Partition

Reviewed by Kenneth A. Ribet

Partition
A Play by Ira Hauptman
Aurora Theatre Company
Berkeley, CA
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The English mathematician G. H. Hardy is one of the most famous collaborators in the history of our subject. He is best known for his joint work with J. E. Littlewood, which began in 1911, and for his intense collaboration with Srinivasa Ramanujan, which Hardy termed "the one romantic incident of my life" [2, p. 2]. The relationship between Hardy and Ramanujan, which figures prominently in Robert Kanigel's "The Man Who Knew Infinity" [3], is the subject of an intriguing new play—Ira Hauptman's "Partition".

Although the term *partition* takes on a number of meanings in the context of the play, the most important partition is the divide between Hardy and Ramanujan. Because Hardy was fearful of being touched by others, both literally and figuratively, there was a great awkwardness between Hardy and Ramanujan when they first met. At the same time the two mathematicians were separated by a great intellectual gulf, which stemmed from Ramanujan's isolation from contemporary European mathematics [2, p. 1]. Throughout "Partition" we see Ramanujan struggling to master the concept of *rigorous proof*, which Hardy believes to be essential to mathematics but which is foreign to Ramanujan's way of thinking. Ramanujan finds fault with himself because of the difficulty of this struggle. He senses that he has failed Hardy by leaving unresolved some of Hardy's mathematical questions.

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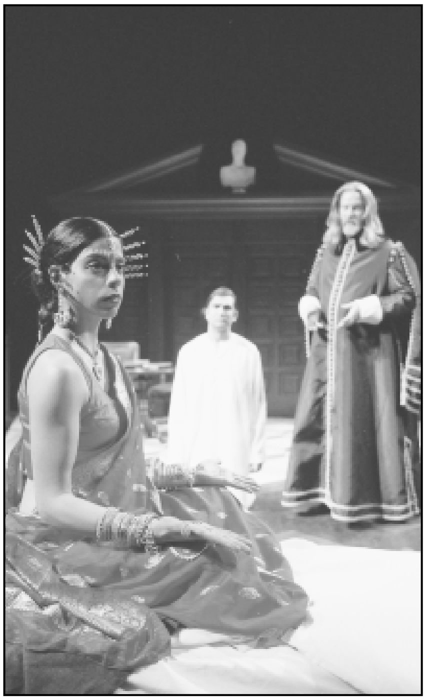
"Partition" has five major characters: Hardy and Ramanujan are complemented by a fictional Trinity College classicist named Billington; the mathematician Pierre de Fermat; and the goddess Namagiri, who was the personal deity of the real-life Ramanujan in India. In the play, Namagiri is seen often interacting with Ramanujan—she follows him to England, prepares his meals, tries to cover him with blankets in his chilly college rooms, and supplies his mathematical inspirations. Somewhat jarringly, we see Namagiri literally writing equations on Ramanujan's tongue with her finger. On the rare occasion when Namagiri's considerable divine mathematical abilities fail her, she scours heaven and earth in search of the keys to combinatorial and Diophantine mysteries.

The presence of Monsieur Fermat in a play about mathematics in Cambridge in the early years of the last century is something of a surprise. He was most welcome in "Fermat's Last Tango", but what is he doing here? The short answer is that he is entertaining us while having a good time for himself. A longer answer is that the Hardy of "Partition" sets out Fermat's Last Theorem (FLT) as a challenge to Ramanujan's mathematical skills. To deal with this challenge, Ramanujan enlists the help of Namagiri, who in turn consults Fermat directly. While this consultation occurs only in the second half of the play, Fermat has been with us since the earliest scenes. We first see Fermat in his study as he is writing his famous marginal note and then periodically after his death as he gloats over the failure of his successors to tame $a^n + b^n = c^n$. Hauptman's Fermat is a witty, engaging, and sardonic fellow who speaks directly to the audience whenever he surfaces to gloat over the failure of Euler, Lamé, and others to



Photograph by David Allen, courtesy of Aurora Theatre Company.

Left to right, Rachel Rajput, Rahul Gupta, and Julian Lopez-Morillas in "Partition".

prove his "last theorem".

During his discussion with Namagiri, Fermat confesses that he no longer remembers his seventeenth-century technique for proving FLT. Fermat's confession forces Namagiri to do a literature search that leads to an overlooked 1908 Ukrainian article on FLT and Poincaré. When Hardy visits Ramanujan in a sanitarium (where Ramanujan has been wrestling with equations instead of resting up to conserve his strength), Ramanujan tells Hardy that Poincaré and modular forms are the key to Fermat's Last Theorem. To those who are familiar with the recent history of Fermat's Last Theorem, this remark by Ramanujan is a strong suggestion that the Ramanujan character was close to discovering the methods of Wiles [7] and Taylor–Wiles [6]. Indeed, many expository accounts of Wiles's proof of Fermat's Last Theorem (such as Simon Singh's *Fermat's Enigma* [4] and his television documentary of Fermat [5]) focused on the connection between elliptic curves and modular forms, and explained modular forms in terms of the geometry of the Poincaré upper half-plane.

"Partition" was performed by the Aurora Theatre Company of Berkeley late this spring (April 11–May 18, 2003). It goes almost without saying that the theme of Hauptman's play made it of special interest to mathematicians. When I attended a performance in May, I recognized many acquaintances as I looked around the audience. Professional mathematicians who saw the play were disturbed by the prominent roles given to Fermat and his Last Theorem, since the real Ramanujan and Hardy did no work on this particular problem. I personally was startled by the implicit anachronistic suggestion that Ramanujan was close to finding a proof of Fermat's Last Theorem that relied on Galois representations, modular forms, Euler systems, and Selmer groups.

In order to enjoy the play, one must relax the implicit identification between the historical Hardy–Ramanujan and the characters on stage. Theater-goers who have little problem observing a goddess in discussion with a seventeenth-century mathematician on stage can make their peace with a historical distortion that allows the audience to hook up with a familiar and famous problem. Once I was able to separate the real Hardy and Ramanujan from their counterparts on stage, I found only good things to say about "Partition". I thought that the acting and production were superb; I especially liked the performance of David Arrow, who played G. H. Hardy. The Aurora Theatre space is very small and intimate: the audience surrounds the stage on three sides and sits a mere four rows deep. Because of the design of the theater, there was a direct connection between the players and the audience. My friends in Berkeley, both mathematicians and nonmathematicians, were very pleased with the production.

The Aurora Theatre's website `http://www.auroratheatre.org/` contains information of interest to readers of this review, including a history of the company and a photograph of the production. Halfway through the play's run in Berkeley and at the end of a week-long workshop on the history of algebra in the nineteenth and twentieth centuries, the Mathematical Sciences Research Institute organized a panel discussion on the Berkeley campus titled "Partition: Hardy and Ramanujan in Berkeley". The discussion included Barbara Oliver, the artistic director of the Aurora Theatre and the director of the "Partition" production; mathematical historian Jeremy Gray; MSRI Associate Director David Hoffman; and actors David Arrow (Hardy) and Rahul Gupta (Ramanujan), who read scenes from the play. The panel discussion was summarized in a story ("'Partition' Plays with History to Create Drama") in the Berkeley Daily Planet [1]. I hope very much that the play will be performed elsewhere and become better known.

References

[1] The Berkeley Daily Planet, "'Partition' Plays with History to Create Drama," `http://www.berkeleydaily.org/article.cfm?storyID=16574`.

[2] G. H. Hardy, Ramanujan, Cambridge University Press, Cambridge, 1940.

[3] R. Kanigel, The Man Who Knew Infinity: A life of the genius Ramanujan, C. Scribner's, New York,1991.

[4] S. Singh, Fermat's Enigma, Anchor Books, New York, 1997.

[5] ____ , The Proof, A NOVA documentary first aired in the U.S. on October 28, 1997. See `http://www.pbs.org/wgbh/nova/proof/`.

[6] R. Taylor and A. J. Wiles, *Ring-theoretic properties of certain Hecke algebras*, Ann. of Math. (2) **141** (1995), no. 3, 553–572.

[7] A. J. Wiles, *Modular elliptic curves and Fermat's last theorem*, Ann. of Math. (2) **141** (1995), no. 3, 443–551.