

# The Mathematician's *Proof*

*Reviewed by Mark Saul*

Right you are—if you think you are.

—Luigi Pirandello

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**Proof**

*A play by David Auburn  
Directed by Daniel Sullivan  
Walter Kerr Theatre  
New York, NY*

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Mathematicians are rarely seen on the Broadway stage, and mathematics itself even less often. So it is some cause for celebration that David Auburn's play *Proof*, having been on Broadway for several months, has just won a Pulitzer Prize. The piece gives us a new look at the role mathematics plays in all our lives.

Why are mathematicians so often perceived by the general public as immature? The image of the mathematician is, too often, that of a nerd, a social misfit, a person obsessed with his (usually not her!) own insights, one who has not yet learned to take notice of those with other interests. The elite, the aloof, the initiated—who would care to think of them as anything more than cases of arrested development?

Like all stereotypes, this view is of course incorrect. But like all stereotypes, it takes its origin from wisps of reality. For the dialogues of mathematicians must seem, to those who don't care to look deeper, like childhood fantasies. Why this obsession for proof, sometimes of statements that would pass as obvious in any other context? Why fret about the possibility of astronomically large counterexamples to a conjecture that is true for the first billion cases? These concerns are dangerously close, in the public mind, to the child's invention of an imaginary companion or to nighttime fears of a monster in the closet.

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*For another view of this play, see Notices, October 2000, pp. 1082-1084.*

So much for misconception. There is also some factual basis for the comparison. In many ways, mathematics is a young man's profession (the gender-specific language is used consciously here). Gauss is said to have remarked that his best ideas had occurred to him by the time he was nineteen— this from the man whose credo was *pauca sed matura* (few but ripe).

It is the ripeness, the bringing to fruition of callow genius, that the public does not usually appreciate. We have the examples of Hadamard and Ahlfors, of Mac Lane and Gelfand, and numerous others whose energy and creativity endured well into their eighth or ninth decade. We have great expositions of mathematics in which the ideas are given the polish of long use. Perhaps most important, we have the common but unseen phenomenon of the mathematician as teacher, leading a new generation through past discoveries and towards new ones. This last effort requires a genius different from that of mathematics itself, a genius that might be more appreciated by the public were it more appreciated by the agents themselves.

All this aside, the image of the mathematician as child is alive and well on Broadway. David Auburn's play *Proof* is about four characters, three of whom are mathematicians (and the fourth a financial analyst). The characters often appear immature and, worse, insane. And yet the evening is delightful, fascinating, and engaging, yielding insight into the relationship between the reality of the mathematician and that of the public.

In some sense, reality is the subject of all of theatre. At its best, theatre confronts a real audience—who have come in the rain and the traffic to see living actors on a living stage—with the imagination of the author, director, or performer. A good production challenges those seated in the theatre to try to distinguish between the art before

them and the world behind. This contrast has long been a part of the dramatist's art.

So the theatre is a good setting to explore the relationship between mathematics and reality. Now *Proof* explores much more than that, and many audiences will see something completely different in the touching story of a young woman's struggle for recognition, for identity, for separation from the mad genius of her father. The interesting point, for a mathematical audience, is the role played by mathematics. For the author might have chosen any number of scientific endeavors as his metaphor. Indeed, the association of genius with insanity is perhaps stronger in the public view of the natural sciences than any such association with mathematics.

So why mathematics? Because of the abstract nature of mathematical results, which renders them invisible from outside the profession. Indeed, the characters in the play are at times seen talking to ghosts, a good metaphor for the appearance of mathematics to the outsider. What could be less tangible than mathematics?

Well, emotions can be less tangible. Sometimes our feelings are difficult to discern, even as we are feeling them, and certainly so for someone not experiencing these same emotions. The dramatist's art maneuvers the audience into feeling the emotions being enacted on stage, and in this particular drama the medium is the mathematics.

On stage we have a young woman, untutored yet brilliant, emotionally fragile yet the sole support of her mentally ill father. We have the father, once a light of the University of Chicago, a noble mind here o'erthrown, whose mathematics has deteriorated into scribbles. (Paradoxically, the general audience can comprehend the meaning of the scribbles much more quickly than they might any of the character's "real" work. The theatre is not a good place to learn mathematics.) We have a younger, more typical mathematician, worried about publication, promotion, and tenure.

And we have the financier from New York, the mathematician's other daughter. Paying the bills, building a family and career, earning a living, she is supremely practical in her contribution to the dialogue. A lot of the play's wit rests on the responses to her remarks by the more mathematical characters. The application of cold logic to the ambiguities of natural language and of natural relationships can render the latter absurd and reveal the complexity of these commonplace phenomena. The effect is like that of a book about nonstandard analysis on those used to the classical exposition: one begins to think that those epsilons and deltas are the more intuitive way to think of the subject and that the surreal numbers are what is contrived.

Indeed, it is this sort of reversal of reality and fantasy, of the intuitive and the contrived, that is

the most interesting mathematical aspect of the play. We never get to see the actual proof—probably something in number theory—that is the bone of contention. The title refers to the mathematical proof, but also to the question of proving authorship of a proof; a few twists of plot make this more difficult than it sounds. And it also refers to the proof that we all require daily of the stability of reality and of personal relationships.

This is probably what the play was meant to explore. But the vehicle for exploration—mathematics—brings yet another meaning. In an ironic twist, it is the mathematics that renders visible the characters' emotions, as the bandages serve to turn the Invisible Man into the likeness of Claude Rains.

Is mathematics real? This question is foolish if asked of a mathematician or of someone whose daily experience is close to mathematics. But the general public finds the imaginary numbers, the abstractions of abstractions of metaphors built on metaphor, the structures based on structures which are based on yet other structures all very hard to swallow. The triumph of this play is to bring another answer to the question. Mathematics for the mathematician is very, very real. The search for accomplishment, for recognition, for connection with others doing similar work is easily as powerful a source of motivation as a more dignified but colder passion for discovery of the truth—perhaps more powerful.

So in this play mathematics is certainly real, as real as the characters and their emotions and the theatre itself. For it is not at all a two-hour parody of mathematics and mathematicians that the audience, mathematical or general, comes away with. It is a deep exploration of the characters' relationships, their self-definition, their struggle for self-realization that is the real subject of the drama.

For the mathematics, it doesn't really matter who wrote the proof discovered in the play. But for the characters involved this is all that matters. For the lay audience uninvolved in mathematics, and even for the mathematician observing (for there is really no mathematics here), it is the resolution of this question and not of any mathematical question that drives the drama, and it is the feelings surrounding this question that provide the deeper experience that we take away from the evening.

A mathematical audience will recognize this. They will see also the immature colleague, the eccentric elder, the fragile young student. Perhaps they will be a bit annoyed at this incomplete but all-too-common picture of the field, but still enjoy the counterpoint between logic and daily life. And most important, they will come away with a deeper appreciation of the role that mathematics plays in their own lives and in those of others.