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# Basic Training In Mathematics: A Fitness Program For Science Students



## **Synopsis**

Based on course material used by the author at Yale University, this practical text addresses the widening gap found between the mathematics required for upper-level courses in the physical sciences and the knowledge of incoming students. This superb book offers students an excellent opportunity to strengthen their mathematical skills by solving various problems in differential calculus. By covering material in its simplest form, students can look forward to a smooth entry into any course in the physical sciences.

## **Book Information**

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## **Customer Reviews**

This is the best book I have found for explaining the math needed by physicists and others in the hard sciences. Shankar uses a very conceptual approach to the mathematics without dwelling on proofs - leaving the reader with an understanding of the mathematics involved. He also tackles difficult ideas like: why are complex numbers necessary and where do they come from? Most books simply assume these ideas and run off into the wild blue yonder with some proofs to give a veneer of completeness, whereas Shankar tries to give a conceptual underpinning that is invaluable when

he tackles advanced topics (such as contour integration). His approach throughout is conceptual and pragmatic - giving you a solid understanding for the math you will actually use. Though it is designed for undergraduates, I would also recommend it to anyone either reviewing their math or (re)learning math they should have already known. I used this book to study for the math section of my physics PhD. qualifier and I only wish that I had stumbled across it sooner - it would have made many of my physics courses a lot easier.

This was the textbook used for a class I took several years ago, and since then I've really grown to appreciate what a great foundation in mathematical methods it gave me. The text is clear and concise, the problems challenging and illuminating. Shankar writes with a dry sense of humor that makes his book anything but dry reading for the student (a frequent problem I've had with other math textbooks). I've found this book an invaluable reference on numerous occasions. I think the best praise that I can give is that it provided me with a mathematical intuition for much of what I learned in physics, especially Quantum Mechanics. Shankar ingeniously sets up many problems so that when the student comes across the topics in later study, he or she not only already understands the mathematical basis for the physical laws but also can guess where the arguments are going next. Using this book and Shankar's Quantum Mechanics textbook in a later course made for one of the most rewarding intellectual explorations I have ever had.

This book tries to cover pretty much all the mathematical methods you'd need in college-level physics if you haven't had much experience with them before. The trouble is that that is a LOT of math, and trying to cover that in a book this size is just asking for trouble. If you don't know any of this stuff, this book is going to kill you. It covers multivariable and vector calculus, differential equations, linear algebra, functions of a complex variable, etc. That is maybe 4-5 different math courses. The idea is that physicists don't really need the rigor of theoretical math, they just need to learn the "tools" so they can do the practical, applied stuff. This book is good if you already have a general idea of these concepts and just want to get the important parts.

Wish I had come across this book earlier. Other undergraduate math refresher/review books are either too basic or too formulaic (if I had wanted a table of functions I would have bought one). The stress is clearly on concepts, followed by techniques. The book is a great review of all the oohs and aahs of undergraduate and high school mathematics that you have forgotten over the years. I graduated from high school 15 years ago and by page 3 I was doing derivatives from first principles.

Richard Courant's "What is Mathematics?" would make an excellent companion to this book. For example I complemented the first two chapters on calculus with the chapters on number systems and, limits and continuity from Courant's book and I truly felt that my calculus review was complete.

This is a great book for someone who did his undergraduate studies in Engineering or Chemistry (like me) and now is entering a Physics program. It is a great review of most of the important stuff in Math for Physics, without the boring mathematical style: straight to the point with relevant examples. Another good point is that it has problems scattered INSIDE the text, which enforce you to do them. Most of them are interesting and in a physical context (as: Lorentz transformations - as an example of a "rotation" matrix , Maxwell equations - an exercise in vector analysis etc.) In addition, I don't agree with the reviewers who claim that you cannot actually LEARN new topics from it. I never learned "complex functions" during my undergrad, and actually managed to learn it with Shankar - at least the things important to a physicist. A drawback: a chapter about group theory could be useful.

The text presents in remarkably clear and concise fashion exactly those areas of mathematics required for the physical sciences, especially physics. The sections on linear algebra, vector spaces, Hilbert space, Fourier analysis and differential equations build and articulate elegantly to open a first window on the vistas of quantum mechanics. Problems are likewise chosen with care to assist the student in raising himself to the next level of understanding, section by section in a well-thought out sequence. The only problems are with visual layout of the text and occasional typographical errors (one in a complex differential equation that forms the basis of a problem). I have since gone back to this text many times as a refresher.

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