

Why it's so impressive that Fermat's last theorem has been solved

It has been mentioned in Dr Who, Star Trek and the Simpsons, but few people truly realise just how much Fermat's last theorem has plagued mathematicians for centuries

Simon Singh, author of Fermat's Last Theorem Photo: Andrew Crowley

By Simon Singh

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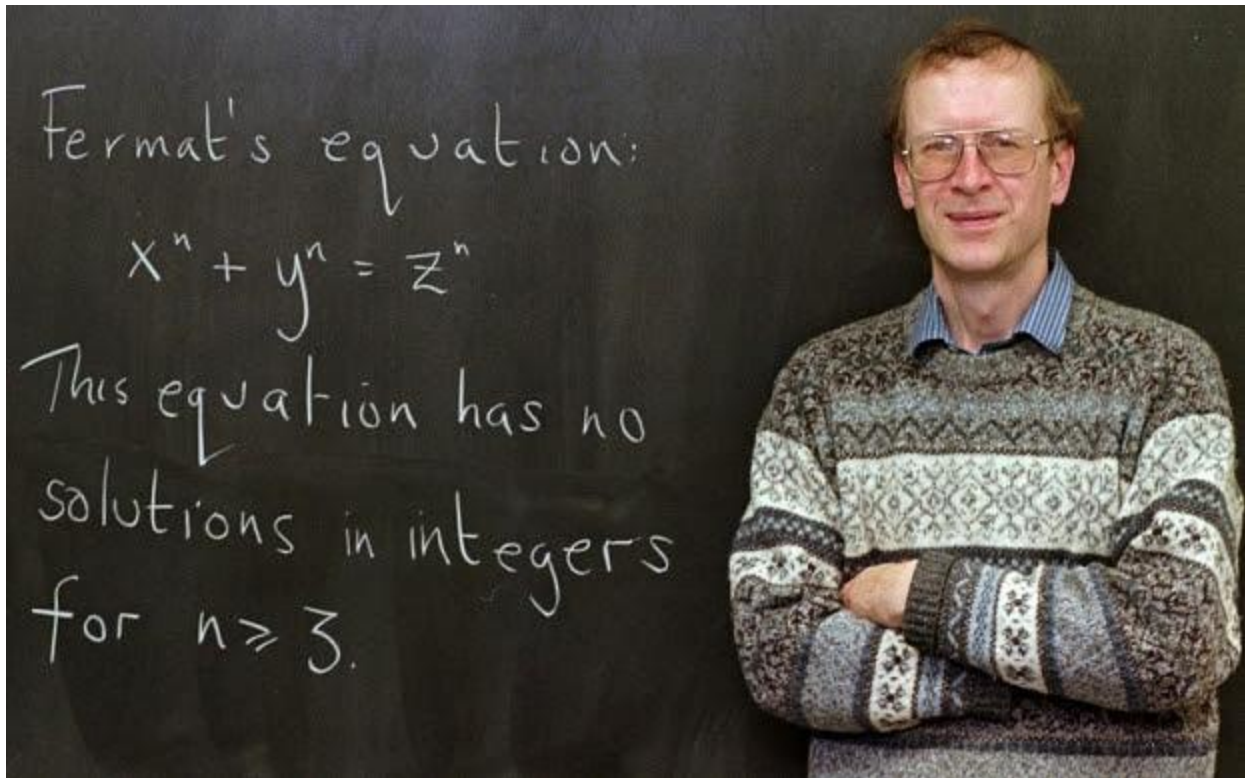
<http://www.telegraph.co.uk/news/science/12198077/Why-its-so-impressive-that-Fermats-last-theorem-has-been-solved.html>

[When Andrew Wiles received the £500,000 Abel Prize for mathematics last week](#), there was a general sense of “At last!” in the mathematical community.

After all, Professor Wiles had already won almost every other prize for his 1995 proof of Fermat’s last theorem, the most notorious problem in the history of mathematics.

As it has been mentioned in Dr Who, Star Trek, [The Simpsons](#) and the Liz Hurley blockbuster Bedazzled, I would hope that most people would know the intricacies of Fermat’s last theorem by now, but here’s a quick recap for those who are still puzzled about why there is so much fuss over solving a maths problem.

The story starts with Pierre de Fermat, one of the all-time great mathematicians, who claimed he could prove that the equation $(a^n + b^n = c^n)$ has no whole number solutions when n is greater than 2. There are some near misses (e.g., $6^3 + 8^3 = 9^3 - 1$), but no numbers that make the equation balance properly.



For three centuries, mathematicians have been trying to find a proof for Fermat's last theorem - now Andrew Wiles has done it.

Given that there are infinitely many possible numbers to check it was quite a claim, but Fermat was absolutely sure that no numbers fitted the equation because he had a logical watertight argument. Sadly, he never wrote down his proof. Instead, in the margin of a book, he left a tantalizing note in Latin: "I have a truly marvellous demonstration of this proposition (demonstrationem mirabilem) which this margin is too narrow to contain."

After Fermat's death, mathematicians found lots of similar notes ("I can prove this, but I have to feed the cat" or "I can prove that, but I have to wash my hair"), so they set about rediscovering Fermat's supposed proofs. They were successful in every case, except proving that $(a^n + b^n = c^n)$ has no solutions, which is why it became known as Fermat's last theorem, namely the last one that could be proven.

For three centuries, mathematicians tried and failed to find a proof, which is why Wiles's eventual success was such a major achievement, and why he has been showered with prizes and accolades. For example, there was the King Faisal International Prize (£140,000), the Wolf Prize (£70,000), a knighthood and the Oxford maths department is now housed in the Andrew Wiles Building. It was even rumoured that Gap asked him to endorse its range of menswear.

Sir Andrew Wiles Photo: PA

The most valuable prize should have been the Wolfskehl prize, 100,000 marks bequeathed by Paul Wolfskehl in 1906. It is said that the wealthy German industrialist was about to take his own life after a failed romance, but an encounter with Fermat's last theorem made him fall in love with mathematics and his new found passion gave him the will to live.

"Every mathematician that I have ever met takes on major problems purely for the intellectual battle, and the rich prizes are just a distraction"

When Wiles won the Wolfskehl prize in 1997, it should have been worth at least £1 million, but massive hyperinflation in Germany after the First World War meant that Wiles received a relatively paltry £30,000.

Of course, the money is irrelevant, because Wiles was driven by the desire to answer one of the history's greatest riddles. He had stumbled upon the last theorem as a 10-year-old and then spent the next 30 years working on the problem. A childhood dream evolved into an adult obsession, and when he eventually figured out a possible strategy for proving Fermat's riddle, he worked in secrecy for seven years before revealing his 200-page proof.



Sir Andrew is currently a professor at Oxford University's Mathematical Institute Photo: Alamy

Every mathematician that I have ever met takes on major problems purely for the intellectual battle, and the rich prizes are just a distraction, usually accepted, but sometimes rejected.

In 2000, the Clay Mathematics identified seven great mathematical mysteries and offered a \$1 million reward for each of these so-called Millennium Problems. So far, only the Poincaré conjecture has fallen.

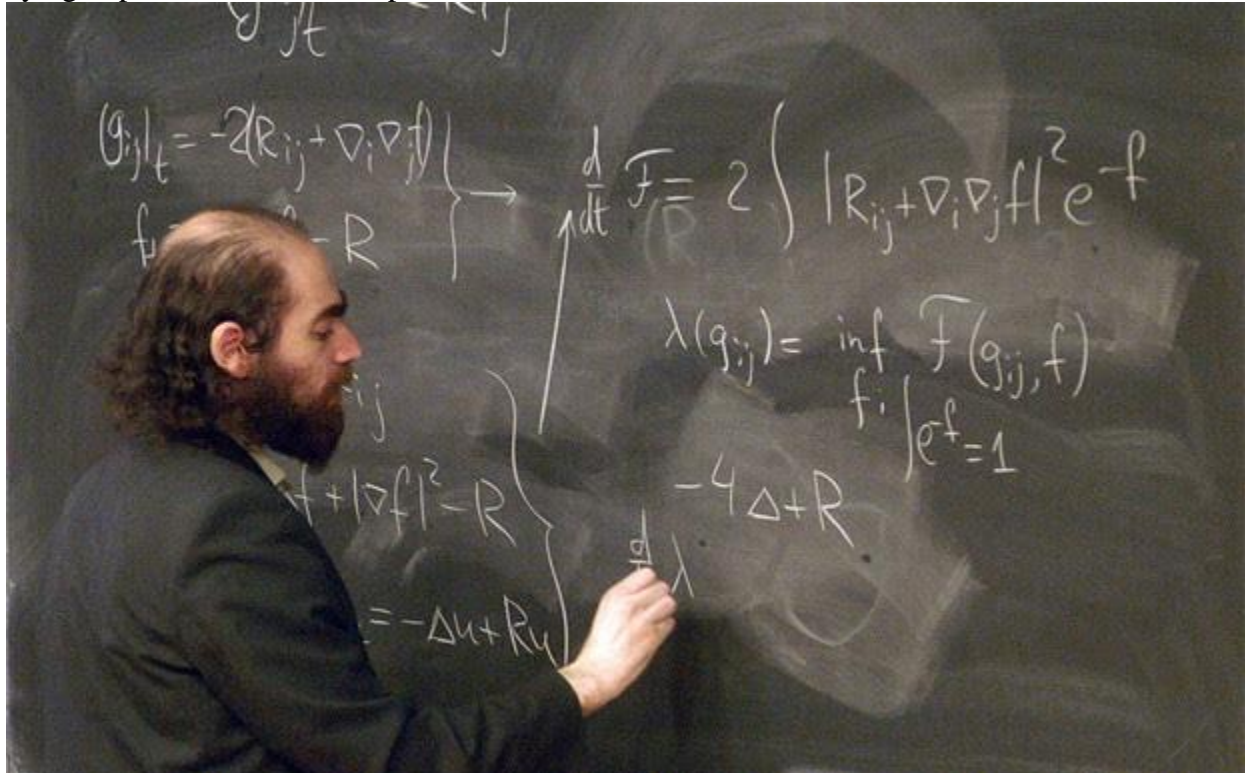
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Sir Andrew Wiles

Posed in 1904 by Henri Poincaré, the conjecture suggests that "every simply connected, closed 3-manifold is homeomorphic to the 3-sphere", and [Grigori Perelman](#) from Saint Petersburg

successfully proved that it is indeed true. When he was offered the £1 million prize, he declined it.

Perelman was then offered the Fields Medal, the most prestigious prize in mathematics. It is only open to those 40 years old or younger, so it is just about the only prize that eluded Andrew Wiles. Perelman was exactly 40, but he decided to spurn the prize, even after Sir John Ball, President of the International Mathematical Union, flew to St Petersburg and spent 10 hours trying to persuade him to accept.



Grigori Perelman, solver of Poincaré's Conjecture, gives a lecture on his solution at NYU's Weaver Hall on April 25 2003 Photo: FRANCES M. ROBERTS

Perelman later recounted what happened: "He proposed to me three alternatives: accept and come; accept and don't come, and we will send you the medal later; third, I don't accept the prize. From the very beginning, I told him I have chosen the third one ... [the prize] was completely irrelevant for me. Everybody understood that if the proof is correct, then no other recognition is needed."

Andrew Wiles graciously accepts the medals and the cheques, but he agrees with Perelman that there are other much richer prizes: "I had this very rare privilege of being able to pursue in my adult life what had been my childhood dream. I know it's a rare privilege, but if you can tackle something in adult life that means that much to you, then it's more rewarding than anything imaginable."

Simon Singh is the author of *Fermat's Last Theorem*, the first book about mathematics to become a No.1 bestseller.