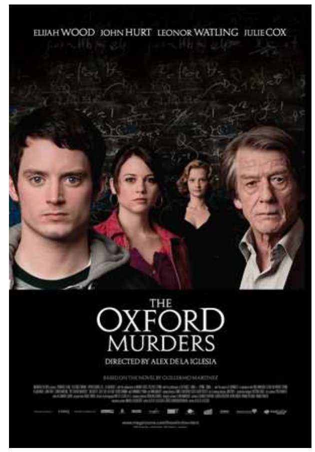
Baccalauréat, toutes séries — Session de juin 2011

Épreuve de section européenne

The Oxford Murders

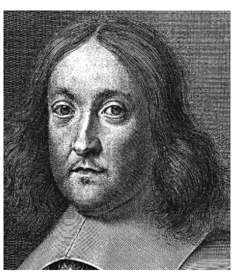
The Oxford Murders is a Spanish-British-French film, directed in 2008 by Alex de la Iglesia, adapted from the novel by the Argentine mathematician and writer Guillermo Martínez.

Here is the beginning of the plot: at Oxford University, Martin is an American student who wants Professor Arthur Seldom as his thesis supervisor. He idolises Seldom and has learned all about him. In a public lecture, Seldom denies the possibility of absolute truth. Hoping to impress his idol, Martin disputes this, asserting his faith in the absolute truth of mathematics: "I believe in the number Pi, in the Golden Ratio, in the Fibonacci sequence. Consequently, if we discover the secret signification of numbers, we'll unveil the hidden sense of reality". Finally, they work together to try and stop a potential series of murders seemingly linked by mathematical symbols…



The Oxford murders movie poster

The characters debate several mathematical, physical and philosophical concepts such as logical series, Heisenberg's Principle of Uncertainty, Gödel's Theorem, the possibility of the perfect crime, Fermat's Last Theorem, the Butterfly effect, etc.



Pierre de Fermat

"Bormat's Last Theorem" that is solved in the movie is clearly a reference to Fermat's Last Theorem.

Fermat's Last Theorem states that no three nonzero positive integers a, b, and c can satisfy the equation $a^n + b^n = c^n$ for any integer n greater than two.

This theorem was first conjectured by the French mathematician Pierre de Fermat in 1637. He claimed he had a proof that was too large to fit in the margin…But this theorem was widely considered to be one of the most difficult problems in the last 300 years. It was only solved in 1995 by the English mathematician Andrew Wiles at Princeton (USA).

Adapted from *Wikipedia*

Questions

1. Quote a few mathematical ideas and numbers involved in the film.
2. Explain what *Fermat's Last Theorem* is. Did Fermat actually prove it ?
3. Fermat's Last Theorem applies for any integer n greater than 2. Explain why it's possible to find three values a, b and c such that $a^2 + b^2 = c^2$. Give a few examples.
4. (a) Explain why, if there exist three natural numbers a, b, c, such that $a^{15} + b^{15} = c^{15}$, it's easy to find such a solution for exponents 5 and 3.

   (b) Consider a non-prime number n, and assume that there exist three natural numbers a, b, c such that $a^n + b^n = c^n$. Prove that there are also solutions for any exponent that is a divisor of n.