

Disproof

The process of mathematics

Mathematics as a science advances through the formulation of conjectures and their proofs and disproof.

A brief history of a famous problem

- ▶ Diophantus publishes *Arithmetica* in Greek Alexandria in the 3rd century CE. (10/13 chapters survive today).
- ▶ Work preserved by Arab and Persian scholars for 1000 years.

Book contains discussion of Pythagorean Triples: natural numbers a, b, c such that

$$c^2 = a^2 + b^2.$$

Let $a = u^2 - v^2$, $b = 2uv$ and $c = u^2 + v^2$ where u and v are natural numbers with no common factors. For example $u = 3$, $v = 2$ so $a = 5$, $b = 12$, and $c = 13$. Then

$$c^2 = a^2 + b^2.$$

More history

- ▶ 6 chapters of Diophantus work translated to Latin in the 16th century.
- ▶ Fermat, a french lawyer in Toulouse, becomes interested in mathematics. He makes many contributions. Among them, he reads Diophantus and asks about triples (a, b, c) of natural numbers that satisfy pythagoras-like theorems with higher powers:

$$c^3 = a^3 + b^3$$

or, more generally,

$$c^n = a^n + b^n$$

where $n \geq 3$. He shows that *there are no solutions in natural numbers to this equation with $n = 3$ or $n = 4$.

More history

In the margin of his copy of *Arithmetica* he writes:

“There are no solutions in natural numbers to the equation $c^n = a^n + b^n$ for any $n \geq 3$. I have a wonderful proof of this proposition but the margin of this book is too small to contain it.”

This note is found by his son after his death.

More history

For 350 years mathematicians tried to find Fermat's proof. This became known as Fermat's Last Theorem, though it should have been called "Fermat's Conjecture."

In the 19th century, a number of mathematicians made progress (Kummer most notably) but the problem remained unsolved.

There were a number of other claimed proofs that turned out to be wrong.

More history

In the 1970's and 1980's, several mathematicians had insight into a new possible way to prove Fermat's theorem.

In 1994, drawing on *all* of the work done before, Andrew Wiles claimed to have found a proof. But it turned out his proof had a mistake in it, too. However, with the help of Richard Taylor, he was able to fix the proof and Fermat's Conjecture *finally* became a theorem after 350 years.

Today

Mathematicians continue to work on many unsolved problems, including the Millenium problems and many, many others.