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

Hiroyuki Chihara (University of the Ryukyus)

ATCM 2025, 13-16 December 2025, Ateneo de Manila University

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 two central themes in modern number theory: the Green-Tao theorem and the abc 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

You can see the following

- Pluto file for this presentation and its html version
- Python, MATLAB and Mathematica for this presentation
- Pluto, Python, MATLAB files for
  - **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.
Try it now on your laptop, tablet or mobile phone!
Your Google ID is required. No installation is required.