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Good Math

A Geek's Guide to the Beauty of Numbers, Logic, and Computation

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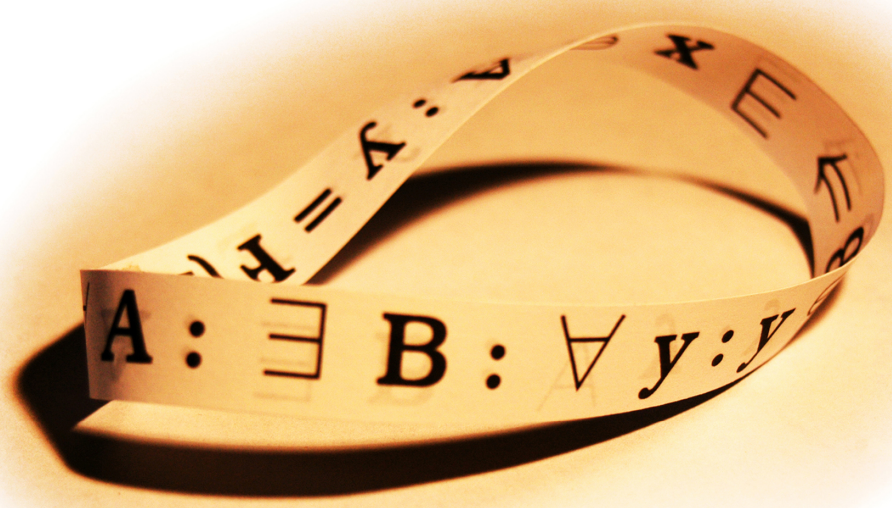

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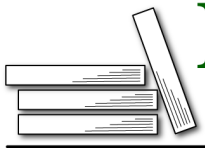

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This book is dedicated to the memory of my father, Irving Carroll (zt"l). He set me on the road to becoming a math geek, which is why this book exists. More importantly, he showed me, by example, how to be a mensch: by living honestly, with compassion, humor, integrity, and hard work.

Preface

Where'd This Book Come From?

Growing up, some of my earliest memories of my father involve math. My dad was a physicist who worked for RCA doing semiconductor manufacturing, so his job involved a lot of math. Sometimes he'd come home with some unfinished work to do over the weekend. He'd be sitting in the living room of our house, with a scattering of papers around him and his trusty slide rule by his side.

Being a geeky kid, I thought the stuff he was doing looked cool, and I'd ask him about it. When I did, he always stopped what he was doing and explained it to me. He was a fantastic teacher, and I learned so much about math from him. He taught me the basics of bell curves, standard deviations, and linear regression when I was in third grade! Until I got to college, I never actually learned anything in math class at school because my dad had always taught it to me long before we got to it in the classroom.

He did much more than just explain things to me. He taught me how to teach. He always told me that until you could explain something to someone else, you didn't really understand it yourself. So he'd make me explain things back to him as though he didn't know them.

Those times with my dad were the foundation of my love of math, a love that's lasted through the decades.

Back in 2006 or so, I started reading science blogs. I thought that these blog things were really fascinating and really exciting. But I didn't think that I had anything to say that would interest anyone else. So I just read what others wrote, and sometimes I commented.

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And then one day I was reading a blog called *Respectful Insolence*, written under the pseudonym "Orac," by a guy who was a professional cancer surgeon. He was talking about a paper written by a couple of crackpots who had drawn ridiculous conclusions from data published in a public database. Orac dismantled their arguments meticulously, explaining why the authors' claims about basic medicine and biology were ridiculous. But in reading the original paper, what struck me was that refuting the authors' misunderstanding of biology was unnecessary; their entire argument turned on interpreting graph data in a way that was completely bogus. That's when I realized that while tons of biologists, doctors, neurologists, physiologists, and physicists were blogging about their specialties, no one was blogging about math!

So I went to Blogger and created a blog. I wrote up my critique of the sloppy math in the paper and sent a link to Orac. I figured that I'd probably get a couple of dozen people to read it and that I'd probably give up on it after a couple of weeks.

But once I'd published that first post on my new blog, I thought about my dad. He was the kind of guy who wouldn't approve of spending time making fun of people. Doing that once in a while was fine, but making an entire hobby out of it? Not something he'd be proud of.

Remembering how he taught me, I started writing about the kind of math I loved, trying to help other people see why it was so beautiful, so fun, and so fascinating. The result was my blog, *Good Math/Bad Math*. It's been almost seven years since I started writing it, and my posts now number in the thousands!

When I started my blog, I thought that no one would be interested in what I had to say. I thought that I'd probably be read by a couple dozen people, and I'd give up in disgust after a couple of weeks. Instead, years later, I've acquired thousands of fans who read every post I write.

This book is my way of reaching out to a wider audience. Math *is* fun and beautiful and fascinating. I want to share that fun, beauty, and fascination with you. In this book,

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you'll find the fruits of the time my dad spent with me, teaching me to love math and teaching me to teach it to others.

I still have his slide rule. It's one of my most prized possessions.

Who This Book Is For

If you're interested in math, this book is for you! I've tried to write it so that it's accessible to anyone with a basic high-school background in math. The more background you have, the more depth you'll notice, but even if you've only taken high-school algebra, you should be able to follow along.

How to Read This Book

This isn't a book that you need to read cover-to-cover. Each chapter is mostly stand-alone. You can pick topics that interest you and read them in any order. Within the six parts of the book, chapters will often refer back to previous chapters in the same part for details. You'll get more out of those chapters if you read the referenced sections, but if you don't feel like it, you should still be able to follow along.

What Do You Need?

For most of the book, you need nothing but curiosity. In a few sections, there are a couple of programs. In case you want to run them, there are links and instructions in the section with the program.

Acknowledgments

It's always tricky trying to acknowledge everyone who contributed to a book like this. I'm sure that I'll wind up forgetting someone: if you deserved an acknowledgement but I left you out, I apologize in advance and thank you for your help!

Many thanks to the following people:

- My "blogfather" and friend Orac (aka David Gorski), who gave me the motivation to start my blog and helped me get the attention of readers when I was starting out

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- The many readers of my blog, who've caught my mistakes and helped me become a better writer
- My fellow bloggers at Scientopia
- The people who gave time and effort doing technical reviews of drafts of this book: Paul Keyser, Jason Liszka, Jorge Ortiz, and Jon Shea
- My coworkers at Foursquare, for giving me support and feedback and for making work such a fun place to be
- The crew at The Pragmatic Bookshelf, especially David Thomas and David Kelly, who went above and beyond the call of duty to make it possible to typeset the math in this book
- And, of course, my family, for putting up with a crazed geek writer

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