

Review of <sup>1</sup>

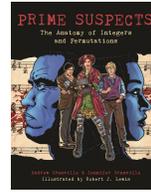
**Prime Suspects:  
The Anatomy of Integers and Permutations  
A Graphic Novel**

**Andrew Granville and Jennifer Granville**  
Illustrated by **Robert J. Lewis**

Princeton University Press, 2019  
232 pages, \$29.95 Paperback, \$24.50 eBook

Review by

**William Gasarch** (gasarch@cs.umd.edu)



**Gasarch:** Hardy, Ramanujan, what did you think of the graphic novel *Prime Suspects*?

**Ramanujan:** I thought it was great! It was intuitive! It discussed deep concepts in number theory and permutations and avoided proofs which would not have been appropriate for a graphic novel. And intuitions are more important than proofs anyway.

**Hardy:** I didn't like it! I found the lack of rigor disturbing. This, this, ... graphic novel is too informal! The math was correct but there were no proofs!

**Ramanujan:** The appendix, which is prose, gives more information and references, so that a reader can learn more if they want to.

**Gasarch:** So, Srinivasa, tell us about the main story. But don't give too much away.

**Ramanujan:** The story opens with two cops, Tao and Greene, finding a body: Arnie Int is dead! This seems related to another murder: Daisy Permutation is dead! In a normal mystery the question would be 'Who committed these murders?'. However, in this story they are more interested in the similarities of the two victims. Arnie Int's autopsy involves numbers and primes, whereas Daisy Permutation's autopsy involves permutations and cycles. You may wonder how an autopsy can involve math concepts. Well... the world of *Prime Suspects* is very different from our world.

**Gasarch:** A crime that involves math! So Godfrey, how does it compare to the TV show *Numb3rs*? (I reviewed *Numb3rs* in this column: <https://www.cs.umd.edu/~gasarch/bookrev/37-3.pdf>.)

**Hardy:**

1. The crime and solutions in *Numb3rs* make more sense.
2. The math in *Numb3rs* makes less sense and is often made up.

**Gasarch:** Did you like the story?

**Ramanujan:** The authors portrayed academia pretty well, though I have never seen a murder (note from Gasarch: I have taught for 40 years and have also never seen a murder). The world of *Prime Suspects* is different from ours in interesting ways.

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**Hardy:** But the mystery was unsatisfying.

**Gasarch:** It would be hard to have a story with both correct advanced math (which this story does) and a mystery worthy of Agatha Christie.

**Hardy:** Uh, Bill, recall that Ramanujan died in 1920, and Agatha Christie published her first novel in 1920.

**Gasarch:** Since I portrayed you as having an opinion about *Numb3rs*, I can have Srinivasa knowing who Agatha Christie is.

**Ramanujan:** I do. And yes, the mystery in *Prime Suspects* is not as good as a work by Agatha Christie. Though that is a high bar.

**Gasarch:** Godfrey, is the math that is discussed already known to my readers (as was the case for *Logicomix*, a graphic novel about logic that was reviewed in SIGACT News, Vol. 41, No. 2, 2010 (see <https://www.cs.umd.edu/~gasarch/bookrev/41-2.pdf>), or will it be new to them?

**Hardy:** Some of it was new to me!

**Ramanujan:** I had already intuited it.

**Gasarch:** One of you, describe the math.

**Ramanujan:** Numbers can be factored into primes. In 1919 Godfrey and I proved that a *typical* number  $n$  can be factored into  $\sim \log \log n$  primes. There are many more theorems about factoring a number into primes. On the other hand, permutations can be factored into cycles. In 1942 Goncharov proved that a *typical* permutation on  $n$  letters can be factored into  $\sim \log n$  cycles. There are many more theorems about factoring a permutation into cycles.

What is amazing is that many theorems about factoring a number into primes have an analog in factoring a permutation into cycles. I suspect your readers did not know that. Now they do!

**Gasarch:** So let's wrap this up. Both of you, say something you like and dislike about the book that you have not already mentioned.

**Hardy:**

**LIKE:** The art is great. The characters are well-drawn, and the math is well-illustrated. Most of the character's names were either those of mathematicians (e.g., Gauss), variants of names of mathematicians (e.g., Langer for Lang). Oh, and there is one more curious case: one of the main characters is a female math grad student whose name is Emmy Germain.

**DISLIKE:** The mystery and its resolution are not that interesting.

**Ramanujan:**

**LIKE:** In the background there are some math in-jokes.

**DISLIKE:** There is no character named after Godfrey Hardy or Srinivasa Ramanujan.

**Hardy:** Bill, how about you? Give us something you liked and something you didn't like, and you can't use any of our answers. And you can't use ChatGPT.

**Gasarch:** I'll give two LIKES and a DISLIKE.

**LIKE:** The authors discuss math I did not know that is interesting and deep.

**LIKE:** They didn't have every sentence end with an exclamation point, which is a common device for comic books! And a stupid one - not every sentence is that exciting!

**DISLIKE:** I have no criticism of the book, but I will give one of this review. Recall that *The New Mathematical Coloring Book* was written in the form of a memoir (*When I first met Paul Erdős ...*). Hence my review (see <https://www.cs.umd.edu/~gasarch/bookrev/NICK/soifer.pdf>) was in the form of a memoir (*When I first read this book ...*). Since *Prime Suspects* is a graphic novel, I would have wanted the review to be a in that format. But alas, I have neither the time, money, nor expertise to pull that off! I hope that writing the review as a conversation suffices.

**Ramanujan:** Bill, you always end your reviews with saying who should buy this book

**Gasarch:** A non-math person could understand some of the math in *Prime Suspects* but might not appreciate it. Hence I think that anyone who knows and likes math on the college level would like it.