MATH1BA

*2024 - 2025*

Bachelor in Mathematics

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**MATH1BA -  Introduction**

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## Introduction

### Introduction

You love mathematics.

You want to learn to reason rigorously and critically.

You want to develop your creativity to solve problems, model and visualize complex situations, drawing on modern digital tools and a rich, solid mathematical tradition.

You have a good sense of argumentation and want to communicate your ideas in a faithful, accessible and attractive way.

UCLouvain offers you a training program that will enable you to acquire the skills needed to :

- develop and apply cutting-edge mathematics,
- transmit mathematical knowledge to a variety of audiences,
- support decision-making through rational data analysis.

### Your profile

A solid background in mathematics, such as a strong mathematics option in secondary education, is highly recommended for mathematics studies. It is also important to have a good general scientific and technological culture, a good command of the French language and a good knowledge of English.

### Your future job

Mathematicians are active in many fields where mathematics interacts with other disciplines: chemical and pharmaceutical industries, insurance, finance and actuarial science, consulting, modeling, systems planning and optimization, computer and data sciences, artificial intelligence, cryptography and computer security, astronomy, weather forecast, climate science, ecology and more.

Mathematicians share their passion for mathematics as teachers in upper secondary and higher education.

Mathematicians also contribute to mathematical research. They develop our understanding of the world by introducing new concepts, tools and constructions, and by studying them rigorously. They identify and implement the concepts and tools needed to solve mathematical problems of importance to our society, our economic activity or the development of other scientific disciplines.

### Your programme

The Bachelor of Mathematical Sciences program consists of 180 credits.

The 150 general training credits cover

- Fundamental mathematics: algebra (linear algebra, group theory, commutative algebra, etc.), geometry (affine geometry, vector geometry, differential geometry, topology) and analysis (functions of several variables, complex analysis, measure theory, differential equations and functional analysis).
- Applied mathematics: probability, data analysis and inferential statistics, numerical analysis and computer programming,
- Other scientific disciplines, including physics, chemistry, biology, earth science and economics.

The program offers the possibility of selecting certain courses to focus more on fundamental or applied mathematics. The main language of instruction is French, with a few courses in English and English courses for scientists.

The training is based on progressive learning and a program that allows time for high-quality personal work, with high-quality close supervision: exercise sessions, laboratories, group or individual work, tutorials and the opportunity to carry out initial personal research under the guidance of a teacher.

The 30-credit minor allows you to go deeper in training in mathematics or statistics and data science. Other minor choices allow you to develop skills in related disciplines (physics, computer science, economics and management, philosophy) or to open up to other disciplines.

### Your parcours

At the end of the bachelor's program, students will have acquired the disciplinary foundations needed for further studies with :

- A master's degree in mathematics
- A master's degree in mathematics education
- In the fields of statistics and data science : A Master's degree in actuarial science / A Master's degree in data science, with an emphasis on statistics / A Master's degree in statistics, general orientation / A master's degree in statistics, with a focus on biostatistics (after taking or adding 3 biology credits).

All these Master's degrees are accessible regardless of the choice of minor. Other master's degrees are available under certain conditions.

MATH1BA -  **Teaching profile**

## Learning outcomes

By the end of the course the student will have acquired the knowledge of the discipline and the transferable skills needed to pursue studies in mathematics or in closely related fields (physics. statistics, actuarial science, computing). This knowledge and skill-set will also be developed by the end of the Master programme in the many and varied contexts and problems that come from other fields (economics and finance, actuarial science, statistics and biostatistics, computing and cryptography, telecommunications, biochemistry and pharmacology, physics and astronomy, climatology and meteorology).

The programme offers a broad education in the fundamental fields of mathematics and an introduction to closely related fields (especially physics, but also statistics, applied mathematics, and computing).

During the Bachelor programme, future graduates in mathematics will be able to bring to bear a critical, constructive and innovative view on the present-day world and its problems. They will have developed their educational and personal plans, which they will pursue during the Master programme with increasing independence.

On successful completion of this programme, each student is able to :

1) recognise and understand a basic foundation of mathematics.

  • Choose and use the basic tools of calculation to solve mathematical problems.
  • Recognise the fundamental concepts of important current mathematical theories.
  • Establish the main connections between these theories, analyse them and explain them through the use of examples.

2) identify, by use of the abstract and experimental approach specific to the exact sciences, the unifying features of different situations and experiments in mathematics or in closely related fields (probability and statistics, physics, computing).

  • Follow an abstract reasoning in order to solve problems concerning mathematics and their applications.

3) show evidence of abstract thinking and of a critical spirit.

  • Argue within the context of the axiomatic method Recognise the key arguments and the structure of a proof.
  • Construct and draw up a proof independently.
  • Evaluate the rigour of a mathematical or logical argument and identify any possible flaws in it.
  • Distinguish between the intuition and the validity of a result and the different levels of rigorous understanding of this same result.

4) communicate in a clear, precise and rigorous way, in French and in English.

  • Write a mathematical text in French according to the conventions of the discipline.
  • Structure an oral presentation in French, highlight key elements, identify techniques and concepts and adapt the presentation to the listeners' level of understanding.
  • Communicate in English (level C1 for reading comprehension, level B2 for listening comprehension and for oral and written expression, CEFR).

5) learn in an independent manner.

  • Find relevant sources in the mathematical literature.
  • Read and understand an advanced mathematical text and locate it correctly in relation to knowledge acquired.

## Programme structure

The programme leading to the Bachelor in Mathematics is composed of 180 credits spread over three years of study and organised as follows:

  • a general education, called the major, of 150 credits;
  • a minor of 30 credits.

The major includes the following subjects:

  • disciplinary courses: analysis, algebra, geometry;
  • courses in closely related disciplines: physics, mechanics, computing and numerical analysis, probability and statistics;
  • seminar on mathematical current events and on physics in the first year, review work in the third year;
  • introductory courses (one course to be chosen): biology, chemistry, earth sciences, economics;
  • human sciences (philosophy and religious studies) and languages.

The first-year programme (60 credits in the major) is identical to that for the first year of Bachelor in Physics. At the end of the first year, there is automatic authorisation for transfer to the Bachelor in Physical Sciences.

In the second and third years, students complete their major programme (50 credits in the second year and 40 credits in the third) either with the additional module minor in mathematics or with another minor to which they have access, chosen on the basis of a project developed in conjunction with their study adviser.

Students who have a degree with more than three years of study, and especially those with a teacher training certificate (upper secondary education), may request personalised admission so as to benefit from a reduced programme. Their programme will be established in conjunction with the study adviser on the basis of the skills the student has already acquired.

# MATH1BA Programme

## Detailed programme by subject

O Mandatory
⊗ Optional
△ Not offered in 2024-2025
⊘ Not offered in 2024-2025 but offered the following year
⊕ Offered in 2024-2025 but not the following year
△ ⊕ Not offered in 2024-2025 or the following year
🟨 Activity with requisites
🌐 Open to incoming exchange students
🌐 Not open to incoming exchange students
[FR]

# List of available minors

Students can choose to study certain aspects of their bachelor's degree in greater depth:

- Additional module in mathematics
- Additional module in statistics and data science.

They can also choose to develop their skills in related disciplines:

- Minor in physics
- Minor in applied mathematics
- Minor in computer science
- Access minor to master's degree in economics
- Minor in management ("Initiation")
- Minor in Philosophy

Student choose from the list below of the most commonly programmed minors for mathematicians, or apply for access to one of the UCLouvain minors in the full list (https://uclouvain.be/fr/etudier/mineures.html), taking into account any admission requirements.

> Additionnal module in Mathematics  *[ en-prog-2024-appmath ]*
> Approfondissement en statistique et sciences des données  *[ en-prog-2024-appstat ]*
> Minor in Culture and Creation  *[ en-prog-2024-mincucrea ]*
> Minor in Scientific Culture  *[ en-prog-2024-mincults ]*
> Minor in Development and Environment  *[ en-prog-2024-mindenv ]*
> Minor : Issues of Transition and Sustainable Development (*)  *[ en-prog-2024-mindd ]*
> Minor in Economics  *[ en-prog-2024-minecon ]*
> Minor in Gender Studies  *[ en-prog-2024-mingenre ]*
> Minor in Geography  *[ en-prog-2024-mingeog ]*
> Minor in Mangement (basic knowledge)  *[ en-prog-2024-minogest ]*
> Minor in Computer Sciences  *[ en-prog-2024-minsinf ]*
> Minor in Philosophy  *[ en-prog-2024-minfilo ]*
> Minor in entrepreneurship (*)  *[ en-prog-2024-minmpme ]*
> Minor in Economics (open)  *[ en-prog-2024-minoeco ]*
> Minor in Physics  *[ en-prog-2024-minphys ]*
> Minor in numerical technologies and society  *[ en-prog-2024-minstic ]*
> Minor in Applied Mathematics  *[ en-prog-2024-lminomap ]*
> Minor in Mechanics  *[ en-prog-2024-lminomeca ]*
> Mineure Polytechnique  *[ en-prog-2024-minpoly ]*

*(\*) This programme is the subject of access criteria*

o **Sciences humaines**

o **Philosophie**
*L'étudiant choisit*
*From 2 to 4credit(s)*

**Sciences humaines**

o **Philosophie**
*L'étudiant choisit*
*From 2 to 4credit(s)*

| ⚓ LTECO2300 | Societies, cultures, religions : Ethical questions | Marcela Lobo Bustamante | FR [q1] [15h] [2 Credits] 🌐 |
|---|---|---|---|

## ○ Bloc au choix

*L'étudiant complète son programme en choisissant des cours des 2 blocs suivants (il est conseillé à l'étudiant de s'inscrire à au moins 10 crédits par bloc annuel). Cependant, avoir suivi tous les cours du bloc Statistique et Informatique est recommandé si vous souhaitez vous inscrire au master en science des données, orientation statistique.*

### ⚓ Bloc Mathématique

| ⚓ LMAT1223 | Differential equations | Heiner Olbermann | FR [q2] [30h +15h] [5 Credits] 🌐 *> English-friendly* |
|---|---|---|---|
| ⚓ LMAT1322 | Real and harmonic analysis | Augusto Ponce | FR [q2] [30h +30h] [5 Credits] 🌐 *> English-friendly* |
| ⚓ LMAT1342 | Geometry 3 | Pascal Lambrechts | FR [q1] [30h +30h] [5 Credits] 🌐 *> English-friendly* |
| ⚓ LMAT1331 | Commutative algebra | Enrico Vitale | FR [q2] [30h +15h] [5 Credits] 🌐 |
| ⚓ LMAT1361 | Galois Theory | Pierre-Emmanuel Caprace | FR [q2] [30h +15h] [5 Credits] 🌐 |

### ⚓ Bloc Statistique et Informatique

*A l'exception de LINFO1103 et LINFO1123, il est recommandé de suivre LEPL1402 avant les autres cours de la liste ci-dessous :*

| ⚓ LINFO1123 | Calculability, Logic and Complexity | Yves Deville | FR [q2] [30h +30h] [5 Credits] 🌐 |
|---|---|---|---|
| ⚓ LINFO1121 | Algorithms and data structures 🔶 | Pierre Schaus | FR [q1] [30h +30h] [5 Credits] 🌐 |

### ⚓ Cours au choix

*L'étudiant choisit un des deux cours suivants :*

| ⚓ LINGE1222 | Multivariate Statistical Analysis 🔶 | Antoine Soetewey | FR [q2] [30h +15h] [4 Credits] 🌐 |
|---|---|---|---|
| ⚓ LBIRA2110A | Statistical analysis of multivariate data - Biometrics 1 | Xavier Draye Frédéric Gaspart Laura Symul | FR [q1] [22.5h +15h] [4 Credits] 🌐 *> English-friendly* |

## ⚓ Optional courses

*These credits are not counted within the 120 required credits.*

| ⚓ LSST1001 | IngénieuxSud | Stéphanie Merle Jean-Pierre Raskin | FR [q1+q2] [15h +45h] [5 Credits] 🌐 |
|---|---|---|---|
| ⚓ LSST1002M | Information and critical thinking - MOOC | Myriam De Kesel | FR [q2] [30h +15h] [3 Credits] 🌐 |

## ✿ *Minor or additional module*

*L'étudiant complète sa formation en choisissant un approfondissement ou une mineure dans la liste proposée pour le bachelier en sciences mathématiques. Il répartit les unités d'enseignement dans le 2e et le 3e bloc annuel, de manière à ce que son programme annuel totalise 60 crédits.*
*Maximum 1 element(s)*

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### MATH1BA -  Information

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## Access Requirements

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*Decree of 7 November 2013 defining the landscape of higher education and the academic organization of studies.*

*The admission requirements must be met prior to enrolment in the University.*

***In the event of the divergence between the different linguistic versions of the present conditions, the French version shall prevail.***

SUMMARY

- General access requirements
- Specific access requirements
- Access based on validation of professional experience
- Special requirements to access some programmes

## General access requirements

Except as otherwise provided by other specific legal provisions, admission to undergraduate courses leading to the award of a Bachelor's degree will be granted to students with one of the following qualifications :

1. A Certificate of Upper Secondary Education issued during or after the 1993-1994 academic year by an establishment offering full-time secondary education or an adult education centre in the French Community of Belgium and, as the case may be, approved if it was issued by an educational institution before 1 January 2008 or affixed with the seal of the French Community if it was issued after this date, or an equivalent certificate awarded by the Examination Board of the French Community during or after 1994;

2. A Certificate of Upper Secondary Education issued no later than the end of the 1992-1993 academic year, along with official documentation attesting to the student's ability to pursue higher education for students applying for a full-length undergraduate degree programme;

3. A diploma awarded by a higher education institution within the French Community that confers an academic degree issued under the above-mentioned Decree, or a diploma awarded by a university or institution dispensing full-time higher education in accordance with earlier legislation;

4. A higher education certificate or diploma awarded by an adult education centre;

5. A pass certificate for one of the entrance examinations organized by higher education institutions or by an examination board of the French Community; this document gives admission to studies in the sectors, fields or programmes indicated therein;

6. A diploma, certificate of studies or other qualification similar to those mentioned above, issued by the Flemish Community of Belgium, the German Community of Belgium or the Royal Military Academy;

7. A diploma, certificate of studies or other qualification obtained abroad and deemed equivalent to the first four mentioned above by virtue of a law, decree, European directive or international convention;

Note:

Requests for equivalence must be submitted to the Equivalence department (Service des équivalences) of the Ministry of Higher Education and Scientific Research of the French Community of Belgium in compliance with the official deadline.

The following two qualifications are automatically deemed equivalent to the Certificate of Upper Secondary Education (Certificat d'enseignement secondaire supérieur – CESS):

- European Baccalaureate issued by the Board of Governors of a European School,
- International Baccalaureate issued by the International Baccalaureate Office in Geneva.

8. Official documentation attesting to a student's ability to pursue higher education (diplôme d'aptitude à accéder à l'enseignement supérieur - DAES), issued by the Examination Board of the French Community.

## Specific access requirements

- Access to bachelor programmes for candidates of nationality outside the European Union who are not assimilated to Belgian nationals is subject to the following criteria:

  - not have obtained a secondary education diploma for more than 3 years maximum. Example: for an admission application for the academic year 2024-2025, you must have obtained your diploma during the academic years 2021-2022, 2022-2023 ou 2023-2024. In the French Community of Belgium, the academic year runs from September 14 to September 13
  - not already hold an undergraduate degree

- Candidates, whatever their nationality, with a secondary school diploma **from a country outside the European Union**, must have obtained an average of 13/20 minimum or, failing that, have obtained this average, have passed one year of study in Belgium (for example special Maths / sciences). A non-successful year will not be taken into consideration.

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|---|---|
| Faculty | Faculty of Science (SC) |
| Sector | Sciences and Technology (SST) |
| Acronym | MATH |
| Postal address | Chemin du Cyclotron 2 - bte L7.01.02 |
| | 1348 Louvain-la-Neuve |
| | Tel:  +32 (0) 10 47 31 52  -  Fax:  +32 (0) 10 47 25 30 |
| Website | https://uclouvain.be/fr/facultes/sc/math |

Academic supervisor: Jean Van Schaftingen

Jury

- President: Tim Van der Linden
- Secretary and Study advisor: Pierre Bieliavsky

Useful Contact(s)

- Administrative manager for the student's annual program: Nathalie Micha