

phase diagrams and their relation to thermodynamics. You are remarkably knowledgeable about the subject if you do not learn something from this book.

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How Math Explains the World

A Guide to the Power of Numbers, from Car Repair to Modern Physics

James D. Stein
Smithsonian/Collins, New York,
2008. \$24.95 paper (264 pp.).
ISBN 978-0-06-124176-5

I wanted to review James Stein's *How Math Explains the World: A Guide to the Power of Numbers, from Car Repair to Modern Physics* because I expected it to be a modern source of information about Fermi problems, which I use in my classes. I was looking for something like John Allen Paulos's now rather dated *Innumeracy: Mathematical Illiteracy and Its Consequences* (Vintage, 1990). I was wrong.

My undergraduate students, primar-

ily from liberal-arts disciplines, use the phrase "do the math" to mean "put in the numbers"; they reserve the longer phrase "do the mathematics" for formal reasoning and actually doing proofs. So from that viewpoint, Stein's book is really not about math and the power of numbers to explain the world; instead, it is about mathematics on the one hand and explaining the physical world on the other. The problem with the book is that those two topics are not synthesized; they are interlaced and appear in separate segments that do not connect the mathematics and the physics. The author also spends significant time and effort relating the great mathematicians and some famous physicists to the fruits of their labor. He often tells well-known stories but occasionally adds some interesting new elements that give insight into a source of the accomplishments or an indication of the eccentricities of those people he mentions.

I can't easily guess the purpose of Stein's book, and I would not recommend it as the kind of class supplement I was looking for. It certainly does not use the usual Fermi-problem inference and estimation techniques to clarify

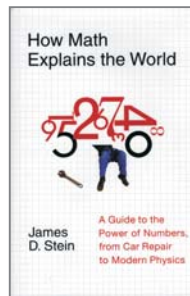
everyday situations. The book also cannot serve as a text on modern physics for poets. Stein is a mathematician, and his understanding of physics clearly comes from second- and third-hand descriptions for laymen. The result is like the telephone game, in which a sentence is passed from player to player and modified at each transfer. Therefore, although the author uses many analogies to attempt to communicate the implications of modern physics, those descriptions are sometimes incorrect and only burden the reader who wants to understand microscopic phenomena.

The book could serve as reading material for a mathematics course, but that course would have to deal with modern fundamental issues of mathematics—not the usual fare for students who won't be majoring in physics or mathematics. Much valuable space is spent on biography. The text could be a supplement to a mathematics-for-poets course; it is an easy read, except that some of the concepts and jargon are introduced without reference, and the index is far from complete. Some good editing would have helped. I was also offended by the author's bait and switch. True, the book opens with a discussion on scheduling for a car repair and closes with modern physics and preference voting. The bulk of the text, however, describes important developments of mathematics and the lives of mathematicians but does not indicate the relevance of mathematics in explaining the world. By the way, I am always bothered when the word "explain" is applied to physics. The way I look at it, physicists do a lot of experiments, and some people thoughtfully try to find a concise, consistent description of all those results—a mathematical description. But if what we do is called an "explanation," then I respectfully disagree.

So, to whom would I recommend *How Math Explains the World*? Someone who is a nonexpert traveling on a cross-continental flight could finish and enjoy it. I regularly teach a course in modern physics to very bright, mostly liberal-arts honors students, and I require that they read a book with some relationship to modern physics and prepare a response for a grade. They can select from a large list of books, and I will add Stein's book to that list. I hope those students who choose it catch some of the physics problems that bothered me.

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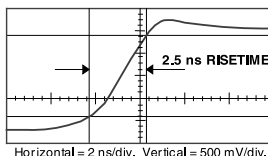
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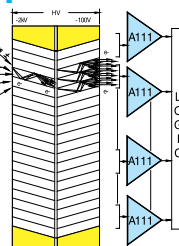
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