

# Computational explorations in modern number theory: the Green–Tao theorem and the abc conjecture

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We present a hands-on example of computational thinking at the intersection of mathematics and programming. Using the **Julia programming language and its Pluto.jl notebook** environment, we visualize exploratory computations inspired by three central themes in modern number theory: the Green-Tao theorem, the abc conjecture, and the Collatz conjecture. By combining built-in primality tests with compact code written in **Julia, Python, MATLAB, and Mathematica**, we generate long arithmetic sequences of primes and enumerate abc-triplets with unusually small radical values. Our educational objective is to allow students to experience the scale and subtlety of modern number-theoretic phenomena through interactive and reproducible computation.

## GitHub

<https://github.com/fiomfd/ATCM2025>

Interactive notebooks of Julia & Pluto, Python & Jupyter Notebook and MATLAB livescript are available:

- **Number Theory** (this talk): the prime number theorem, the Green-Tao theorem, the abc conjecture, the Collatz conjecture
- **Calculus I**: differentiability and tangent lines, Taylor expansion, Riemann sum
- **Calculus II**: tangent planes, 2D and 3D polar coordinates, Newton's method vs gradient descent, Riemann sum
- **Data Analysis**: public data (HK Observatory) and visualization, central limit theorem
- **Linear Algebra**: grayscale and RGB images, grayscale and RGB movies, SVD and low rank approximation, Haar wavelet decomposition



## Jupyter Notebook at Google Colab

<https://colab.research.google.com/github/fiomfd/ATCM2025/>

You can run all the above Jupyter Notebooks of Python on the web.  
Your Google ID is required. No installation is required.

**Try it now on your laptop, tablet or mobile phone!**

