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math HORIZONS

81% of Math Horizons readers plan on going to graduate school, 55% percent of those students don't know which school they'll attend yet!

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MATH HORIZONS

This book is intended to help students preparing to participate in the USA Mathematical Olympiad (USAMO) in the hope of representing the United States at the International Mathematical Olympiad (IMO). The USAMO is the third stage of the selection process leading to participation in the IMO. The preceding examinations are the AMC 10 or the AMC 12 (which replaced the American High School Mathematics Examination) and the American Invitational Mathematics Examination (AIME). Participation in the AIME and the USAMO is by invitation only, based on performance in the preceding exams of the sequence.

The top 12 USAMO students are invited to attend the Mathematical Olympiad Summer Program (MOSP) regardless of their grade in school. Additional MOSP invitations are extended to the most promising non-graduating USAMO students as potential IMO participants in future years. During the first days of MOSP, IMO-type exams are given to the top 12 USAMO students with the goal of identifying the six members of the USA IMO Team. The Team Selection Test (TST) simulates an actual IMO, consisting of six problems to be solved over two 4 1/2 hour sessions. The 12 equally weighted problems (six on the USAMO and six on the TST) determine the USA Team.

The Mathematical Olympiad booklets have been published since 1976. Copies for each year through 1999 can be ordered from the Mathematical Association of America's (MAA) American Mathematics Competitions (AMC). This publication, as well as Mathematical Olympiads for each year from 2000 to 2004 are published by the MAA. In addition, various other publications are useful in preparing for the AMC-AIME-USAMO-IMO sequence (see Chapter 6, Further Reading). For more information about the AMC examinations or the MOSP, or to order Mathematical Olympiad booklets

In this book we will look at the interaction between two fields of mathematics: number theory and ergodic theory (as part of dynamical systems). The subject under study is thus part of what is known in France as Theorie Ergodique des Nombres, and consists of a family of series expansions of numbers in the unit interval [0,1] with their 'metrical properties.' So the questions we want to study are number theoretical in nature, and the answers will be obtained with the help of ergodic theory. That is, we will view these expansions as iterations of an appropriate measure-preserving transformation on [0,1], which will then be shown to be ergodic. The number-theoretical questions will be reformulated in the language of ergodic theory. What it means to be ergodic, or- in general- what the basic ideas behind ergodic theory entail, will be explained along the way.
This book grew out of a course given in 1996 at George Washington University, Washington, DC, during the Summer Program for Women in Mathematics, sponsored by NSA. Out aim was not to write yet another book on ergodic theory (there are already several outstanding books, most of them mentioned in these pages), but to introduce first-year graduate students to a dynamical way of thinking. Consequently, many classical concepts from ergodic theory are either briefly mentioned, or even left out. In this book we focus our attention on easy concepts like ergodicity and the ergodic theorem, and then apply these concepts to familiar expansions to obtain old and new results in an elegant and straightforward manner.
Clearly this means that a number of concepts from probability and measure theory will be used. In our set-up we first introduce these, in-we hope and think-an informal and gentle way.

Review (a fair-use review excerpt; the source must be cited):
"Though aimed at beginning graduate

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MAA Spotlight

MAA University
Summer Institute of Hyperbole

Dr. Matt E. Matik
MAA University

Many students leave a traditional calculus course with very little sense of the powerful role calculus plays in the modern world. They don't know that calculus is the language which describes anything that changes, that much of technology is based on ideas from calculus, that calculus is useful in social science as well as physical and biological science, or that optimization is a key to efficiently in business and industrial processes. If we merely tell students these things, they may not take our pronouncements very seriously. If we offer students only "toy" applications, we invite them not to take us seriously.
This volume contains eighteen serious and diverse applications of calculus. Students will see how calculus can explain the structure of a rainbow, guide a robot arm, or analyze the spread of AIDS. Each application module starts with a concrete problem-Is a Canadian voting scheme fair? What happens when you tune a radio? How could you choose the best portfolio of stocks?- and develops a solution to the problem based on the ideas of calculus. The discussions are fairly detailed, realistic and pay careful attention to the process of mathematical modeling.

The modules are written for students, complete with exercises, solutions, and references. Whether they are used as individual reading, as material for group work, or just as the basis for "application" lectures in class, they will make it clear that calculus is actively employed in the world outside our classrooms.
Field Theory and Its Classical Problems lets Galois theory unfold in a natural way, beginning with the geometric construction

Field Theory and Its Classical Problems lets Galois theory unfold in a natural way, beginning with the geometric construction problems of antiquity, continuing through the constructibility of regular n-gons and the properties of roots of unity, and then on to the solvability of polynomial equations by radicals, and beyond. The logical pathway is historic, but the terminology is consistent with modern treatments. No previous knowledge of groups, fields, or abstract algebra is assumed. Notable topics treated along this route include the transcendence of e and of pi, cyclotomic polynomials, polynomials over the integers, Hilbert's irreducibility theorem, and many other gems in classical mathematics. Historical and bibliographical notes complement the text, and complete solutions are provided to all problems.
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MATH HORIZONS

This volume, compiled by the editors on behalf of the Linear Algebra Curriculum Study Group, is for instructors and students of linear algebra as well as all those interested in the ideas of elementary linear algebra. We have noticed, through attendance at special sessions organized at the Joint Annual Meetings and through talks given at other conferences and universities, that there is broad and sustained interest in the content of undergraduate linear algebra courses.
Since the course became a centerpiece of the mathematics curriculum, beginning around 1960, new topics and new treatments have gradually reshaped it, with noticeably greater evolution than in calculus courses. In addition, current courses are often taught by those not trained in the subject or by those who learned linear algebra in a course rather different from the present one. In this setting, it is not surprising that there is considerable interest in the context and subtleties of ideas in the linear algebra course and in a perspective based upon what lies just beyond. With this in mind, we have selected 74 items and an array of problems, some previously published and some unpublished in response to our request for such items. We hope that these will provide a useful background and alternative techniques for instructors, sources of enrichment projects and extended problems for teachers and students, impetus for further textbook evolution to writers, and the enjoyment of discovery to others.
The Linear Algebra Curriculum Study Group (LACSG) began with a special session, at the January 1990 Joint Annual Meetings, focusing upon the elementary linear algebra course. This session was organized by Duane Porter, following upon an NSF-sponsored Rocky Mountain Mathematics Consortium Lecture Series given by Charles Johnson at the University of Wyoming; David Carlson and David Lay were panel members for that session. With NSF encouragement and support, these four organized a five day workshop held at the College of William and Mary in August, 1990. The goal was to initiate substantial and sustained national interest in improving the undergraduate linear algebra curriculum. The workshop panel was broadly based, both geographically and with regard to the nature of institutions represented. In addition, consultants from client disciplines described the role of linear algebra in their areas and suggested ways in which the curriculum could be improved from their perspective.
Preliminary versions of LACSG recommendations were completed at this workshop and widely circulated for common. After receiving comments and with the benefit of much discussion, a version was published in 1993. This was followed by a companion volume to this one in 1997 (Resources for Teaching Linear Algebra). Work of the LACSG has continued with the organization of multiple special sessions at each of the Joint Annual meetings from 1990 through 1998. With sustained strong attendance at these sessions, acknowledged influence on newer textbooks, discussion in letters to the AMS Notices, and the ATLAST workshops, the general goal of the LACSG is

ars, most from the American Mathematical Monthly and the college Mathematics Journal. New (previously unpublished) items were selected from about 100 responses to our call for contributions. Generally, we have chosen items that relate in some way to the first course, might evolve into the first course, or are just beyond it. However, second courses are an important recommendation of the LACSG, and some items are, perhaps, only appropriate at this level. Typically, we have avoided for which both the topic and treatment are well established in current textbooks. For example, there has been dramatic improvement in the last few decades in the use of row operations and reduced echelon form to elucidate or make calculations related to basic issues in linear algebra. But, many of these have quickly found their way into textbooks and become well established, so that we have not included discussion of them. Also, because of the ATLAST volume, we have not concentrated upon items that emphasize the use of technology in transmitting elementary ideas, though this is quite important. We do not claim that each item is a "gem" in every respect, but something intrigued us about each one. Thus, we feel that each has something to offer and, also, that every reader will find something of interest.
Based upon what we found, the column is organized into ten topical "parts." The parts and the items within each part are in no particular order, except that we have tried to juxtapose items that are closely related. Many items do relate to parts other than the one we chose. The introduction to each part provides a bit of background or emphasizes important issues about constituent items. Because of the number of items reprinted without editing, we have not adopted a common notation. Each item should be regarded as a stand-alone piece with its own notation or utilizing fairly standard notation.

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The Mathematical Association of America is the largest professional society that focuses on mathematics accessible at the undergraduate level. Our members include university, college, and high school teachers; graduate and undergraduate students; pure and applied mathematicians; computer scientists; statisticians; and many others in academia, government, business, and industry. We welcome all who are interested in the mathematical sciences

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