k+2} \right) \\ &= \frac{1}{k+1} \left(\frac{k^2 + 2k + 1}{k+2} \right) \\ &= \frac{1}{k+1} \left(\frac{(k+1)^2}{k+2} \right) = \frac{(k+1)}{(k+2)}. \end{aligned}$$

This implies, $P(k+1)$ is true. The validity of $P(k+1)$ follows from that of $P(k)$. Therefore, by the principle of mathematical induction, for any natural number n ,

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \cdots + \frac{1}{n(n+1)} = \frac{n}{n+1}.$$

Mathematical Induction Problems And Solutions

Mark Borodovsky, Svetlana Ekisheva



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Mathematical Toolbox: Interweaving Topics, Problems, and Solutions Boris Pritsker,2023-02-08 Expanding Mathematical Toolbox Interweaving Topics Problems and Solutions offers several topics from different mathematical disciplines and shows how closely they are related The purpose of this book is to direct the attention of readers who have an interest in and talent for mathematics to engaging and thought provoking problems that should help them change their ways of thinking entice further exploration and possibly lead to independent research and projects in mathematics In spite of the many challenging problems most solutions require no more than a basic knowledge covered in a high school math curriculum To shed new light on a deeper appreciation for mathematical relationships the problems are selected to demonstrate techniques involving a variety of mathematical ideas Included are some interesting applications of trigonometry vector algebra and Cartesian coordinate system techniques and geometrical constructions and inversion in solving mechanical engineering problems and in studying models explaining non Euclidean geometries This book is primarily directed at secondary school teachers and college professors It will be useful in teaching mathematical reasoning because it emphasizes how to teach students to think creatively and strategically and how to make connections between math disciplines The text also can be used as a resource for preparing for mathematics Olympiads In addition it is aimed at all readers who want to study mathematics gain deeper understanding and enhance their problem solving abilities Readers will find fresh ideas and topics offering unexpected insights new skills to expand their horizons and an appreciation for the beauty of mathematics

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Lectures, Problems And Solutions For Ordinary Differential Equations (Second Edition) Yuefan

Deng, 2017-08-11 This unique book on ordinary differential equations addresses practical issues of composing and solving differential equations by demonstrating the detailed solutions of more than 1 000 examples The initial draft was used to teach more than 10 000 advanced undergraduate students in engineering physics economics as well as applied mathematics It is a good source for students to learn problem solving skills and for educators to find problems for homework assignments and tests The 2nd edition with at least 100 more examples and five added subsections has been restructured to flow more pedagogically

Algebra and Trigonometry Problem Solver Jerry R. Shipman, 2012-05 Each Problem Solver is an insightful and essential study and solution guide chock full of clear concise problem solving gems All your questions can be found in one convenient source from one of the most trusted names in reference solution guides More useful more practical and more informative these study aids are the best review books and textbook companions available Nothing remotely as comprehensive or as helpful exists in their subject anywhere Perfect for undergraduate and graduate studies Here in this highly useful reference is the finest overview of algebra and trigonometry currently available with hundreds of algebra and trigonometry problems that cover everything from algebraic laws and absolute values to quadratic equations and analytic geometry Each problem is clearly solved with step by step detailed solutions

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students of algebra and trigonometry continue to remain perplexed as a result of numerous subject areas that must be remembered and correlated when solving problems. Various interpretations of algebra and trigonometry terms also contribute to the difficulties of mastering the subject. In a study of algebra and trigonometry, REA found the following basic reasons underlying the inherent difficulties of both math subjects. No systematic rules of analysis were ever developed to follow in a step by step manner to solve typically encountered problems. This results from numerous different conditions and principles involved in a problem that leads to many possible different solution methods. To prescribe a set of rules for each of the possible variations would involve an enormous number of additional steps making this task more burdensome than solving the problem directly due to the expectation of much trial and error. Current textbooks normally explain a given principle in a few pages written by a mathematics professional who has insight into the subject matter not shared by others. These explanations are often written in an abstract manner that causes confusion as to the principle's use and application. Explanations then are often not sufficiently detailed or extensive enough to make the reader aware of the wide range of applications and different aspects of the principle being studied. The numerous possible variations of principles and their applications are usually not discussed and it is left to the reader to discover this while doing exercises. Accordingly the average student is expected to rediscover that which has long been established and practiced but not always published or adequately explained. The examples typically following the explanation of a topic are too few in number and too simple to enable the student to obtain a thorough grasp of the involved principles. The explanations do not provide sufficient basis to solve problems that may be assigned for homework or given on examinations. Poorly solved examples such as these can be presented in abbreviated form which leaves out much explanatory material between steps and as a result requires the reader to figure out the missing information. This leaves the reader with an impression that the problems and even the subject are hard to learn completely the opposite of what an example is supposed to do. Poor examples are often worded in a confusing or obscure way. They might not state the nature of the problem or they present a solution which appears to have no direct relation to the problem. These problems usually offer an overly general discussion never revealing how or what is to be solved. Many examples do not include accompanying diagrams or graphs denying the reader the exposure necessary for drawing good diagrams and graphs. Such practice only strengthens understanding by simplifying and organizing algebra and trigonometry processes. Students can learn the subject only by doing the exercises themselves and reviewing them in class obtaining experience.

Learning Through Teaching Mathematics Roza Leikin, Rina Zazkis, 2010-04-10

The idea of teachers Learning through Teaching LTT when presented to a naïve bystander appears as an oxymoron. Are we not supposed to learn before we teach? After all under the usual circumstances learning is the task for those who are being taught not of those who teach. However this book is about the learning of teachers not the learning of students. It is an ancient wisdom that the best way to truly learn something is to teach it to others. Nevertheless once a teacher has taught a particular topic or concept and

consequently truly learned it what is left for this teacher to learn As evident in this book the experience of teaching presents teachers with an exciting opportunity for learning throughout their entire career This means acquiring a better understanding of what is being taught and moreover learning a variety of new things What these new things may be and how they are learned is addressed in the collection of chapters in this volume LTT is acknowledged by multiple researchers and mathematics educators In the first chapter Leikin and Zazkis review literature that recognizes this phenomenon and stress that only a small number of studies attend systematically to LTT processes The authors in this volume purposefully analyze the teaching of mathematics as a source for teachers own learning

Resources for Teaching Discrete Mathematics

Brian Hopkins, 2009 Hopkins collects the work of 35 instructors who share their innovations and insights about teaching discrete mathematics at the high school and college level The book's 9 classroom tested projects including building a geodesic dome come with student handouts solutions and notes for the instructor The 11 history modules presented draw on original sources such as Pascal's Treatise on the Arithmetical Triangle allowing students to explore topics in their original contexts Three articles address extensions of standard discrete mathematics content Two other articles explore pedagogy specifically related to discrete mathematics courses adapting a group discovery method to larger classes and using logic in encouraging students to construct proofs

Problems And Solutions In Introductory And Advanced Matrix Calculus (Second Edition)

Yorick Hardy, Willi-hans Steeb, 2016-07-14 This book provides an extensive collection of problems with detailed solutions in introductory and advanced matrix calculus Supplementary problems in each chapter will challenge and excite the reader ideal for both graduate and undergraduate mathematics and theoretical physics students The coverage includes systems of linear equations linear differential equations integration and matrices Kronecker product and vector operation as well as functions of matrices Furthermore specialized topics such as spectral theorem nonnormal matrices and mutually unbiased bases are included Many of the problems are related to applications for group theory Lie algebra theory wavelets graph theory and matrix valued differential forms benefitting physics and engineering students and researchers alike It also branches out to problems with tensors and the hyperdeterminant Computer algebra programs in Maxima and SymbolicC have also been provided

Problems and Solutions in Biological Sequence Analysis

Mark Borodovsky, Svetlana Ekisheva, 2006-09-04 This book is the first of its kind to provide a large collection of bioinformatics problems with accompanying solutions Notably the problem set includes all of the problems offered in Biological Sequence Analysis by Durbin et al Cambridge 1998 widely adopted as a required text for bioinformatics courses at leading universities worldwide Although many of the problems included in Biological Sequence Analysis as exercises for its readers have been repeatedly used for homework and tests no detailed solutions for the problems were available Bioinformatics instructors had therefore frequently expressed a need for fully worked solutions and a larger set of problems for use on courses This book provides just that following the same structure as Biological Sequence Analysis and significantly extending the set of workable problems it

will facilitate a better understanding of the contents of the chapters in BSA and will help its readers develop problem solving skills that are vitally important for conducting successful research in the growing field of bioinformatics All of the material has been class tested by the authors at Georgia Tech where the first ever MSc degree program in Bioinformatics was held

Group Theory In Physics: Problems And Solutions Michael Aivazis, Wu-ki Tung, 1991-06-25 This solutions booklet is a supplement to the text book Group Theory in Physics by Wu Ki Tung It will be useful to lecturers and students taking the subject as detailed solutions are given

The American Mathematical Monthly, 1921 Includes section Recent publications

Mathematical Induction 101 Duc Van Khanh Tran, 2023-01-02 This book starts with a brief introduction of mathematical induction and provides 101 practice problems of mathematical induction proofs The problems have various levels of difficulty and cover a wide range of topics sequences series products inequality trigonometry floor function derivatives integrals matrices set theory etc Those who want to learn about mathematical induction can learn from this book and those who are already familiar with mathematical induction can find some fun problems to practice Reviews In the ideal situation every college student should learn some mathematics with the depth and difficulty largely varying As in the practice of most refined universities mathematical education should never be standardized Meanwhile math induction is one of the key tools that students need to know Based on my teaching experiences to many Chinese and international students I found Tran's book fairly interesting and accessible Mathematical Induction 101 contains 101 carefully chosen exercise problems I believe that Tran's book will prove to be useful for college students in the broad range of arts and sciences Hopefully many will appreciate the beauty and power of mathematical reasoning with mastery of math induction after using this book Prof Chunwei Song Peking University This book provides an interesting collection of identities and inequalities that can be proved by mathematical induction These 101 practices will be useful to learn standard techniques Some of the topics and their solutions would also be found stimulating even for advanced students of mathematics Prof Hiroaki Nakamura Osaka University This book provides almost all types of problems in high school and collegiate mathematics which can be solved by mathematical induction To each problem a self contained and detailed solution is given Difficulty ranges from quite elementary to somewhat complex Among them there are many interesting ones I am particularly interested in problems related to the Fibonacci sequence floor function and iterated functions Prof Emeritus Young One Kim Seoul National University As a mathematics student this is a book I would have loved in my introductory proof class Duc Van Khanh Tran has written up a fantastic way to both learn and practice one of the most essential tools in a mathematician's toolkit Induction It's difficult to find such a large comprehensive array of well written and demonstrative practice problems which makes this all the more valuable a resource Duc Van Khanh Tran carefully pens each solution to be as intuitive and explanatory as possible so the risk of confusion at a solution is minimal The vast amount of problems is complemented by the vast array of topics the book covers Inequalities sequences trigonometry power series derivatives and integrals are only some of the concepts found

guaranteeing that anyone interested in math will get something new out of this book I've tried a few of these for fun I really like the integral problems myself All in all if you'd like to learn about induction hone your induction skills or just want a bunch of fun induction problems purchase away You won't regret it Said Kaili Undergraduate Student of Mathematics University of Virginia Despite minimal prior proof background I can grasp the main scopes of the book without much difficulty Indeed Duc Tran's book provides clear instructions comprehensive content and helpful problems that ease students into learning mathematical induction Ky Minh Vinh Nguyen Undergraduate Student of Informatics University of Texas at Austin

School Mathematics Textbooks In China: Comparative Studies And Beyond Jianpan Wang, Lianghuo Fan, Binyan Xu, 2021-01-28 Our collected work contains mathematics education research papers Comparative studies of school textbooks cover content selection compilation style representation method design of examples and exercises mathematics investigation the use of information technology and composite difficulty level to name a few Other papers included are about representation of basic mathematical thought in school textbooks a study on the compilation features of elementary school textbooks and a survey of the effect of using new elementary school textbooks

Algorithm Design: A Methodological Approach - 150 problems and detailed solutions Patrick Bosc, Marc Guyomard, Laurent Miclet, 2023-01-31 A bestseller in its French edition this book is original in its construction and its success in the French market demonstrates its appeal It is based on three principles 1 An organization of the chapters by families of algorithms exhaustive search divide and conquer etc On the contrary there is no chapter devoted only to a systematic exposure of say algorithms on strings Some of these will be found in different chapters 2 For each family of algorithms an introduction is given to the mathematical principles and the issues of a rigorous design with one or two pedagogical examples 3 For the most part the book details 150 problems spanning seven families of algorithms For each problem a precise and progressive statement is given More importantly a complete solution is detailed with respect to the design principles that have been presented often some classical errors are pointed out Roughly speaking two thirds of the book is devoted to the detailed rational construction of the solutions

O-level Additional Mathematics Challenging Learn-by-Example (Yellowreef) Thomas Bond, Chris Hughes, 2013-11-26 covers latest MOE syllabus comprehensive examples and solutions for quick revision helps students to familiarise with various exam question types complete edition and concise edition eBooks available

Lectures in Applied Mathematics and Informatics Luigi M. Ricciardi, 1990 A collection of selected lectures in applied mathematics delivered by visiting professors within the Research Doctorate Programme in Applied Mathematics and Informatics at the University of Naples Each lecture is a self contained chapter focusing on the latest issues in applied mathematics and informatics Emphasis is placed on computational aspects but very recent findings are discussed without excessive technical jargon

The Pre-calculus Problem Solver Max Fogiel, Research and Education Association, 1984

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