

# Numericon

by Marianne Freiberger and Rachel Thomas



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REVIEWED BY PAMELA GORKIN

Lots of people fear mathematics. Some even claim to hate it. But given a few minutes with those people, you can easily come up with several *really* interesting mathematical stories to convince them otherwise. Tell them about Evariste Galois. Tell them about the mathematics in *The Simpsons*. The Fibonacci sequence fascinates readers of *The Da Vinci Code*; tell them about the golden ratio,  $\phi$ . Grigory Perelman and the Fields medal even made it to The Colbert Report.<sup>1</sup> That's a pretty good story, apparently. And how about the four-color theorem? You can easily convince someone that they will need four colors to ensure that adjacent regions in a graph are colored differently. Isn't it natural to wonder if four colors always suffice? And, after you've gotten their attention, you might want to talk about something a bit more abstract, perhaps the difference between Euclidean and hyperbolic geometry. If that doesn't get them, the gambler's fallacy surely will. All these stories and many more appear in *Numericon*, a new book by Marianne Freiberger and Rachel Thomas.

*Numericon* is a physically small book (my wooden ruler tells me it's about 8"  $\times$  5" yielding a ratio suspiciously close to the golden ratio) with chapters numbered in much the same way as those in Constance Reid's *From Zero to Infinity*—except here, in addition to Chapters 0, 1, 2, 3, 4, 5, 6, 7, 10, 12, 42, 43, 60, and 100, we have chapters  $\sqrt{2}$  (Butterflies, Murder and a Proof that Didn't Fit in the Margin),  $\phi$  (From Irrationality to the Divine),  $e$  (Naturally!),  $\tau$  (Easy as  $\pi$ ?), 16929639...270130176 (The Height of Perfection), Graham's number (Too Big to Write but Not Too Big for Graham),  $\infty$  (Are We There Yet?),  $x$  (Marks the Spot), and  $i$  (Imaginary is Everything). There is also a one-line chapter called  $\varepsilon$  entitled, "It is a truth universally acknowledged...," which continues "that  $\varepsilon$  (pronounced 'epsilon') is always a very small number and usually comes with a  $\delta$  (pronounced 'delta')."

If you can think of a familiar mathematical tale that you think is kind of catchy, a brief version of it probably appears in this book. Let's focus on just one mathematician: Euler. There's Euler and his role in the Goldbach conjecture, Euler and partitions of positive integers, and there's a story of Euler and formulas for even perfect numbers. But there's more. In a subsection entitled "e Is for Euler" (followed by "e is for Napier") there's a discussion of how to

approximate the real number  $e$ . Of course, Euler's identity  $e^{i\pi} + 1 = 0$ , connecting five of the most important constants in mathematics, makes an appearance in Chapter *i*. And, after a brief discussion of vertices ( $V$ ), edges ( $E$ ), and faces ( $F$ ), Euler's formula for connected, planar graphs,  $V - E + F = 2$ , shows up in a subsection of Chapter 3 (It Takes Three) entitled "Atoms of Geometry." The Basel problem, with attribution to Euler, appears (anonymously) in a little box on " $\pi$  series." But this book is careful to include more recent applications of mathematics; some that might surprise those who claim that mathematics is useless. All of the following make an appearance here: CERN (the European Organization for Nuclear Research), CAT scans, computer-generated images, epidemiology, geodesic domes, and bees.

You should think of each of these stories as an amuse-bouche: Each story is short and intriguing. These don't dive deeply into a topic; that's not the point of this book. The goal is to keep you reading—both here and elsewhere. The authors do not provide complete references but rather a brief list of resources with short commentary in a section entitled "Get Me Some of that Special Source!" The authors' list includes fiction (e.g., *The Library of Babel* by Jorge Luis Borges), mathematical articles (e.g., Freeman Dyson's *Some Guesses in the Theory of Partitions*), and classics, such as Gleick's *Chaos*. For more about the story of Fermat's Last Theorem, the authors refer to Simon Singh's *Fermat's Enigma* and, after you know about Singh, it's just a small step to *The Code Book* or *The Simpsons and Their Mathematical Secrets*. Some obvious choices are missing; for example, given the many appearances Euler makes in this text (as well as Euler's identity, Euler's formula, Euler's characteristic, and Euler's number) one would expect to see William Dunham's *Euler, The Master of Us All* listed here. Of course, one can also turn to online sources for more information and that is actually one of the biggest perks of reviewing this book: being introduced to the online magazine *Plus*.

Freiberger and Thomas are, currently, the editors of *Plus*. If you're an educator or interested in the stories mentioned above, you should definitely check out this site<sup>2</sup>. *Plus*, available freely for "educational and non-commercial purposes," is a part of the Millennium Mathematics Project (MMP) that conveys the excitement and importance of mathematics to the public. Both *Plus* and *Numericon* aim to fight misconceptions about mathematics: It's not useless, it's not irrelevant, and—as this book and website show—it's definitely not boring.

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<sup>1</sup>The Colbert show has ended, but the video of this episode is still available: <http://thecolbertreport.cc.com/videos/xr6owj/cheating-death—fields-medal>.

<sup>2</sup><http://plus.maths.org/content/about-plus>