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982 - LUCAS LAILA

This book is a celebration of mathematical problem solving at the level of the high school American Invitational Mathematics Examination. There is no other book on the market focused on the AIME. It is intended, in part, as a resource for comprehensive study and practice for the AIME competition for students, teachers, and mentors. After all, serious AIME contenders and competitors should seek a lot of practice in order to succeed. However, this book is also intended for anyone who enjoys solving problems as a recreational pursuit. The AIME contains many problems that have the power to foster enthusiasm for mathematics - the problems are fun, engaging, and addictive. The problems found within these pages can be used by teachers who wish to challenge their students, and they can be used to foster a community of lovers of mathematical problem solving! There are more than 250 fully-solved problems in the book, containing ex-

amples from AIME competitions of the 1980's, 1990's, 2000's, and 2010's. In some cases, multiple solutions are presented to highlight variable approaches. To help problem-solvers with the exercises, the author provides two levels of hints to each exercise in the book, one to help stuck starters get an idea how to begin, and another to provide more guidance in navigating an approach to the solution.

This is a challenging problem-solving book in Euclidean geometry, assuming nothing of the reader other than a good deal of courage. Topics covered included cyclic quadrilaterals, power of a point, homothety, triangle centers; along the way the reader will meet such classical gems as the nine-point circle, the Simson line, the symmedian and the mixtilinear incircle, as well as the theorems of Euler, Ceva, Menelaus, and Pascal. Another part is dedicated to the use of complex numbers and barycentric coordinates, granting the reader both a traditional and computational viewpoint of the material. The final part consists of some more ad-

vanced topics, such as inversion in the plane, the cross ratio and projective transformations, and the theory of the complete quadrilateral. The exposition is friendly and relaxed, and accompanied by over 300 beautifully drawn figures. The emphasis of this book is placed squarely on the problems. Each chapter contains carefully chosen worked examples, which explain not only the solutions to the problems but also describe in close detail how one would invent the solution to begin with. The text contains a selection of 300 practice problems of varying difficulty from contests around the world, with extensive hints and selected solutions. This book is especially suitable for students preparing for national or international mathematical olympiads or for teachers looking for a text for an honor class.

"...offer[s] a challenging exploration of problem solving mathematics and preparation for programs such as MATHCOUNTS and the American Mathematics Competition."--Back cover

For over fifty years, the Mathematical Association of America (MAA) has been engaged in the construction and administration of challenging contests for students in American and Canadian high schools at every level of ability. This is the ninth book of problems and solutions from the American Mathematics Competitions 12 (AMC), aimed at students of high school age, and featuring 325 problems from the 13 AMC contests held in the years 2001-2007. Graphs and figures have since been redrawn to make them more consistent in form and style, and the solutions to the problems have been both edited and supplemented. The Problem Index contained classifies the problems into the following major subject areas: Algebra and Arithmetic, Sequences and Series, Triangle Geometry, Circle Geometry, Quadrilateral Geometry, Po-

lygon Geometry, Counting Coordinate Geometry, Solid Geometry, Discrete Probability, Statistics, Number Theory, and Logic. These are then broken down into subcategories and cross-referenced for ease of use.

This book consists only of author-created problems with author-prepared solutions (never published before) and it is intended as a teacher's manual of mathematics, a self-study handbook for high-school students and mathematical competitors interested in AMC 12 (American Mathematics Competitions). The book teaches problem solving strategies and aids to improve problem solving skills. The book includes a list of the most useful theorems and formulas for AMC 12, it also includes 14 sets of author-created AMC 12 type practice tests (350 author-created AMC 12 type problems and their detailed solutions). National Math Competition Preparation (NMCP) program of RSM used part of these 14 sets of practice tests to train students for AMC 12, as a result 75 percent of NMCP high school students qualified for AIME. The authors provide both a list of answers for all 14 sets of author-created AMC 12 type practice tests and author-prepared solutions for each problem. About the authors: Hayk Sedrakyan is an IMO medal winner, professional mathematical Olympiad coach in greater Boston area, Massachusetts, USA. He is the Dean of math competition preparation department at RSM. He has been a Professor of mathematics in Paris and has a PhD in mathematics (optimal control and game theory) from the UPMC - Sorbonne University, Paris, France. Hayk is a Doctor of mathematical sciences in USA, France, Armenia and holds three master's degrees in mathematics from institutions in Germany, Austria, Armenia and has

spent a small part of his PhD studies in Italy. Hayk Sedrakyan has worked as a scientific researcher for the European Commission (sadco project) and has been one of the Team Leaders at Harvard-MIT Mathematics Tournament (HMMT). He took part in the International Mathematical Olympiads (IMO) in United Kingdom, Japan and Greece. Hayk has been elected as the President of the students' general assembly and a member of the management board of Cite Internationale Universitaire de Paris (10,000 students, 162 different nationalities) and the same year they were nominated for the Nobel Peace Prize. Nairi Sedrakyan is involved in national and international mathematical Olympiads having been the President of Armenian Mathematics Olympiads and a member of the IMO problem selection committee. He is the author of the most difficult problem ever proposed in the history of the International Mathematical Olympiad (IMO), 5th problem of 37th IMO. This problem is considered to be the hardest problems ever in the IMO because none of the members of the strongest teams (national Olympic teams of China, USA, Russia) succeeded to solve it correctly and because national Olympic team of China (the strongest team in the IMO) obtained a cumulative result equal to 0 points and was ranked 6th in the final ranking of the countries instead of the usual 1st or 2nd place. The British 2014 film *X+Y*, released in the USA as *A Brilliant Young Mind*, inspired by the film *Beautiful Young Minds* (focuses on an English mathematical genius chosen to represent the United Kingdom at the IMO) also states that this problem is the hardest problem ever proposed in the history of the IMO (minutes 9:40-10:30). Nairi Sedrakyan's students (including his son Hayk Sedrakyan) have received 20 medals in the International Mathematical Olympiad (I-

MO), including Gold and Silver medals.

This book consists only of author-created problems with author-prepared solutions (never published before) and it is intended as a teacher's manual of mathematics, a self-study handbook for high-school students and mathematical competitors interested in AMC 10 (American Mathematics Competitions). The book teaches problem solving strategies and aids to improve problem solving skills. The book includes a list of the most useful theorems and formulas for AMC 10, it also includes 12 sets of author-created AMC 10 type practice tests (300 author-created AMC 10 type problems and their detailed solutions). National Math Competition Preparation (NMCP) program of RSM used part of these 12 sets of practice tests to train students for AMC 10, as a result 75 percent of NMCP high school students qualified for AIME. The authors provide both a list of answers for all 12 sets of author-created AMC 10 type practice tests and author-prepared solutions for each problem. About the authors: Hayk Sedrakyan is an IMO medal winner, professional mathematical Olympiad coach in greater Boston area, Massachusetts, USA. He is the Dean of math competition preparation department at RSM. He has been a Professor of mathematics in Paris and has a PhD in mathematics (optimal control and game theory) from the UPMC - Sorbonne University, Paris, France. Hayk is a Doctor of mathematical sciences in USA, France, Armenia and holds three master's degrees in mathematics from institutions in Germany, Austria, Armenia and has spent a small part of his PhD studies in Italy. Hayk Sedrakyan has worked as a scientific researcher for the European Commission (sadco project) and has been one of the Team Leaders at Harvard-MIT Mathematics Tournament (HMMT). He took part in the In-

ternational Mathematical Olympiads (IMO) in United Kingdom, Japan and Greece. Hayk has been elected as the President of the students' general assembly and a member of the management board of Cite Internationale Universitaire de Paris (10,000 students, 162 different nationalities) and the same year they were nominated for the Nobel Peace Prize. Nairi Sedrakyan is involved in national and international mathematical Olympiads having been the President of Armenian Mathematics Olympiads and a member of the IMO problem selection committee. He is the author of the most difficult problem ever proposed in the history of the International Mathematical Olympiad (IMO), 5th problem of 37th IMO. This problem is considered to be the hardest problems ever in the IMO because none of the members of the strongest teams (national Olympic teams of China, USA, Russia) succeeded to solve it correctly and because national Olympic team of China (the strongest team in the IMO) obtained a cumulative result equal to 0 points and was ranked 6th in the final ranking of the countries instead of the usual 1st or 2nd place. The British 2014 film X+Y, released in the USA as A Brilliant Young Mind, inspired by the film Beautiful Young Minds (focuses on an English mathematical genius chosen to represent the United Kingdom at the IMO) also states that this problem is the hardest problem ever proposed in the history of the IMO (minutes 9:40-10:30). Nairi Sedrakyan's students (including his son Hayk Sedrakyan) have received 20 medals in the International Mathematical Olympiad (IMO), including Gold and Silver medals.

This second edition presents a collection of exercises on the theory of analytic functions, including completed and detailed solutions. It introduces students to various applications and aspects

of the theory of analytic functions not always touched on in a first course, while also addressing topics of interest to electrical engineering students (e.g., the realization of rational functions and its connections to the theory of linear systems and state space representations of such systems). It provides examples of important Hilbert spaces of analytic functions (in particular the Hardy space and the Fock space), and also includes a section reviewing essential aspects of topology, functional analysis and Lebesgue integration. Benefits of the 2nd edition Rational functions are now covered in a separate chapter. Further, the section on conformal mappings has been expanded.

This book, written by an accomplished female mathematician, is the second to explore nonstandard mathematical problems – those that are not directly solved by standard mathematical methods but instead rely on insight and the synthesis of a variety of mathematical ideas. It promotes mental activity as well as greater mathematical skills, and is an ideal resource for successful preparation for the mathematics Olympiad. Numerous strategies and techniques are presented that can be used to solve intriguing and challenging problems of the type often found in competitions. The author uses a friendly, non-intimidating approach to emphasize connections between different fields of mathematics and often proposes several different ways to attack the same problem. Topics covered include functions and their properties, polynomials, trigonometric and transcendental equations and inequalities, optimization, differential equations, nonlinear systems, and word problems. Over 360 problems are included with hints, answers, and detailed solutions. Methods of Solving Nonstandard Problems will interest high school and college students, whether

they are preparing for a math competition or looking to improve their mathematical skills, as well as anyone who enjoys an intellectual challenge and has a special love for mathematics. Teachers and college professors will be able to use it as an extra resource in the classroom to augment a conventional course of instruction in order to stimulate abstract thinking and inspire original thought.

A large range of problems drawn from mathematics olympiads from around the world.

For more than 50 years, the Mathematical Association of America has been engaged in the construction and administration of challenging contests for students in American and Canadian high schools. The problems for these contests are constructed in the hope that all high school students interested in mathematics will have the opportunity to participate in the contests and will find the experience mathematically enriching. These contests are intended for students at all levels, from the average student at a typical school who enjoys mathematics to the very best students at the most special school. In the year 2000, the Mathematical Association of America initiated the American Mathematics Competitions 10 (AMC 10) for students up to grade 10. The Contest Problem Book VIII is the first collection of problems from that competition covering the years 2001–2007. J. Douglas Faires and David Wells were the joint directors of the AMC 10 and AMC 12 during that period, and have assembled this book of problems and solutions. There are 350 problems from the first 14 contests included in this collection. A Problem Index at the back of the book classifies the problems into the following major subject ar-

reas: Algebra and Arithmetic, Sequences and Series, Triangle Geometry, Circle Geometry, Quadrilateral Geometry, Polygon Geometry, Counting Coordinate Geometry, Solid Geometry, Discrete Probability, Statistics, Number Theory, and Logic. The major subject areas are then broken down into subcategories for ease of reference. The problems are cross-referenced when they represent several subject areas.

Based on Stanford University's well-known competitive exam, this excellent mathematics workbook offers students at both high school and college levels a complete set of problems, hints, and solutions. 1974 edition.

The William Lowell Putnam Mathematical Competition is the premier undergraduate mathematical competition in North America. This volume contains problems from the years 1985–2000, with solutions and extensive commentary. It is unlike the first two Putnam volumes and unlike virtually every other problem-based book, in that it places the problems in the context of important mathematical themes. The authors highlight connections to other problems, to the curriculum, and to more advanced topics. The best problems contain kernels of sophisticated ideas related to important current research, and yet the problems are accessible to undergraduates. The heart of the book is in the solutions, which have been compiled through extensive research. In editing the solutions, the authors have kept a student audience in mind, explaining techniques that have relevance to more than the problem at hand, suggesting references for further reading, and mentioning related problems, some of which are unsolved.

Any high school student preparing for the American Mathematics

Competitions should get their hands on a copy of this book! A major aspect of mathematical training and its benefit to society is the ability to use logic to solve problems. The American Mathematics Competitions (AMC) have been given for more than fifty years to millions of high school students. This book considers the basic ideas behind the solutions to the majority of these problems, and presents examples and exercises from past exams to illustrate the concepts. Anyone taking the AMC exams or helping students prepare for them will find many useful ideas here. But people generally interested in logical problem solving should also find the problems and their solutions interesting. This book will promote interest in mathematics by providing students with the tools to attack problems that occur on mathematical problem-solving exams, and specifically to level the playing field for those who do not have access to the enrichment programs that are common at the top academic high schools. The book can be used either for self-study or to give people who want to help students prepare for mathematics exams easy access to topic-oriented material and samples of problems based on that material. This is useful for teachers who want to hold special sessions for students, but it is equally valuable for parents who have children with mathematical interest and ability. As students' problem solving abilities improve, they will be able to comprehend more difficult concepts requiring greater mathematical ingenuity. They will be taking their first steps towards becoming math Olympians!

Every mathematician (beginner, amateur, and professional alike) thrills to find simple, elegant solutions to seemingly difficult problems. Such happy resolutions are called "aha! solutions," a phrase popularized by mathematics and science writer Martin

Gardner. Aha! solutions are surprising, stunning, and scintillating: they reveal the beauty of mathematics. This book is a collection of problems with aha! solutions. The problems are at the level of the college mathematics student, but there should be something of interest for the high school student, the teacher of mathematics, the "math fan," and anyone else who loves mathematical challenges. This collection includes one hundred problems in the areas of arithmetic, geometry, algebra, calculus, probability, number theory, and combinatorics. The problems start out easy and generally get more difficult as you progress through the book. A few solutions require the use of a computer. An important feature of the book is the bonus discussion of related mathematics that follows the solution of each problem. This material is there to entertain and inform you or point you to new questions. If you don't remember a mathematical definition or concept, there is a Toolkit in the back of the book that will help.

This is the ninth book of problems and solutions from the American Mathematics Competitions (AMC) contests. It chronicles 325 problems from the thirteen AMC 12 contests given in the years between 2001 and 2007. The authors were the joint directors of the AMC 12 and the AMC 10 competitions during that period. The problems have all been edited to ensure that they conform to the current style of the AMC 12 competitions. Graphs and figures have been redrawn to make them more consistent in form and style, and the solutions to the problems have been both edited and supplemented. A problem index at the back of the book classifies the problems into subject areas of Algebra, Arithmetic, Complex Numbers, Counting, Functions, Geometry, Graphs, Logarithms, Logic, Number Theory, Polynomials, Probability, Se-

quences, Statistics, and Trigonometry. A problem that uses a combination of these areas is listed multiple times. The problems on these contests are posed by members of the mathematical community in the hope that all secondary school students will have an opportunity to participate in problem-solving and an enriching mathematical experience.

10 practice tests (250 problems) for students who are preparing for high school mathematics contests such as American Mathematics Competitions (AMC-10/12), MathCON Finals, and Math Leagues. It contains 10 practice tests and their full detailed solutions. The authors, Sinan Kanbir and Richard Spence, have extensive experience of math contests preparation and teaching. Dr. Kanbir is the author and co-author of four research and teaching books and several publications about teaching and learning mathematics. He is an item writer of Central Wisconsin Math League (CWML), MathCON, and the Wisconsin section of the MAA math contest. Richard Spence has experience competing in contests including MATHCOUNTS®, AMC 10/12, AIME, USAMO, and teaches at various summer and winter math camps. He is also an item writer for MathCON.

While the books in this series are primarily designed for AMC competitors, they contain the most essential and indispensable concepts used throughout middle and high school mathematics. Some featured topics include key concepts such as equations, polynomials, exponential and logarithmic functions in Algebra, various synthetic and analytic methods used in Geometry, and important facts in Number Theory. The topics are grouped in lessons focusing on fundamental concepts. Each lesson starts with a few

solved examples followed by a problem set meant to illustrate the content presented. At the end, the solutions to the problems are discussed with many containing multiple methods of approach. I recommend these books to not only contest participants, but also to young, aspiring mathletes in middle school who wish to consolidate their mathematical knowledge. I have personally used a few of the books in this collection to prepare some of my students for the AMC contests or to form a foundation for others. By Dr. Titu Andreescu US IMO Team Leader (1995 - 2002) Director, MAA American Mathematics Competitions (1998 - 2003) Director, Mathematical Olympiad Summer Program (1995 - 2002) Coach of the US IMO Team (1993 - 2006) Member of the IMO Advisory Board (2002 - 2006) Chair of the USAMO Committee (1996 - 2004) I love this book! I love the style, the selection of topics and the choice of problems to illustrate the ideas discussed. The topics are typical contest problem topics: divisors, absolute value, radical expressions, Veita's Theorem, squares, divisibility, lots of geometry, and some trigonometry. And the problems are delicious. Although the book is intended for high school students aiming to do well in national and state math contests like the American Mathematics Competitions, the problems are accessible to very strong middle school students. The book is well-suited for the teacher-coach interested in sets of problems on a given topic. Each section begins with several substantial solved examples followed by a varied list of problems ranging from easily accessible to very challenging. Solutions are provided for all the problems. In many cases, several solutions are provided. By Professor Harold Reiter Chair of MATHCOUNTS Question Writing Committee. Chair of SAT II Mathematics committee of the Educational Testing

Service Chair of the AMC 12 Committee (and AMC 10) 1993 to 2000.

A collection of problems put together by coaches of the U.S. International Mathematical Olympiad Team.

"In 2000, the Mathematical Association of America initiated the American Mathematics Competitions 10 (AMC 10) for students up to grade 10. The Contest Problem Book VIII is the first collection of problems from that competition, covering the years 2000-2007. J. Douglas Faires and David Wells were the joint directors of the AMC 10 and AMC 12 during that period, and have assembled this book of problems and solutions." "There are 350 problems from the first 14 contests included in this collection. A Problem Index at the back of the book classifies the problems into the following major subject areas: Algebra and Arithmetic, Sequences and Series, Triangle Geometry, Circle Geometry, Quadrilateral Geometry, Polygon Geometry, Coordinate Geometry, Solid Geometry, Counting, Discrete Probability, Statistics, Number Theory, and Logic. The major subject areas are then broken down into subcategories for ease of reference. The problems are cross-referenced when they represent several subject areas."--BOOK JACKET.

Remarkable puzzlers, graded in difficulty, illustrate elementary and advanced aspects of probability. These problems were selected for originality, general interest, or because they demonstrate valuable techniques. Also includes detailed solutions.

Many mathematicians have been drawn to mathematics through their experience with math circles: extracurricular programs exposing teenage students to advanced mathematical topics and a

myriad of problem solving techniques and inspiring in them a life-long love for mathematics. Founded in 1998, the Berkeley Math Circle (BMC) is a pioneering model of a U.S. math circle, aspiring to prepare our best young minds for their future roles as mathematics leaders. Over the last decade, 50 instructors--from university professors to high school teachers to business tycoons--have shared their passion for mathematics by delivering more than 320 BMC sessions full of mathematical challenges and wonders. Based on a dozen of these sessions, this book encompasses a wide variety of enticing mathematical topics: from inversion in the plane to circle geometry; from combinatorics to Rubik's cube and abstract algebra; from number theory to mass point theory; from complex numbers to game theory via invariants and mono-variants. The treatments of these subjects encompass every significant method of proof and emphasize ways of thinking and reasoning via 100 problem solving techniques. Also featured are 300 problems, ranging from beginner to intermediate level, with occasional peaks of advanced problems and even some open questions. The book presents possible paths to studying mathematics and inevitably falling in love with it, via teaching two important skills: thinking creatively while still "obeying the rules," and making connections between problems, ideas, and theories. The book encourages you to apply the newly acquired knowledge to problems and guides you along the way, but rarely gives you ready answers. "Learning from our own mistakes" often occurs through discussions of non-proofs and common problem solving pitfalls. The reader has to commit to mastering the new theories and techniques by "getting your hands dirty" with the problems, going back and reviewing necessary problem solving techniques

and theory, and persistently moving forward in the book. The mathematical world is huge: you'll never know everything, but you'll learn where to find things, how to connect and use them. The rewards will be substantial. In the interest of fostering a greater awareness and appreciation of mathematics and its connections to other disciplines and everyday life, MSRI and the AMS are publishing books in the Mathematical Circles Library series as a service to young people, their parents and teachers, and the mathematics profession.

Collection of nearly 200 unusual problems dealing with congruence and parallelism, the Pythagorean theorem, circles, area relationships, Ptolemy and the cyclic quadrilateral, collinearity and concurrency and more. Arranged in order of difficulty. Detailed solutions.

This is the seventh book of problems and solutions from the Mathematics Competitions. Contest Problem Book VII chronicles 275 problems from the American Mathematics Contests (AMC 12 and AMC 10 for the years 1995 through 2000, including the 50th Anniversary AHSME issued in 1999). Twenty-three additional problems with solutions are included. A Problem Index classifies the 275 problems in to the following subject areas: Algebra, Complex Numbers, Discrete Mathematics (including Counting Problems), Logic, and Discrete Probability, Geometry (including Three Dimensional Geometry), Number Theory (including Divisibility, Representation, and Modular Arithmetic), Statistics, and Trigonometry. For over 50 years many excellent exams have been prepared by individuals throughout our mathematical community in the hope that all secondary school students will have an opportunity to participate in these problem solving and enriching mathemat-

ics experiences. The American Mathematics Contests are intended for everyone from the average student at a typical school who enjoys mathematics to the very best student at the most special school.

Over 300 unusual problems, ranging from easy to difficult, involving equations and inequalities, Diophantine equations, number theory, quadratic equations, logarithms, more. Detailed solutions, as well as brief answers, for all problems are provided.

This book is intended as a teacher's manual and as an independent-study handbook for students and mathematical competitors. Based on a traditional teaching philosophy and a non-traditional writing approach (the stair-step method), this book consists of new problems with solutions created by the authors. The main idea of this approach is to start from relatively easy problems and "step-by-step" increase the level of difficulty toward effectively maximizing students' learning potential. In addition to providing solutions, a separate table of answers is also given at the end of the book. A broad view of mathematics is covered, well beyond the typical elementary level, by providing more in depth treatment of Geometry and Trigonometry, Number Theory, Algebra, Calculus, and Combinatorics.

A textbook suitable for undergraduate courses. The materials are presented very explicitly so that students will find it very easy to read. A wide range of examples, about 500 combinatorial problems taken from various mathematical competitions and exercises are also included.

* Problem-solving tactics and practical test-taking techniques provide in-depth enrichment and preparation for various math com-

petitions * Comprehensive introduction to trigonometric functions, their relations and functional properties, and their applications in the Euclidean plane and solid geometry * A cogent problem-solving resource for advanced high school students, undergraduates, and mathematics teachers engaged in competition training

This third volume of problems from the William Lowell Putnam Competition is unlike the previous two in that it places the problems in the context of important mathematical themes. The authors highlight connections to other problems, to the curriculum and to more advanced topics. The best problems contain kernels of sophisticated ideas related to important current research, and yet the problems are accessible to undergraduates. The solutions have been compiled from the American Mathematical Monthly, Mathematics Magazine and past competitors. Multiple solutions enhance the understanding of the audience, explaining techniques that have relevance to more than the problem at hand. In addition, the book contains suggestions for further reading, a hint to each problem, separate from the full solution and background information about the competition. The book will appeal to students, teachers, professors and indeed anyone interested in problem solving as a gateway to a deep understanding of mathematics.

265 challenging problems in all phases of group theory, gathered for the most part from papers published since 1950, although some classics are included.

The American Mathematics Competition (AMC) series is a group of contests that judge students' mathematical abilities in the

form of a timed test. The AMC 8 is the introductory level competition in this series and is taken by tens of thousands of students every year in grades 8 and below. Students are given 40 minutes to complete the 25 question test. Every right answer receives 1 point and there is no penalty for wrong or missing answers, so the maximum possible score is 25/25. While all AMC 8 problems can be solved without any knowledge of trigonometry, calculus, or more advanced high school mathematics, they can be tantalizingly difficult to attempt without much prior experience and can take many years to master because problems often have complex wording and test the knowledge of mathematical concepts that are not covered in the school curriculum. This book is meant to teach the skills necessary to solve mostly any problem on the AMC 8. However, our goal is to not only teach you how to perfect the AMC 8, but we also want you to learn and understand the topics presented as if you were in a classroom setting. Above all, the first and foremost goal is for you to have a good time learning math! The units that will be covered in this book are the following: - Test Taking Strategies for the AMC 8 - Number Sense in the AMC 8 - Number Theory in the AMC 8 - Algebra in the AMC 8 - Counting and Probability in the AMC 8 - Geometry in the AMC 8 - Advanced Competition Tricks for the AMC 8

Appealing to everyone from college-level majors to independent learners, *The Art and Craft of Problem Solving*, 3rd Edition introduces a problem-solving approach to mathematics, as opposed to the traditional exercises approach. The goal of *The Art and Craft of Problem Solving* is to develop strong problem solving skills, which it achieves by encouraging students to do math rather than just study it. Paul Zeitz draws upon his experience as a coach for

the international mathematics Olympiad to give students an enhanced sense of mathematics and the ability to investigate and solve problems.

This book takes the reader on a journey through the world of college mathematics, focusing on some of the most important concepts and results in the theories of polynomials, linear algebra, real analysis, differential equations, coordinate geometry, trigonometry, elementary number theory, combinatorics, and probability. Preliminary material provides an overview of common methods of proof: argument by contradiction, mathematical induction, pigeonhole principle, ordered sets, and invariants. Each chapter systematically presents a single subject within which problems are clustered in each section according to the specific topic. The exposition is driven by nearly 1300 problems and examples chosen from numerous sources from around the world; many original contributions come from the authors. The source, author, and historical background are cited whenever possible. Complete solutions to all problems are given at the end of the book. This second edition includes new sections on quadratic polynomials, curves in the plane, quadratic fields, combinatorics of numbers, and graph theory, and added problems or theoretical expansion of sections on polynomials, matrices, abstract algebra, limits of sequences and functions, derivatives and their applications, Stokes' theorem, analytical geometry, combinatorial geometry, and counting strategies. Using the W.L. Putnam Mathematical Competition for undergraduates as an inspiring symbol to build an appropriate math background for graduate studies in pure or

applied mathematics, the reader is eased into transitioning from problem-solving at the high school level to the university and beyond, that is, to mathematical research. This work may be used as a study guide for the Putnam exam, as a text for many different problem-solving courses, and as a source of problems for standard courses in undergraduate mathematics. Putnam and Beyond is organized for independent study by undergraduate and graduate students, as well as teachers and researchers in the physical sciences who wish to expand their mathematical horizons.

This book contains the curriculum materials of the Math Challenge courses at Areteem Institute. The math competitions for middle and high school students generally do not involve college mathematics such as calculus and linear algebra. There are four main topics covered in the competitions: Number Theory, Algebra, Geometry, and Combinatorics. The problems in the math competitions are usually challenging problems for which conventional methods are not sufficient, and students are required to use more creative ways to combine the methods they have learned to solve these problems. The companion book, "Cracking the High School Math Competitions," covers these topics, along with fundamental concepts required and problem solving strategies useful for solving problems in the math competitions such as AMC 10 & 12, ARML, and ZIML Division JV. This book provides complete solutions to the problems in the aforementioned book. For information about Areteem Institute, visit <http://www.areteem.org>.