

Master's Program in Mathematics

■ Master of Science

Program Educational Objectives

The Master's Program in Mathematics cultivates researchers who have a wide perspective covering from pure to applied mathematics, educators or instructors who are sufficiently skilled in mathematics to play a role in the education industry, and highly specialized professionals, etc. who can use their mathematical science abilities to the full on the social front.

Graduate Profile	He or she should have a wide perspective necessary for being a researcher and be sufficiently skilled in mathematics to play a role in the education industry, and possess mathematical science abilities sufficient to be active on the social front as a highly specialized professional.
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Diploma Policy

The degree of Master of Science is commenced to those who have fulfilled the requirements for the completion of the Master's programs, as set out in the Graduate School Regulations of the University of Tsukuba and related university regulations, and who are deemed to have the following competences.

	Competences	Evaluation perspectives
Knowledge and Skills	1. Knowledge application competence: Ability to contribute to society with advanced knowledge	① Can you apply knowledge gained through research and other activities in society? ② Can you identify new problems, even in other fields of expertise, based on broad knowledge?
	2. Management competence: Ability to appropriately address challenges from broad standpoints	① Can you take on major tasks with systematic planning? ② Can you understand and solve problems from multiple perspectives?
	3. Communication competence: Ability to accurately and clearly communicate expert knowledge	① Are you capable of efficient communication for research purposes? ② Can you discuss research or research-specific knowledge with experts from your own field and from other fields?
	4. Teamwork competence: Ability to work with a team and actively contribute to the achievement of goals	① Do you have experience cooperatively and actively working on challenges as part of a team? ② Have you helped promote projects and activities other than your own research?
	5. Internationality competence: Willingness to contribute to international society	① Are you aware of making contributions to international society and getting involved in international activities? ② Have you obtained the linguistic skills necessary for international information collection and action?
	6. Mathematical analysis ability: Ability to see the nature of issues from a wide mathematical perspective and analyze them mathematically	① If the basic understanding of problems in various research realms was gained ② If a good command of basic mathematical knowledge was gained
	7. Ability to carry out mathematical research: Ability to carry out research while setting up research tasks based on advanced knowledge	① If problems are identified based on the advanced knowledge in one's own area of expertise ② If research is carried out while its tasks are worked on in a systematic manner

	Competences	Evaluation perspectives
Knowledge and Skills	8. Ability to solve mathematical tasks: Ability to work on tasks from a wide perspective and by using advanced mathematical knowledge	① If the use of advanced mathematical knowledge is actively tried ② If capable of seeing problems from multiple perspectives and solving them
	9. Mathematical pursuit ability: Ability to work on issues from a mathematical viewpoint and pursue mathematical principles behind those issues	① If the pursuit of mathematical principles as the nature of issues is actively tried to gain new findings ② If aware of social contribution activities through mathematics
	10. Mathematical expressiveness: Communication ability to debate with those from different areas and not just one's own area	① If linguistic skill necessary for smooth communication was gained ② If the ability to explain and understand was gained to debate with those from different areas and not just one's own area
Guidelines for Assessing Learning Outcomes	<p>The evaluation of learning outcomes is conducted through achievement assessments based on the "Achievement Assessment Form". This process objectively verifies and evaluates the acquisition of competences aligned with the degree conferral policy at each stage. The stages and methods of achievement assessment are outlined below.</p> <ul style="list-style-type: none"> - The master's thesis presentation at the time of graduation, combined with field-specific interim presentations held around the end of the spring semester of the second year, assesses whether the candidate possesses the abilities appropriate for a Master of Science degree. - The thesis examination assesses whether the candidate has produced academic research outcomes appropriate for a Master of Science degree. The thesis defense and final examination serve as the final assessment of achievement in these areas. 	

<p>Evaluation Criteria for Degree Theses/ Dissertations</p>	<p>【Review board members】 Structure of thesis review board Set up with one chief reviewer and two or more sub-reviewers.</p> <p>【Review method】 The thesis review board administers thesis review and final exam.</p> <p>【Review items】</p> <ol style="list-style-type: none">1. The research theme must be clearly indicated with the presence of academic significance.2. The preceding researches associated with the research theme must be appropriately presented.3. The line of reasoning to reach the conclusion must be provided logically and clearly.4. The line of reasoning and conclusion of the degree thesis must have novelty or ingenuity and be an academic contribution with contents that open up new findings in the area or a review article containing the student's view.5. The thesis must have appropriate sentence expressions and thesis construction as a degree thesis. <p>【Level standards required for the degree thesis】 A thesis for degree grant meeting all of the above evaluation items passes as a master's thesis after the final exam is included in the judgment.</p>
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Curriculum Policy

To develop diverse human resources, the Program adopts the system of education and research supervision formed by the four areas of algebra, geometry, analysis and mathematics of information. The Program is designed to provide students with education and research supervision to develop a breadth of basic skills in pure and applied sciences and to have the big picture in mind in natural science extending to science and technology and to engineering as well as the generic knowledge and ability that support students to be active in diverse social scenes, along with the research ability, specialized knowledge and ethical view in each area.

<p>Curriculum Design Framework</p>	<p>The Program offers plenty of General Foundation Subjects, careful Major Subjects, and seminars according to each student's ability in their own area of expertise, so that they can develop a broad perspective ranging from the foundation of modern mathematics to its application to each area of the sciences and up to the leading-edge areas of modern mathematics. The research carried out under the advice of faculty members helps students develop the fundamental and applied abilities appropriate to a master's degree in science to grow to be a human resource active in the society through science. In order to cultivate the basic skills and wide perspectives as well as generic knowledge and ability in associated areas with the student's major at the core, Colloquium on Pure and Applied Sciences (1 credit) must be taken as a required subject from Degree Programs' Common Courses, and students are encouraged to take other Degree Programs' Common Courses, Inter-disciplinary Foundation Courses and Graduate General Education Courses. The research supervision takes a multiple-instruction scheme to develop a research ability that exerts multifaceted perspectives.</p> <ul style="list-style-type: none"> - With Introduction to Algebra I, Introduction to Algebra II, Special Lecture on Algebra I, Algebra I and Algebra II, students gain the ability to extract algebraic structures in mathematical problems. - With Introduction to Geometry I, Introduction to Geometry II, Special Lecture on Geometry I, Geometry I and Geometry II, students gain the ability to geometrically grasp mathematical problems. - With Introduction to Analysis I, Introduction to Analysis II, Special Lecture on Analysis I, Analysis I, Analysis II and Stochastic Analysis, students gain the ability to analyze mathematical problems in the discipline of analysis. - With Introduction to Mathematics of Information I, Introduction to Mathematics of Information II, Special Lecture on Mathematics of Information I, Mathematical Logic, Mathematical Statistics and Computer Mathematics, students gain the ability to view mathematical problems from the aspect of mathematics of information. - With Internship in Mathematics I, Internship in Mathematics II and Frontiers of Mathematics, students gain the fundamental abilities for forming their future career paths. - With the Research IA, Research IB, Research IIA and Research IIB in the area, students develop the fundamental and applied abilities appropriate to a master's degree in science to gain presentation and communication abilities.
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Teaching and Learning Methods	<ul style="list-style-type: none"> - The presentations of research plan and research outcomes are opened when each academic year finishes, and thereby quality supervision is provided to enrich education and further promote research.
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Admission Policy

Desired Student Profile	<p>We seek candidates those who possess mathematical knowledge as equivalent to a university graduate, have the great interest and motivation to learn further advanced mathematics and the motivation to conduct research on modern mathematics and pursue to draw on their mathematical research experiences and abilities in the future to become a “researcher”, “educator” or “highly specialized professional”.</p>
Student Selection Process	<p>Candidates must have mathematical comprehension as equivalent to a university graduate and English proficiency necessary for carrying out mathematical research. The recommendation entrance exam places emphasis on the activities that the candidate has been engaged so far in the areas of mathematics and also the aspiration and research plan that the candidate wishes to achieve after admitted.</p>

Learning Support Framework

Academic Support	<ul style="list-style-type: none"> - The graduate course “Special Research”, which provides research guidance for master's theses, is conducted with students giving presentations in the laboratory nearly every week. Within this framework, in addition to providing presentation guidance, close supervision is also provided regarding research progress and time management. - Around the end of the spring semester of the second year, students hold an interim presentation on their research for their master's thesis, providing an opportunity to receive guidance on presentation skills from faculty members other than their advisor. - Prior to the master's thesis presentation, we hold a a research symposium-style presentation entitled “Tsukuba young researchers workshop”, inviting young researchers from overseas to participate. This provides an opportunity to deliver presentations in English. - By appointing an assistant advisor, we have established a system where students can consult with someone other than their primary advisor regarding various academic matters.
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<p>Opportunities for Peer Interaction</p>	<ul style="list-style-type: none"> - Around the end of the spring semester of the second year, an interim presentation session is held for research related to the master's thesis, providing an opportunity for students to understand each other's research and interact. - Part of the seminar series held by the Mathematics Department is designated as the graduate course "Frontiers in Mathematics" . Many students participate in the seminars, and the tea time held before the start provides an opportunity for students to interact with each other. - Events similar to discussion meetings, such as "Mathematical Intersections" and "RCMS Salon", are also held to provide opportunities for student interaction. - By assigning graduate students as tutors to the "Mathematics Tutoring Program" —a learning support session for undergraduate students—we are creating opportunities for interaction between undergraduates and graduate students, as well as among graduate students themselves.
<p>Opportunities for Student-Faculty Interaction</p>	<ul style="list-style-type: none"> - Part of the seminar series held by the Mathematics Division is designated as the graduate course "Frontiers in Mathematics". Many faculty members participate in the seminar, and a tea break before the session provides an opportunity for interaction between students and faculty. - Events such as "Mathematical Intersections" and "RCMS Salon", similar to discussion meetings, are also held to provide opportunities for interaction between students and faculty.

Approaches to Assuring and Enhancing Educational Quality

- For research toward the Master of Science thesis, in addition to the thesis presentation at the time of graduation, an interim presentation by field is held around the end of the spring semester of the second year.
- Course evaluation questionnaires and graduation questionnaires are conducted, and feedback from students is utilized to improve lectures.
- At both the interim and final stages, an assessment of competence achievement is conducted where students perform a self-assessment, which is then verified by their academic advisor.
- At the Degree Evaluation Committee, the committee assesses students' learning outcomes and verifies the validity of the curriculum and the appropriateness of instruction.