

Pythagorean Crimes

Reviewed by Alex Kasman

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Tefcros Michaelides

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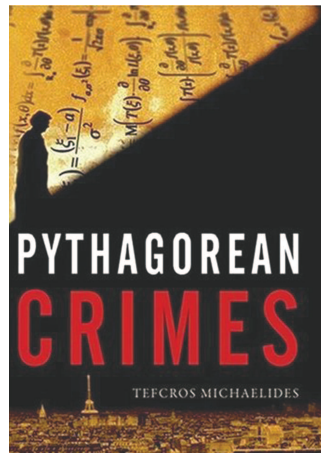
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There are many different ways in which mathematics can show up in a work of fiction. The author could have conceived of an interesting, but entirely fictional, mathematical result that advances the plot—such as the hidden message in the decimal expansion of the number π from Carl Sagan's novel *Contact*. Sometimes, the mathematical specifics are of no particular importance—as in David Auburn's *Proof*, where the interest is in the question of authorship of a theorem that is never described. Yet other works of fiction make use of a story to enhance the reader's understanding and appreciation of a real mathematical result.

Pythagorean Crimes by Tefcros Michaelides is a mathematical mystery novel that falls into the last of these categories. The narrator, Michael Igerinos, is a man from an aristocratic family who studied math in Göttingen at the turn of the twentieth century but wound up taking over his father's business in Greece and so only keeps up with mathematics as an amateur. As the novel begins we learn that his good friend, Stefanos Kandartzis, has been murdered. The murder victim, who like the novel's author holds a Ph.D. in mathematics from a French university and teaches high school in his native Greece, used to meet weekly with Michael to play chess and discuss mathematics. Seemingly in response to questions

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from the police, we are treated to a long digression in "flashback form" that recalls their friendship from the time they met until the day of the murder, all of which happens to coincide with many exciting developments in the history of mathematics and art during the years 1900 through 1931.



The title of the book refers to the supposed murder of Hippiasus by the Pythagoreans for his discovery that the length of the diagonal of a unit square is not a rational number. According to the legend, because the Pythagoreans believed that "all is number" and lacked any concept of an irrational number, they drowned Hippiasus at sea in order to keep his "dangerous" discovery secret. Although it is certainly possible that this tragic story is true, we have so little reliable information about the Pythagoreans that it seems equally probable that it is no more than a myth. (In another common version of the legend, he is merely exiled rather than killed. Moreover, there are different stories about Hippiasus in which he was killed for crimes unrelated to the discovery of irrational numbers, such as revealing the secrets of geometry to those outside of the Pythagorean cult or for claiming someone else's results as his own.) In the novel, however, we read about Hippiasus in three brief sections that expand on the traditional legend of his discovery and subsequent murder. These well written passages succeed in taking a

mathematical discovery that many nonmathematicians would probably perceive as dry and ensuring that it is emotionally powerful. Michaelides' prose generates the atmosphere of a cult in which a mathematical discovery could be perceived as outrageous heresy and the feelings of excitement and uncertainty as Hippias wonders whether to reveal his discovery to the group.

Most of the novel, however, takes place in the more recent past and focuses on history that is much more certain. As it turns out, the two good friends first met at the International Congress of Mathematicians in 1900 at which David Hilbert delivered his famous lecture on the future of mathematics. Michaelides does a great job of putting this lecture in its historical context by explaining how it was motivated by Poincaré's lecture at the previous Congress and the discussion of the limits of science begun by physiologist Emile du Bois-Remond whose motto was "*ignoramus et ignorabimus*" (we do not know and we will not know). When it relates this sort of factual information the novel begins to sound like a textbook. The reader is expected to absorb a great deal of information about mathematicians and their discoveries in a short amount of time. A reader who is a mathematician has the dual advantage of already knowing about many of these people and having read dense mathematical texts. For those with less prior mathematical experience, however, it may be difficult. That is precisely why the inclusion of these facts in a murder mystery—where one must pay close attention to many small details, never being sure which ones will be relevant to the eventual resolution—is potentially so useful.

I do not mean to suggest that reading *Pythagorean Crimes* will be easy or unenlightening for a mathematician. Michaelides appears to have done very careful research in writing it, and it is so detailed that nearly anyone is sure to learn something. Even those who know all of the mathematical results are unlikely to be as familiar with the political contexts in which they developed. Here, I use the word "political" in the sense of interactions between different groups of mathematicians as well as its more traditional sense. For instance, although I have had several occasions to read the text of Hilbert's speech, I was not previously aware of the tension between him and Peano or the subtle verbal "warfare" between their two groups at the Congress. Another example arises as Michael and Stefanos gossip while observing a discussion between Hadamard and de la Vallée-Poussin:

"Whether it was Gauss or Legendre," I replied, "what does it matter who formulated the question first? You are telling me these two discovered the answer independently. I am amazed they haven't yet come to

blows." I made this last comment in jest, of course, wishing to keep the conversation at the level of simple gossip...

My friend swallowed the bait. "If they were to come to blows, they would have a thousand and one reasons for doing so, quite apart from the disputed theorem. Can't you see? Hadamard is a Jew, de la Vallée-Poussin a Catholic—and a graduate of a Jesuit college, to boot; Belgian, but of French extraction. And observe what each is wearing: one a fedora, the other a silk tie and pince-nez. If you ask the latter who Dreyfus is, he may not even know. As for the other, he is passionately committed to the campaign for a retrial. A follower of Zola and all that. In fact, I think Hadamard and Dreyfus are related."

Moreover, encountering them in this novel gives one a sense of going beyond simply knowing *about* these historical figures. Of course, I knew of David Hilbert before, but having read this book I now feel as if I knew him personally and had occasion to run into him among the can-can dancers at the Moulin Rouge!

The artistic culture in Paris at the time is also a major focus of the novel. Stefanos takes Michael away from the math conference to introduce him to some of his friends, including a painter named Pablo Ruiz. They have a discussion with the artist about the possibility of tiling the plane with different regular polygons. When Michael returns to Paris years later, Ruiz is instead going by his mother's name, Picasso, and is still interested in mathematics. In fact, Michael is there (and so also is the reader) at the dramatic moment when Maurice Princet discusses non-Euclidean geometries with Picasso, helping inspire the artist to create "cubism". Like the discussions of mathematics, the discussion of art is dense with historical details.

In historical fiction such as this, it is reasonable to wonder whether the history is presented accurately and fairly. (See, for example, Frans Oort's review, in the June/July 2008 *Notices*, of *Measuring the World*, which criticizes that novel's portrayal of Gauss.) No obvious inaccuracies or slanderous representations jumped out at me as I read this book. However, it is clear that the author knows a great deal more about this period in history than I do, and I am merely trusting that he is offering a historically accurate portrayal. This faith is reinforced by the author's guilty tone in the postscript to the book when he admits to certain trivial inaccuracies. For instance, he confesses, "I had to place Picasso in Paris a couple of months too

early (in fact, he first visited Paris in the autumn of 1900)." It may be that my faith is misplaced, but I like to think that an author who is so concerned about whether Picasso was in Paris in August as opposed to "the autumn" is one who can be trusted.

There are other portions of the book that are more fictional than fact-based. They address such nonmathematical topics as Stefanos' heroic adventures as a soldier, Michael's open marriage with an unusually independent woman, his dealings with the underworld in order to free a young prostitute, and Stefanos' romantic involvement with each of these women (unknowingly with the former and secretly with the latter). These bits of sex and violence, perhaps necessary to maintain the interest of readers, are handled tastefully and are relevant to the mystery.

As for the mystery, it is unfortunately not terribly mysterious. To a perspicacious reader, the fact that the novel spans the years from 1900 until 1931 may itself suggest which mathematical result eventually becomes essential to the plot: Kurt Gödel's 1931 paper in which he provides a negative answer to one of the problems posed by Hilbert in 1900.

It was certainly a shock to many people when Gödel demonstrated the necessary existence of undecidable propositions in mathematics, destroying Hilbert's hope that for mathematicians there was "no *ignorabimus*". Combining knowledge of this fact with the title of the book (and its reference to a man who was killed for making a discovery deemed to be dangerous to the faith of other mathematicians), one might fear that the resolution of the mystery will be a little too obvious to anyone who already knows some of the history of mathematics. Fortunately, the author was clever enough to include one additional surprise "twist", so that even if you are knowledgeable enough to suspect that a discussion of incompleteness is certain to arise in the final chapters, things still do not work out quite the way that you might expect.

Michaelides not only knows about the history of mathematics, but also knows about connections between mathematics and fiction. He has written essays on this subject and has also translated into Greek several works of "mathematical fiction" that were written in French and English. So I am sure he is very familiar with the three books that I consider to be most similar to *Pythagorean Crimes*. Since it was written originally in Greek and is infused with modern Greek culture and history, it is sure to be compared to Apostolos Doxiadis' novel *Uncle Petros and Goldbach's Conjecture* (*Notices* review, November 2000). However, it is arguably much more similar to two other relatively recent novels of mathematical fiction: *A Certain Ambiguity* by Gaurav Suri and Hartosh Singh Bal (*Notices* review, February 2008) and Denis Guedj's *The Parrot's*

Theorem (*Notices* review, March 2001). It is interesting to me that Gödel's Theorem is of central importance to three out of these four "fact heavy" novels. Only *The Parrot's Theorem* avoids using this literarily potent mathematical result as a key plot device.

The mystery story is presumably there to help those with less knowledge of the history of mathematics to stay focused and interested while learning all that is necessary to appreciate Gödel's theorem. For those novices who successfully get through to the conclusion, this will certainly be an emotionally charged introduction to one of the most interesting results in mathematical history. Another tool provided to aid these less mathematically experienced readers—mentioned but not actually present in the "uncorrected proof" of the book that I read—is a glossary with separate sections for people, concepts, places, events, and "things". Sadly, I fear that the number of people who are not already familiar with Gödel's work and yet are still sufficiently interested in mathematics to read through the new English translation of this fact-filled novel will be very small. In any case, many readers of the *AMS Notices* will enjoy reading this book for the feeling that they have been able to spend some time with famous historical figures whom we all know by name, providing a context that can enhance our appreciation of these researchers and their work.