The Parrot's Theorem

Reviewed by Queena N. Lee-Chua

Literature for young adults often has elements of adventure and fantasy, as seen in the works of J. R. R. Tolkien, C. S. Lewis, and Lewis Carroll. *The Parrot's Theorem* is not only an adventure story but a mathematical novel as well, and it takes the reader on an odyssey through history (from Thales to Wiles). This delightful book is reminiscent of Lewis Carroll's *Through the Looking Glass* and *Curiosa Mathematica*, where mathematical tidbits are golden threads interwoven through a rich tapestry of fantasy.

The main characters are delineated in considerable depth—the deaf eleven-year-old Max Liard, whom Euclid would have classified as a solid, since Max has "length, breadth and depth" (p. 9); the reclusive bookseller Monsieur Pierre Ruche, who is bequeathed a vast library of mathematical tomes by Grosrouvre, a long-lost friend in the Amazon; and, of course, Sidney the parrot, a voluble storehouse of mathematical knowledge—theorems, proofs, and all. Not since the Cheshire Cat has such an entertaining figure been found in the pages of a mathematical fantasy book.

The highly appealing plot has all the elements of a well-crafted mystery. What exactly caused the sudden death of Grosrouvre in Brazil? What secrets lurk in Mr. Ruche's library, dubbed the Rainforest Library by Max and his family? Why are those goons after Sidney? Who kidnapped Max? And how can Archimedes, Pythagoras, Fibonacci, Cardano, and others help in ensuring that vital proofs do not fall into the wrong hands? As befits a good thriller, this book also has a satisfying twist at the end.
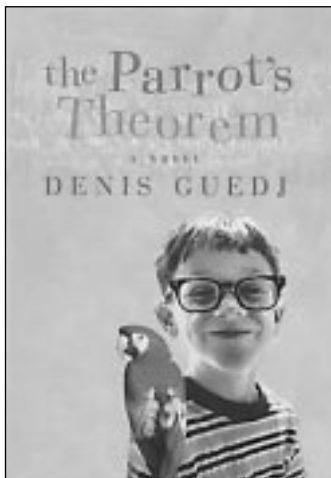
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Yet it is the mathematics and the mathematicians that hold the novel together. In order to solve the mystery, the characters must all take a mathematical history course. And what an enlightening course it turns out to be! Here the author, a professor of the history of science at Université de Paris VIII and an award-winning film writer, is at his best. The historical accounts, many of which will be familiar to mathematically inclined readers, flow seamlessly through these pages and seem in no way contrived. How Thales used similar triangles to measure the Pyramid of Cheops is explained by Mr. Ruche through a slide show, and this concept is extended when Max measures the Obelisk in Paris. Irrational numbers and the Pythagorean theorem are the topics of a play by Max and Mr. Ruche, and the proof that $\sqrt{2}$ is irrational comes alive in a conversation between Max's siblings. To introduce a tour of *The Elements*, Mr. Ruche recounts the origin of one of Euclid's famous, and possibly apocryphal, dictums: When King Ptolemy asked Euclid if there were no easier way to understand mathematics, Euclid replied, "There is no royal road to geometry."

A well-crafted chapter is devoted to expounding on the three great mathematical problems of the ancient world—the squaring of the circle, the duplication of the cube, and the trisection of an angle. The author does not hesitate to use terms such as cissoid, conchoid, or trisectrix, but through the help of figures and witty conversation he manages to convey the meaning to the lay reader without sacrificing mathematical accuracy.

Further explanation of these concepts is found in a couple of footnotes which, though they may detract from the flow of prose in an ordinary novel, are strategically placed here.

The author does not stick only to ancient mathematics but also includes discussion of the work of Newton and Leibniz, Cardano and Tartaglia, Galois, Gauss, Fermat, Cauchy, Pascal, Poisson, and Fibonacci. The book also includes some less familiar but no less fascinating historical figures: the Franciscan monk Luca Pacioli, whose *Summa de arithmetica*, published at the height of the Renaissance, was a masterpiece that brought Arabic algebra to the West; the physician Nicolas Chuquet, who wrote the earliest algebra textbook in French and was the first to use negative exponents; and Bernt Holmboe, whose student Niels Abel would eventually surpass him. Another chapter touches on the basics of calculus, such as limits, differentiation, and integration. There is not as much detail as is found in David Berlinski's *A Tour of the Calculus,* but probably enough to spark the curiosity of the lay reader. The mechanics of logarithms and exponentiation are gently put forth, and the subsequent segue into interest rate problems feels totally natural. Mathematical highlights, such as Goldbach's Conjecture, Fermat's Last Theorem, and Euler's Conjecture, are also woven into the plot. Aside from stories about mathematicians' lives, the book also looks into the origins of common symbols: among them, the number 0, the equal sign, the square root symbol, the number e, fractional notation, and the coordinate system.

But perhaps the primary reason this book may become a classic in young adult literature is its literary beauty. The author not only has presented the mathematics in an entertaining way but has also written some lovely passages that are the linguistic equivalents of elegant mathematical proofs. He explains the structure of a quatrain ("lines one, two and four linked by rhyme, while line three is free," p. 144) and discusses what is perhaps the best exemplar: Omar al-Khayyam's *Rubaiyat*, with its haunting verses (pp. 144–5). During a discourse on friendly numbers he mentions that Pythagoras reportedly invented the word "friendship" by defining "friend" as "someone who is another me, like the numbers 220 and 284. Two numbers are friends if each is the sum of everything that measures the other" (p. 68). This becomes a portent, for shortly before dying Grosrouvre reminds Mr. Ruche, "What about us—are we friends? What is the sum of those things that define you or me? I think perhaps the time is coming when we will find out" (p. 68).

Word play abounds throughout the novel. Grosrouvre writes Mr. Ruche's first name (Pierre) as a delightful mathematical-linguistic pun, πr, pronounced "pee-air" (in French). Most people know that the prefix "bi-" means "two," but does it ever occur to us that Native Americans refer to a bison as "two-horn"? "Iso-" means "same", and "skelos" means "legs", hence the term "isosceles"; but are we aware that "scalene" comes from the Greek word for "limping"? Students know that algebra comes from *al-Jabr*, but they may be intrigued to know that its ancient meaning is "bone-setter". Witness this exchange between Mr. Ruche and his chauffeur, Mr. Habibi (p. 157):

> "*Al-Jabr* means a bone-setter," said Mr. Habibi. "Where I come from, if you have a *douar*, if you break a thing, you go to *al-Jabr* and he twist this way—Ow!—and that way, and set the bone back in place. Yes, *Jabr* is someone who fixes something that is broken."

> Mr. Ruche jumped in, "In the story of *Don Quixote* there is an 'algebrist'—a bone-setter. I never understood why he was called an algebrist before. Cervantes must have learned the word from the Spanish Moors."

However, some typographical errors mar an otherwise engaging read. The architect I. M. Pei, is "Ieo," not "Leo" Ming Pei (p. 199). The sine addition formula is the sum, not the difference, of two products (p. 169). In the display box, the summation sign is missing in the formula for the total surface area of all the rectangles (p. 237). A mistranslation appears in the first line of the proof of the irrationality of $\sqrt{2}$. Two numbers a and b are co-prime, not "both prime" (p. 95)[1].

Still, all's well that ends well. Max is rescued, the fate of Mr. Ruche's friend is finally revealed, the bad guys receive a well-deserved end, and Sidney? Ah, Sidney. It would be utterly improper to reveal the twist, wouldn't it? No wonder the novel became an instant bestseller in France when it first appeared in 1998. The periodical *Le Point* touts *The Parrot's Theorem* as "a beautiful book glorying in the great adventures of the human mind" (inside cover), and it is all this and more. It is evidence that there is no fundamental difference between great mathematics and great literature—both possess an elegance that resonates within the human soul.

Acknowledgment

References

[1] DAVID BERLINSKI, *A Tour of the Calculus*, Pantheon Books, New York, 1995.

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[1] *Editor's Note: The publisher of the U.S. edition, St. Martin's Press, told the* Notices *that these errors would be fixed in the U.S. edition.*