





## MATH2M - 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 practise the many professional activities that require substantial mathematical skills: research and teaching, but also highly varied professions in which mathematics interacts with other fields and mathematicians collaborate with people who come from different intellectual backgrounds.

The skills acquired during the course will allow him to adapt to different professional contexts (linked, for example, to economic sciences, to the engineering sciences, to health sciences) and to acquire rapidly the techniques specific to his profession.

The programme offers a general education in the important fields of fundamental mathematics, including recent advanced subjects, and allows the student to deal in depth with closely related fields that have already been introduced in the Bachelor in Mathematics (especially physics, but also statistics, actuarial science, and computing).

Depending on the choice of option, by the end of the course the graduate will also have acquired a deeper knowledge of a field of research (research focus) or the skills required to teach mathematics in secondary schools (teaching focus).

As with any UCL graduate, the graduate Master in Mathematics will be capable of taking a critical, constructive and innovative view of the present-day world and its problems, of acting as a responsible and competent citizen in society and in his professional milieu, of independently acquiring and using new knowledge and skills throughout his professional life, and of managing major projects in all their aspects, both individually and as part of a team.

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

**Finalité spécialisée** - Grâce aux cours de l'option choisie, les étudiants de deux options auront aussi acquis la capacité d'analyser, en profondeur et sous divers points de vue, un problème mathématique ou un système complexe relevant de disciplines scientifiques autres que les mathématiques, pour en extraire les points essentiels et les mettre en relation avec les outils théoriques les mieux adaptés.

pas d'acquis d'apprentissage détaillés

1) master the disciplinary knowledge and basic transferable skills whose acquisition began in the Bachelor programme. He will have expanded his basic disciplinary knowledge and skills.

- Choose and use the fundamental methods and 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) show evidence of abstract thinking and of a critical spirit.

- Recognise the fundamental concepts of important current mathematical theories.
- Identify the unifying aspects of different situations and experiences.
- Argue within the context of the axiomatic method.
- Construct and draw up a proof independently, clearly and rigorously.

3) communicate in a scientific manner.

- Write a mathematical text in French according to the conventions of the discipline.
- Structure an oral presentation and adapt it 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).

4) show evidence of independent learning.

- Find sources in the mathematical literature and assess their relevance.
- Correctly locate an advanced mathematical text in relation to knowledge acquired.
- Ask himself relevant and lucid questions on a mathematical topic in an independent manner.

5) analyse a mathematical problem and suggest appropriate tools for studying it in depth

- Rédiger un texte mathématique selon les conventions de la discipline.
- Structurer un exposé oral en l'adaptant au niveau d'expertise des interlocuteurs.

**Finalité approfondie** - L'étudiant qui se destine à la recherche aura acquis une connaissance plus approfondie d'un ou de plusieurs domaines des mathématiques actuelles et de ses problématiques. Ces connaissances visent à lui permettre d'interagir avec d'autres chercheurs dans le cadre d'une recherche de niveau doctoral.

- Développer de façon autonome son intuition mathématique en anticipant les résultats attendus (formuler des conjectures) et en vérifiant la cohérence avec des résultats déjà existants.
- Se documenter et résumer l'état des connaissances actuelles concernant un problème mathématique.
- Poser de façon autonome des questions pertinentes et lucides sur un sujet avancé de mathématique.
- Analyser un problème de recherche et proposer des outils adéquats pour l'étudier de façon approfondie et originale.

6) **if the research focus is chosen**, begin a research project thanks to a deeper knowledge of one or more fields and their problematic issues in current mathematics. This knowledge aims at allowing the student to interact with other researchers in the context of a research project at doctoral level.

- Develop in an independent way his mathematical intuition by anticipating the expected results (formulating conjectures) and by verifying their consistency with already existing results.

- Gather material and summarise the current state of knowledge relating to a mathematical problem.
- Ask relevant and lucid questions on an advanced mathematical topic in an independent manner.

**Finalité didactique** - L'étudiant qui se destine à l'enseignement sera prêt à assumer des tâches professionnelles dans l'enseignement secondaire et à apporter ses compétences pédagogiques et disciplinaires.

- Mettre en relation les contenus mathématiques du programme de l'enseignement secondaire et ceux de la formation universitaire.
- Comparer et intégrer différentes approches possibles aux principaux sujets du programme de mathématique de l'école secondaire, identifier les étapes clef et les points délicats du programme.
- Mettre en place des dispositifs d'apprentissage adaptés, originaux et pertinents tant du point de vue de la rigueur que du point de vue de l'intuition.
- Proposer des problèmes provenant de différents domaines permettant d'introduire, illustrer et mettre en œuvre des notions mathématiques du programme.

7) **if the teaching focus is chosen**, bring together the skills needed to successfully begin the career of teacher of mathematics in upper secondary school and to make positive progress.

- Take action in the school setting, in partnership with other involved parties.
- Teach in real and observed situations.

In a more specific way, in regard to the teaching of mathematics, the graduate is able:

- To link the mathematical content of the secondary school teaching programme with that of university education.
- Compare and integrate different possible approaches to the main subjects of secondary school mathematics, identify the key stages and the sensitive points of the programme.
- Employ learning methods that are appropriate, original and relevant both from the point of view of precision and from that of intuition.
- Formulate interdisciplinary examples in the form of problems to introduce, illustrate and put into practice the mathematical concepts of the programme.
- Be self-critical and plan with continuous development in mind. For more details, see [Teacher training certificate \(upper secondary education\) \(Mathematics\)](#).

Depending on the chosen focus, he will be able to adapt to various professional contexts and he will be able to :

- Do a statistical analysis of large sets of data with the help of softwares.
- Master several fields of current probability and mathematical statistics and their problems.
- Use basic concepts and models in survival analysis, specific tools of biostatistics and techniques and standards of clinical tests.
- Exploit in an integrated way various know-hows in actuarial sciences and in financial mathematics in order to analyse complex problems in quantitative management of risks.
- Use fundamental tools of computing and programming in order to solve management problems involved in the financial impact of risks.

## Programme structure

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The programme for the Master in Mathematical Sciences is composed of:

- core subjects of 50 credits, of which 26 credits are for the dissertation;
- a focus of 30 credits;
- one option and selected courses for 40 credits.

Note here that:

- a part of the programme of study corresponding to around 30 credits (some of which may be involved in writing the dissertation) may be performed in the context of one of the international mobility programmes established by the Faculty.
- Courses already taken as part of the in-depth minor in mathematics may not be included in the student's Master programme
- With the agreement of the School of Mathematics, the student may defer to the second year an activity scheduled for the first year or bring forward to the first year an activity scheduled for the second year (with the exception of LMAT2997 and LMAT2999). In these cases, timetable clashes may arise. For a standard programme, this Master will total, whatever the focus, the options and/or the optional courses chosen, a minimum of 120 credits divided into two annual sections of 60 credits each.

## MATH2M Programme

## Detailed programme by subject

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## CORE COURSES [50.0]

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- 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] Teaching language (FR, EN, ES, NL, DE, ...)
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				Year	
				1	2
⊗ LFILO2003E	Ethics in the Sciences and technics (sem)	Alexandre Guay (compensates Charles Pence) Hervé Jeanmart René Rezsóhazy	FR [q2] [15h+15h] [2 Credits] 🌐		x
⊗ LTHEO2840	Science and Christian faith	Benoît Bourguine Paulo Jorge Dos Santos Rodrigues	FR [q1] [15h] [2 Credits] 🌐		x

⊗ **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] 🌐	x	x
⊗ LSST1002M	Information and critical thinking - MOOC	Anne Bauwens (compensates Jean-François Rees) Myriam De Kesel	FR [q2] [30h+15h] [3 Credits] 🌐	x	x

## ***LIST OF FOCUSES***

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- > [Research Focus](#) [ en-prog-2024-math2m-lmath200a ]
- > [Teaching Focus](#) [ en-prog-2024-math2m-lmath200d ]

## ***RESEARCH FOCUS [30.0]***

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In the research focus, the programme offers a general education in the major fields of fundamental mathematics and a deeper education in one of the research areas of the School of Mathematics. In seminar LMAT2160, a research project is set up by the students. With the agreement of the School, students may replace courses in the research focus by courses in research given in other universities, by courses chosen from the various options, or by courses in the Master in Physics.

**TEACHING FOCUS [30.0]**

**IMPORTANT NOTE:** In accordance with article 138 para. 4 of the decree of 7 November 2013 concerning higher education and the academic organisation of studies, teaching practice placements will not be assessed in the September session. Students are required to make every effort to successfully complete the teaching practice in the June session, subject to having to retake the year.

In the teaching focus, the programme offers general training for the secondary school teacher and specific training in teaching mathematics. The teaching focus confers on the student the title of qualified teacher for upper secondary education.

- 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) Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Year

1

**o Content:****o Séminaire d'observation et d'analyse de l'institution scolaire et de son contexte (en ce compris le stage d'observation) (4 credits)**

Choisir 1 des activités suivantes. Le cours et le séminaire doivent être suivis au même quadrimestre.

⊗ LAGRE2120P	Observation et analyse de l'institution scolaire et de son contexte (en ce compris le stage d'observation)	1
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LSCI2320	Didactics and epistemology of science	Myriam De Kesel (coord.) Marc de Wergifosse Gabriel Dias de
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**OPTION SCIENCES ACTUARIELLES**

- 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) Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

*NB : Students wishing to subsequently enroll in the Master in Actuarial Sciences may valorize all the compulsory courses of the ACTU2M program for which the credits have been validated in MATH2M.*

*From 27 to 29credit(s)*

Year

1 2

**o Content:**

				Year	
⊗ LACTU2010	Property and casualty insurance actuarial science	Michel Denuit	FR [q1] [45h] [7 Credits] 🌐	X	X
⊗ LACTU2030	Life insurance actuarial science	Donatien Hainaut	FR [q1] [30h+7.5h] [5 Credits] 🌐	X	X
⊗ LACTU2040	Social security and pension actuarial science	Pierre Devolder	FR [q2] [30h+7.5h] [5 Credits] 🌐	X	X
⊗ LACTU2170	Financial valuation of actuarial liabilities	Donatien Hainaut	FR [q2] [45h+15h] [7 Credits] 🌐	X	X
⊗ LACTU2240	Actuarial Science in Finance: Advanced Processes and Life Insurance Engineering	Donatien Hainaut	FR [q1] [30h] [5 Credits] 🌐	X	X
⊗ LACTU2210	Quantitative Risk Management	Christian Hafner	EN [q2] [30h] [5 Credits] 🌐 > French-friendly	X	X



## OPTION BIOSTATISTIQUE [30.0]

- 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) Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

*UCL graduates in the Master in Mathematics with option in general statistics have access to the second year of the Master in Statistics with biostatistics orientation. Students will choose one course between LSTAT2130 and LSTAT2220. Students will choose one course from the following*

Year

1 2

### Content:

● LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	1 [q1] [15h+15h] [3 Credits] 🌐	x	x
● LDATS2030					

## AUTRES COURS AU CHOIX

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- 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

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[FR]

⌘ LMAT1237

Introduction to logic: model theory

Enrico Vitale

## Course prerequisites

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There are no prerequisites between course units (CUs) for this programme, i.e. the programme activity (course unit, CU) whose learning outcomes are to be certified and the corresponding credits awarded by the jury before registration in another CU.

## The programme's courses and learning outcomes

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For each UCLouvain training programme, a [reference framework of learning outcomes](#) specifies the skills expected of every graduate on completion of the programme. Course unit descriptions specify targeted learning outcomes, as well as the unit's contribution to reference framework of learning outcomes.



**MATH2M - Information**

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[Access based on application](#)

## Non university Bachelors

> Find out more about [links](#) to the university

## Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"		Direct access	
Masters		Direct access	

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## Holders of a non-University 2nd cycle degree

### Access based on validation of professional experience

> It is possible, under certain conditions, to use one's personal and professional experience to enter a university course without having the required qualifications. However, validation of prior experience does not automatically apply to all courses. Find out more about

## Specific professional rules

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Successful completion of the master's course with **teaching focus** leads to the award of the master's degree with teaching focus and the title of secondary school education specialist.

The [Réforme des Titres et Fonctions](#) ("Titles and Functions Reform"), in force since 1 September 2016, is intended to harmonise the titles, functions and pay scales of basic and secondary education professionals in French Community of Belgium networks.

It also aims to guarantee the priority of preferred titles over minimum titles and to establish a regime for titles in short supply.

AESS holders can learn which functions they can carry out and the pay scales from which they can benefit by [clicking here](#).

The university cannot be held responsible for any problems that students may encounter at a later date with a view to a teaching appointment in the French Community of Belgium.

## Teaching method

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Whenever possible, teachers in the School of Mathematics give priority to close supervision: small-group work, individual tuition, rapid and personalised feedback on activities, active participation of students in the School's teaching decisions. All the courses in the programme contribute to the acquisition of skills such as the capacity for abstract thinking and for reasoning. Other skills (aptitude for communication, independent learning, document research) are especially exercised in seminars specific to the focuses (where students are responsible for work progress), in work linked to the preparation of the dissertation and in the dissertation activity (the Thesis Tutorial, which specifically concentrates on scientific communication in English). The interdisciplinary character of the programme is reinforced by the presence in the options of courses taken from the Masters programmes in physics, in statistics and biostatistics, in actuarial science and in applied mathematics.

Students in the research focus may take introduction to research courses in neighbouring universities in order to learn about mathematical research subjects that are not offered by UCL. An additional teaching module in disciplines other than mathematics is possible for students in the teaching focus.

## Evaluation

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***The evaluation methods comply with the [regulations concerning studies and exams](#). More detailed explanation of the modalities specific to each learning unit are available on their description sheets under the heading "Learning outcomes evaluation method".***

Assessment methods conform to academic regulations and procedures. More details on the methods employed in each teaching unit are available in their description sheet, under the heading 'Assessment methods for student learning'.

Different methods are in place in order to evaluate the knowledge and skills acquired in the course of the learning period; these are adapted to the following types of performance: continuous assessment, especially for practical exercises; assessment of individual work (reading, consultation of databases and bibliographical references, monograph and report writing); overall assessment (written and/or oral) during examination sessions; assessment of public presentations.

Whatever the teaching language of an activity, students may choose to present the corresponding assessment in English or in French. Exceptions are the Thesis Tutorial, philosophy courses and activities specific to the teaching focus.

## Mobility and/or Internationalisation outlook

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Students in the two focuses will have the opportunity of making an Erasmus, Mercator or other study period. The aim of such a study period is either to follow around 30 course credits, or to write the dissertation, while at the same time having the chance to discover another country and a different culture.

For students in the teaching focus it is preferable for the study period to take place at the end of the year. Partner universities are able to offer courses and courses of skills such as the capacity for abstract



