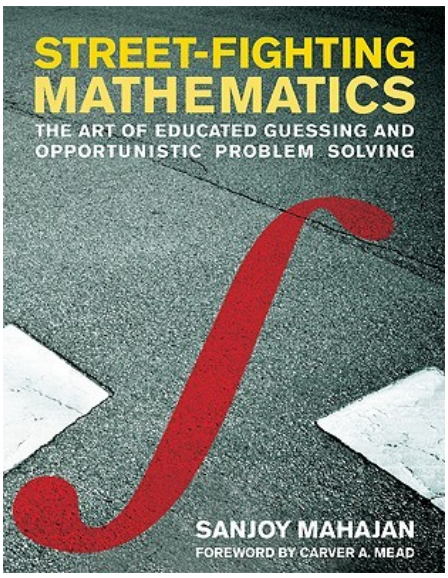

Street-Fighting Mathematics: The Art of Educated Guessing and Opportunistic Problem Solving

Sanjoy Mahajan , Carver A. Mead

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An antidote to mathematical rigor mortis, teaching how to guess answers without needing a proof or an exact calculation.

In problem solving, as in street fighting, rules are for fools: do whatever works--don't just stand there! Yet we often fear an unjustified leap even though it may land us on a correct result. Traditional mathematics teaching is largely about solving exactly stated problems exactly, yet life often hands us partly defined problems needing only moderately accurate solutions. This engaging book is an antidote to the rigor mortis brought on by too much mathematical rigor, teaching us how to guess answers without needing a proof or an exact calculation.

In *Street-Fighting Mathematics*, Sanjoy Mahajan builds, sharpens, and demonstrates tools for educated guessing and down-and-dirty, opportunistic problem solving across diverse fields of knowledge--from mathematics to management. Mahajan describes six tools: dimensional analysis, easy cases, lumping, picture proofs, successive approximation, and reasoning by analogy. Illustrating each tool with numerous examples, he carefully separates the tool--the general principle--from the particular application so that the reader can most easily grasp the tool itself to use on problems of particular interest. Street-Fighting Mathematics grew out of a short course taught by the author at MIT for students ranging from first-year undergraduates to graduate students ready for careers in physics, mathematics, management, electrical engineering, computer science, and biology. They benefited from an approach that avoided rigor and taught them how to use mathematics to solve real problems.

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Street-Fighting Mathematics: The Art of Educated Guessing and Opportunistic Problem Solving Details

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From Reader Review Street-Fighting Mathematics: The Art of Educated Guessing and Opportunistic Problem Solving for online ebook

Robert Martin says

I agree that it is very useful to be able to make back-of-the-envelope approximations to difficult problems, but some of the methods presented here are of questionable utility and are rather hard to justify.

I did like first few chapters which mainly dealt with dimensional analysis and integrals, but it seriously went downhill from there. What irritates me is when they so obviously stick a rabbit into a hat ("1/4 is close enough to 1/ 2pi") then expect you to be impressed when the rabbit pops out later ("our answer is, in fact, exact!!!!"). In essence, this book will teach you the art of reverse-engineered hand-wavy solutions.

It is definitely worth going through the first few chapters, but the rest deserved to be flicked-through at best.

Pôl says

Tricks and techniques to guess "good enough" answers to complicated calculus problems. The math was beyond me, but I have enough of a math/physics background that I understood the basic ideas.

If I ever find myself in a situation where I'm dealing with complicated equations on a day-to-day basis, then this book is going to be sitting on my shelf. The techniques in this book are useful not only for getting quick, rough-estimate answers, but also show you how to better understand equations by looking at them in different ways. I've never been intuitive about math, and I've always had a hard time understanding the real-world meaning of any given equation. It would be invaluable to me to have a book that showed me how to, say, analyze which variable is most important, or how to think about an equation graphically, or how to draw useful analogies.

Highly recommended for calculus, physics, or engineering students, from first year to grad school. Also recommended for any professional who has to deal with complicated equations as part of their job.

Sendhil says

I wish I'd had this book in college. It explicates some quantitative methods (what one might call "physical intuition") that are similar to what I got from studying physics and mathematics at the undergraduate level; however, it unpacks these ideas in a way that standard texts (and, unfortunately, many courses) never do. There is some really nice, very "transferable" thinking here, and the tone is conversational. (To top it all off, Professor Mahajan has made the text available free online under MIT's OpenCourseWare license.)

The only drawback I saw was that (since much of the book presumes familiarity with first- or second-year collegiate math and physics content) there are a lot of nice ideas here that could transfer even further, but which the presentation might not make accessible to parts of its potential audience. So on the other hand, it's

definitely got me thinking about how to draw out some of these ideas for middle- and high-school students who might otherwise be sliding into the chasm of "math isn't supposed to make sense".

Nemo says

Meh. Read it as an intro to the MIT OCW course that is nothing more that a read companion to this book. Honestly it's quite interesting,but the tricks exposed in the book can hardly be applied outside of the context of the book itself. Other stuff it's just common sense. Anyway it's a good read for your amusement, but after reading it i'm not interested anymore in the course.

Bob says

Great read and very insightful. I highly recommend it. My only caveat is that it is not a book for math novices. If you aren't familiar with calculus, differential equations and statistics you may not find the book enjoyable.

Frederick Bingham says

I skimmed this one. It codifies some things I already do, like dimensional analysis and order of magnitude estimation. I could see how this might make a good textbook for the right kind of course.

Daniel Wilson says

A fantastic book which only requires some mathematical wherewithal. Covers various methods for estimation and informal proofs. I really liked the intuitive way he describes the topics, which range from Taylor Series to capacitors to cute geometrical proofs. You can access the book here:

http://mitpress.mit.edu/books/full_pd...

Woflmao says

This book gives examples of educated guessing and approximation methods to evaluate functions, or to obtain information on functions that are too hard to evaluate. As such, the book's target audience are physicists and engineers who frequently need to reason about complicated expressions for which they do not have closed form solutions. (The book is not so much aimed at mathematicians, as they are usually more concerned with analysing the structure of a problem, which is not what the book is about.)
Personally, I found some of the methods surprising, and a few of them were rather common sense. My favourites would be the dimensional analysis, the pictorial proofs, some of the methods about analogies and "taking out the big parts".
However, the history of approximation is a history written by the victors. All the approximations we learn

about in physics which lead to great insights are only there because they were found to work a posteriori. We are not interested in approximations that do not work, and therefore you never read about them. With this book, it is the same. The tricks for approximations you find here are in there because they work in the particular examples. Unfortunately, it is a common theme with heuristics that there is no way of telling how well they generalise to other cases. Some of the techniques in this book also require a lot of previous knowledge about the problem, for example the application of the Navier-Stokes equation to estimate the drag on a falling paper cone.

Tung says

Not to brag, but I was a math whiz in high school and college, which is why I'm a fan of pop-math books that frame real world issues through the lens of numbers. Given the title of this book (and its subtitle "The Art of Educated Guessing and Opportunistic Problem Solving"), I was expecting something similar. I was surprised to find that instead of a pop-math book, this book is a straight-up math textbook. Mahajan teaches several new ways to approach mathematical problem-solving that tries to meld the theoretical with the practical, especially for situations that don't call for perfect precision. He even provides example problems to demonstrate his points and additional practice problems so that you can apply what you've just learned. This book is impossible for anyone who hasn't mastered calculus and basic Physics. The mathematician in me found this interesting; the reader in me realized I made a mistake in putting this on my 2012 Booklist. Recommended for mathematicians only.

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satej soman says

thanks to this book, i'm going to punch the navier-stokes equations if i ever see them on the street

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Adam says

An excellent collection of ways to tackle difficult applied math problems. I wish I had had more time to read it in depth. I can see this being useful in my work.

Svarnyp says

Do not let the title fool you; this book is not for a commoner, this is hardcore mathematics.

Yes, it shows you how to cut corners in mathematics, but it does not shy away from formulae or regular invocations of calculus as something the reader is supposed to be intimately familiar with. This book is a college textbook and an excellent one - with examples, explanations, connections to physics and other STEM sciences. However, I would assume that anyone, who uses this type of advanced math, already thought about ways how to simplify the application of it and thus uses most of what is contained in the book.

Nevertheless, I recommend the book to especially college students or engineers to at least skim through. They will find some puzzles/exercises to test their wits on, and they might see some useful trick. Sanjoy

certainly gave these corner-cutting tools some thought and presented them in depth and with an extensive discussion.

Sometimes the explanations seem more as a part of a supplementary course that relies on someone else to explain the mathematics themselves. Still, what I would certainly want to see in all math textbooks and deserves praise are the various and profound usage examples not only in physics but also in chemistry and other subjects.

Guy Amir says

Great insight for students of physics and engineering. I would recommend young undergraduates to skim through the more intuitive parts (chapter 1 - dimensions, chapter 4 - pictorial proofs and the parts of other chapters that seem to catch your eyes) and read the rest as you advance in your studies. e.g., there's no good reason to read about guessing a Gaussian integral without ever using one or knowing it's properties.

Aaron Terrazas says

Some clever tricks, although I'm not sure a book that has differential equations on page 4 qualifies as "street fighting" level (unless we're talking about the mean streets of Cambridge, MA).

Mika says

"Most of us took mathematics courses from mathematicians—Bad Idea!"
