

Advanced Mathematics MASTER 2 IN LYON 2025-2026

FOUR THEMATIC PROGRAMS

- Refresher courses (late August \Rightarrow early September)
- Basic courses, first semester (September \Rightarrow December)
- Advanced courses, second semester (January \Rightarrow March)
- Research internship (April \Rightarrow July)

\leadsto Internship defences (end of August, early September)

More info on the program, applications, scholarships ... available at
 \leadsto mathematiques.ens-lyon.fr

It is possible to mix courses from different thematic programs (e.g. have a "major" and a "minor" theme).

PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS

Basic Courses

- Evolutionary PDEs (Dragoş Iftimie, Nikolai Tzvetkov)
- Calculus of variations and elliptic equations (Filippo Santambrogio)
- A few models and methods for life sciences (Thomas Lepoutre)

Advanced Courses

- Optimal transport: introduction and overview (Cédric Villani)
- Random and stochastic reaction-diffusion equations (Julien Vovelle)
- Hyperbolic and parabolic partial differential equations: theory and approximation (Frédéric Lagoutière)
- Semiclassical dynamics (Laurent Laflèche)

PROBABILITY AND STATISTICS

Some courses are joint with the M2 program "Maths in action"
mastermas.univ-lyon1.fr/

Basic Courses

- Stochastic calculus (Marielle Simon)
- Random walks (Thomas Budzinski)
- Concentration of measure in probability and high-dimensional statistical learning (Guillaume Aubrun, Aurélien Garivier, Rémi Gribonval)
- Stochastic modelization and statistical learning (Romain Azaïs, Aurélien Garivier, Clément Marteau)

Advanced Courses

- Graphs and ecological networks (Clément Marteau, Thibault Espinasse)
- Stochastic Partial Differential Equations and application to turbulence theory (Igor Honoré, Laurent Chevillard)
- Neural Networks (Cédric Gerbelot, Aurélien Garivier, Rémi Gribonval, Julian Tachella)
- Optimal transport and learning (Aymeric Baradat, Nicolas Boneel, Titouan Vayer)
- Inverse problems and parcimony (Yohann de Castro, Rémi Gribonval)
- Spectral Theory of random operators (Raphaël Ducatez, Christophe Sabot)
- Phase transitions in spin systems (Christophe Garban)
- Scaling limits for stochastic processes: applications to biology (Hélène Leman and Céline Bonnet)

TRANSCENDENCE

... between number theory, differential equations and model theory.

Basic Courses

- Introduction to transcendental number theory (Boris Adamczewski)
- Linear differential equations (Julien Roques)
- Introduction to model theory, ω -stability and \mathcal{o} -minimality (Frank Wagner)

Advanced Courses

- Diophantine approximation and transcendence theory (Anthony Poëls)
- An introduction to G -functions (Eric Delaygue)
- Model theory of differential fields of characteristic zero (Rémi Jaoui)

COMPLEX, ALGEBRAIC & SYMPLECTIC GEOMETRIES

Topics in Complex, Algebraic, Kähler and Symplectic geometries

Basic Courses

- Introduction to Kähler geometry (Jean-Claude Sikorav)
- Introduction to Complex algebraic geometry (Antoine Etessé)
- Convexity in symplectic geometry (Klaus Niederkrüger)
- Reductive algebraic groups over \mathbb{C} (Jérôme Germoni)

Advanced Courses

- GIT and Kempf-Ness theorem (Nicolas Ressayre)
- Topology of real algebraic varieties (Jean-Yves Welschinger)
- Hermite-Einstein metrics and slope stability (Eveline Legendre)