A Message from the Dean

Toshiyuki Katsura
Dean of the Graduate School of Mathematical Sciences
The University of Tokyo

The Graduate School of Mathematical Sciences was established in 1992. Before then, two mathematics departments existed at the University of Tokyo : one in the Faculty of Sciences at Hongo campus and the other in the College of Arts and Sciences at Komaba campus. Combining their respective powers, all faculty members of these two departments moved to the newly established school, which now serves as a center of excellence for the development of mathematics and related fields. At present, our main challenge is to respond to an increased demand in Japan for education in the mathematical sciences.

The new school is located at the southeast end of Komaba campus. Presently, we have 30 positions for professors, 28 for associate professors and 4 for research assistants. We accept, each year, 53 graduate students for our Master program and 32 for the Ph.D program, including 6 foreign students in the Master program and 3 in the PhD program. Our educational responsibilities, however, are not limited to the graduate level. In fact, we take principal charge of the mathematics education at the University of Tokyo, from the undergraduate level through to the doctoral level.

Over the last few decades we experienced a new stage in the evolution of mathematics. There has been tremendous progress in areas where pure mathematics and other branches of sciences collude, and mathematical knowledge has become the backbone of various sciences like physics, biology, chemistry, information theory, engineering, economics, etc. These developments show how important it is to enlarge the scale of our research and of the education in mathematical sciences. Because of this increased demand, the number of graduate students we accept has now nearly doubled, and our school endeavors to produce not only research specialists, but also highly educated technical specialists.

Within the University of Tokyo, the department of mathematics has a long history. It was founded in 1881, and the former mathematics department has always kept its long tradition of sustaining a high academic level. It has maintained a rich library collection, a common research room, and succeeds in sending graduates to fulfill a wide variety of roles in society. In keeping with these fine traditions, the Graduate School of Mathematical Sciences aims at fulfilling its social duty by offering excellent education and by producing outstanding research results. All members of the Graduate School of Mathematical Sciences will make every effort to meet these new exciting challenges.

Brief History

April 1877

The University of Tokyo is established, and the Department of Mathematics, Physics and Astronomy is placed in the Faculty of Science.

September 1881

The Department of Mathematics, Physics and Astronomy is divided into three separate departments.

May 1949

The College of Arts and Sciences is added to the University of Tokyo, in which a separate Department of Mathematics is established.

March 1953

The present-day Graduate School is formed, in which the members of the Department of Mathematics in the Faculty of Science and the Department of Mathematics in the College of Arts and Sciences begin educating graduate students.

April 1962

The Department of Pure and Applied Sciences is established in the College of Arts and Sciences.

April 1992

A new Division of Mathematical Sciences of the Graduate School is formed, consisting of a single Department of Mathematical Sciences combining all the mathematics faculty in the University.

August 1995

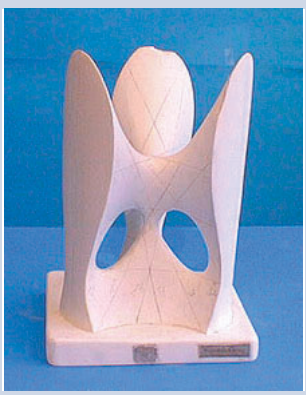
The first phase of the construction of a new building for the Department of Mathematical Sciences is completed.

March 1998

The second phase of the construction of the new Mathematical Sciences building is completed.

April 2004

All National Universities were transformed into National University Corporations, including The University of Tokyo.



Faculty

Professors and Associate Professors

Name	Field of Interest	Keywords
ARAI, Hitoshi	Real and Harmonic Analysis	real variable methods in harmonic analysis, partial differential equations, and several complex variables. harmonic analysis on manifolds
ASUKE, Taro	Differential Topology	foliations, geometric structures, characteristic classes
FUNAKI, Tadahisa	Probability Theory	hydrodynamic limit, stochastic partial differential equations
FURUTA, Mikio	Global Analysis, Low Dimensional Topology	4-dimensional manifold, gauge theory
GIGA, Yoshikazu	Nonlinear Analysis	Navier-Stokes equations, calculus of variation, viscosity solutions, level set method, nonlinear parabolic partial differential equations, crystal growth
GOMI, Kensaku	Mathematical Psychology	foundation of mathematical psychology from a mechanistic view point. In particular, applications of algebraic logic to psychological and critical developments of generational transformational grammar and model theoretic semantics of natural languages
HASEGAWA, Ryu	Theoretical Computer Science	lambda calculus, type theory, category theory, proof theory
HAYASHI, Shuhei	Dynamical Systems	hyperbolicity, homoclinic bifurcations, ergodic theory
HIRACHI, Kengo	Several Complex Variables, CR Geometry	Bergman kernel, strictly pseudoconvex domains, parabolic invariant theory
HORIKAWA, Eiji	Algebraic Geometry, Special Functions	algebraic surface, deformation, hypergeometric function
HOSONO, Shinobu	Mathematical Physics	Calabi-Yau manifolds, mirror symmetry, superstring theory
ICHII, Shingo	Computer Science	computer network, distributed processing, Internet technology and operation
INABA, Hisashi	Mathematical Population Dynamics, Mathematical Biology, Mathematical Demography	structured population dynamics, mathematical models for demography and epidemiology
JIMBO, Michio	Integrable Systems, Representation Theory	soliton, solvable lattice models, affine Lie algebras, quantum groups
KATAOKA, Kiyoomi	Partial Differential Equations, Hyperfunctions, Microlocal Analysis	pseudodifferential operators, microfunctions, boundary value problems
KATO, Akishi	Mathematical Physics	conformal field theory, string theory, integrable systems
KATSURA, Toshiyuki	Algebraic Geometry	abelian variety, positive characteristic, conformal field theory

Faculty

Name	Field of Interest	Keywords
KAWAHIGASHI, Yasuyuki	Operator Algebras	von Neumann algebras, subfactors, algebraic quantum field theory
KAWAMATA, Yujiro	Algebraic Geometry	Kodaira dimension, classification theory, minimal model
KAWAZUMI, Nariya	Differential Topology, Complex Analysis	moduli spaces of Riemann surfaces, mapping class groups, characteristic, classes
KIKUCHI, Fumio	Numerical Analysis, Computational Mechanics	partial differential equations, FEM, error analysis
KITADA, Hitoshi	Scattering Theory,Theory of Time, Philosophy of Mathematics	scattering, Schrödinger equation, local times, philosophy
KOHNO, Toshitake	Topology, Mathematical Physics	braid group, quantum group, conformal field theory
KONNO, Hiroshi	Differential Geometry	symplectic geometry
KUSUOKA, Shigeo	Probability Theory and its Application	stochastic analysis, mathematical finance
MATANO, Hiroshi	Nonlinear Partial Differential Equations	qualitative studies of nonlinear partial differential equations -- mainly elliptic and parabolic equations -- that arise in physics, biology and other fields of science and geometry, with emphasis on the global and dynamical structure of solutions
MATSUMOTO, Hisasyoshi	Representation Theory	Whittaker vector, generalized Verma module, unitary degenerate series
MATSUMOTO, Yukio	Topology	low dimiensional manifolds, Riemann surfaces, mapping class groups
MATSUO, Atsushi	Mathematical Physics and Representation Theory	comformal field theory, vertex operators, quantum groups, hypergeometric functions
MIYAOKA, Yoichi	Algebraic Geometry, Complex Manifolds	algebraic varieties, vector bundles, characteristic classes
MORITA, Shigeyuki	Geometry and Topology of Manifolds	low dimensional topology, mapping class group, moduli space of curves, invariants of 3-manifolds
NAKAMURA, Shu	Differential Equations, Mathematical Physics	Schrödinger equations, scattering theory, spectral theory
NOGUCHI, Junjiro	Complex Analysis in Several Variables, Complex Geometry, Function Theory in Several Complex Variables, Value Distribution Theory, Kobayashi Hyperbolic Manifolds, Diophantus Problem over Function Fields	complex analysis in several variables, complex geometry, several complex variables, value distribution theory, holomorphic mappings, Kobayashi hyperbolic manifolds, Diophantus problem over function fields, rational points
ODA, Takayuki	Number Theory	automorphic forms, discontinuous groups, arithmetic homotopy
OKAMOTO, Kazuo	Theory of Differential Equations in a Complex Domain	Painlevé equations, special functions in several complex variables, integrable system

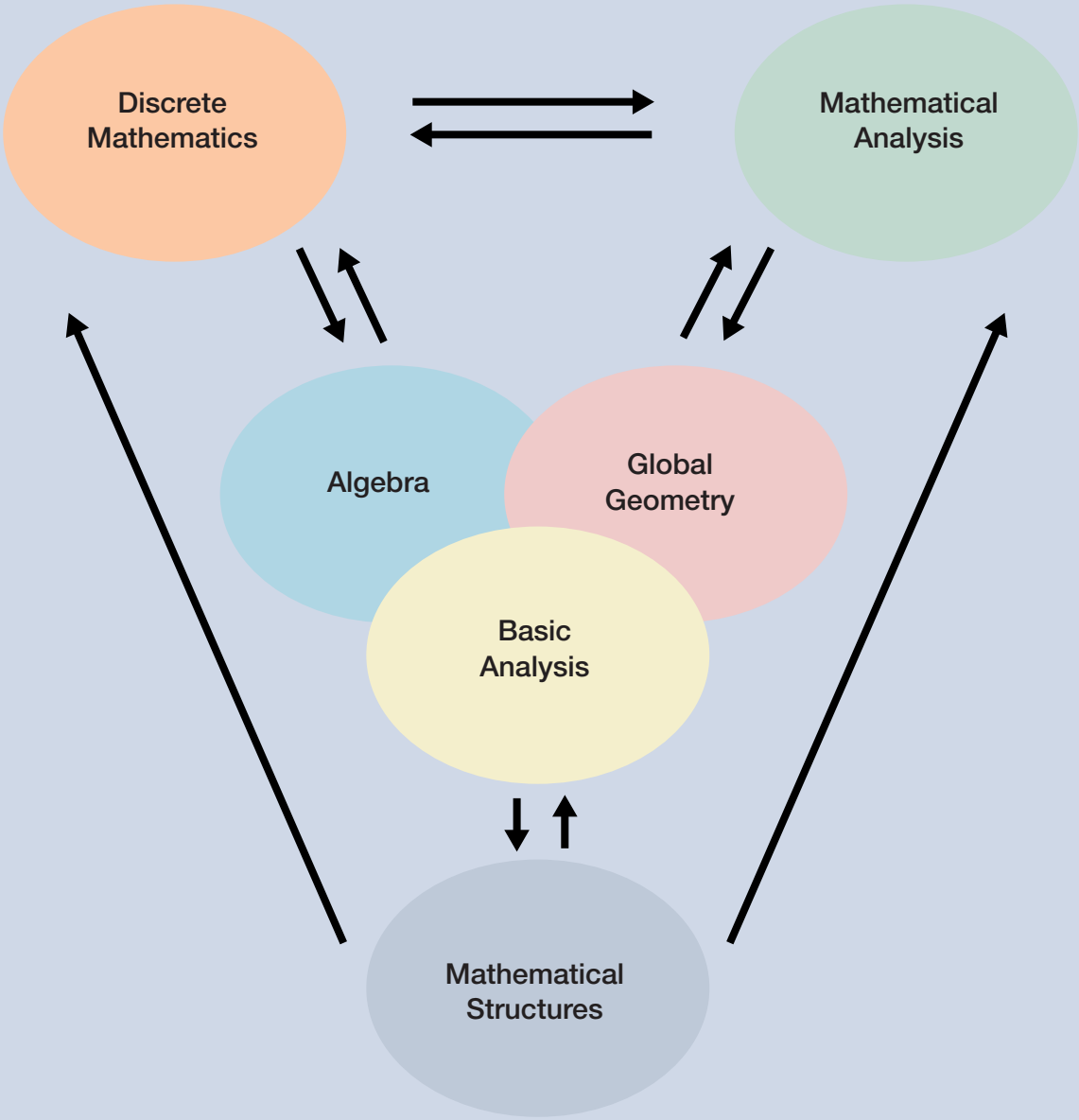
Name	Field of Interest	Keywords
OSHIMA, Toshio	Algebraic Analysis	representation theory, partial differential equations, completely integrable systems
OZAWA, Narutaka	Operator Algebras	C*-algebra
SAITO, Shuji	Arithmetic Geometry, Algebraic Geometry	higher dimensional class field theory, algebraic cycles, Motivic cohomology, Hodge theory, p-adic Hodge theory
SAITO, Takeshi	Arithmetic Geometry	étale cohomology, ramification, local fields
SAITO, Yoshihisa	Representation Theory, Mathematical Physics	infinite dimensional Lie algebras, quantum groups
SAKAI, Hidetaka	Special Functions, Integrable Systems, Ordinary Differential Equations	Painlevé equations, difference equations
SEKIGUCHI, Hideko	Non-Commutative Harmonic Analysis	semisimple Lie groups, unitary representations, Penrose transforms
SHIHO, Atsushi	Arithmetic Geometry	crystals, p-adic cohomology, rigid geometry
SHIRAISHI, Jun' ichi	Solvable Lattice Model	elliptic quantum group
TAKAGI, Hiromichi	Birational Geometry	minimal model program, Fano varieties, flips
TAKAYAMA, Shigeharu	Complex Geometry	adjoint bundle, singular Hermitian metric, multiplier ideal sheaf
TERADA, Itaru	Algebraic Combinatorics	Young diagrams, Robinson-Schensted correspondences, group representations
TERASOMA, Tomohide	Algebraic Geometry	cohomology of algebraic variety, Hodge theory
TOKIHIRO, Tetsuji	Mathematical Physics, Applied Mathematics	integrable system, soliton, cellular automaton, ultradiscrete system
TSUBOI, Takashi	Topology	foliation, diffeomorphism groups
TSUJI, Takeshi	Number Theory, Arithmetic Geometry	p-adic Hodge theory, p-adic representation, log algebraic geometry
WEISS, Georg S.	Nonlinear Partial Differential Equations, Calculus of Variations, Geometric Measure Theory	free boundary problems, regularity, combustion, fully nonlinear equations
WILLOX Ralph	Mathematical Physics, Integrable Systems	integrable discrete systems, Darboux transformations, Painlevé equations, integrable reductions
YAMAMOTO, Masahiro	Inverse Problems for Differential Equations	determination of coefficients, well-posedness in Tikhonov's sense, numerical computations
YOSHIKAWA, Ken-Ichi	Complex Geometry, Automorphic Forms	analytic torsion, moduli spaces, Borcherds product
YOSHIDA, Nakahiro	Statistics	asymptotic expansion and Malliavin calculus, limit theorems for semimartingales, statistical inference for stochastic differential equations, actuarial mathematics

Faculty

Research Associates

Name	Field of Interest	Keywords
ASOU, Kazuhiko	Computer Science	network
GOCHO, Toru	Differential Geometry	topological field theory, symplectic manifold
KATAOKA, Toshitaka	Number Theory, Representation of Finite Groups	Galois extension, character
KIYONO, Kazuhiko	Toplogy	group action, gauge theory, Atiyah-Singer index theorem
TAKAHASHI, Katsuo	Applied Analysis	reaction-diffusion system, nonlinear equations, biomathematics

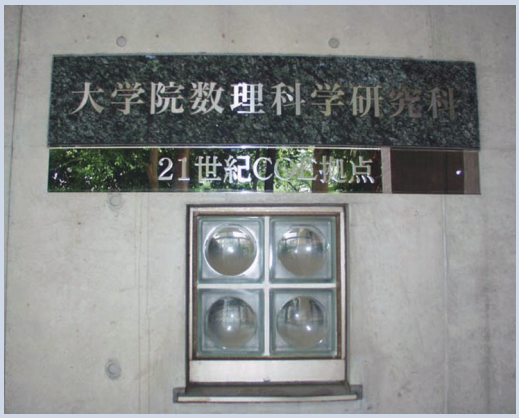
The Six Sections of the Graduate School of Mathematical Sciences



21st Century COE program

Base for New Development of Mathematics to Science and Technology

The establishment of a “Base for New development of Mathematics to Science and Technology” proposed by the Graduate School of Mathematical Sciences, was adopted as part of the “21st Century COE” program in fiscal year 2003, for a 5 year period.



The aim of this proposal is to establish an international stronghold for research and education in mathematics and its applications and thereby to strengthen our existing international research activities. Also, from a long term perspective and in line with the general philosophy of the Graduate School in Mathematical Sciences since its inception, an important goal is to educate researchers in mathematics such that they possess a broad and diverse outlook over the mathematical sciences.

The contributions of mathematics to society have long been indirect, be it as the basic science or infrastructure that supports science in general or, as a means for solving problems that arise in a scientific context. However, since the advent of computing, new techniques derived from mathematical theories have become directly applicable to real-life technologies and high level mathematics has become an important tool in for example modelling. As we have now arrived at a point where patents can even be awarded on purely mathematical content, the demand for mathematical applications that fit tightly with needs arising in society has increased even more.

However, it is quite common for the time span between construction of a mathematical theory and its eventual application to reach fifty or even a hundred years. It also often happens that applicable mathematics arises from purely intellectual and theoretical pursuits, in which actual applications were never really considered. It is therefore crucial that research in mathematics be conducted in a free-reining atmosphere, without being captive to a specific field or to a need for immediate applicability. On the other hand, if one disregards applications completely, it becomes impossible to respond to any particular needs that might arise in society. In view of the considerable expertise in research and education in mathematics we built up over the years, we therefore chose to emphasize more applied aspects in the realization of our proposal.

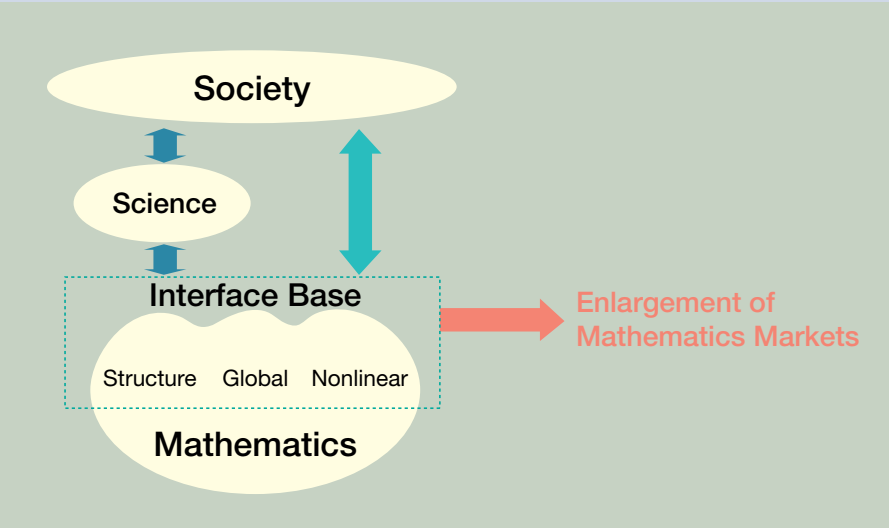
Our project is intended to act as an interface between research in applied mathematics and mathematical research in itself. At its centre one finds the strategic board, presided by the project leader, where all plans and proposals for the COE project are drawn up and decided. Subjugate to the strategic board we have 3 research divisions (‘structure’, ‘nonlinear’ and ‘global’) and the applied mathematics research groups which comprise all research in fields that are not yet well-established as mathematical science in Japan. At present there are 3 such research groups : in Finance & Actuary, in Nonlinear Phenomena and in Statistical Analysis and Computing.

The project aims not only at increasing the likelihood of finding applications of mathematics in society, but also

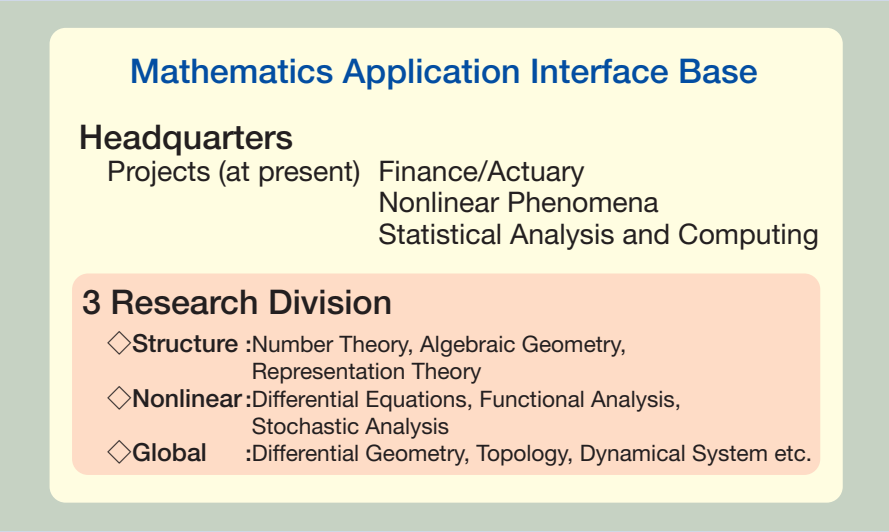
at generating new mathematical disciplines (from an applied perspective) while systematically assuming the role of a junction between mathematics and its applications.

So far we have employed 3 invited professors, more than 100 postdoctoral fellows and research assistants and we have invited an important number of foreign researchers. This allowed us to organize numerous COE related lectures, lecture series and student seminars. Each year we also organize public lectures as well as large scale international conferences. For example, during fiscal year 2005 we organized the 3rd COE international conference “Groups, Homotopy and Configuration Spaces” (5~11 July 2005) as well as a colloquium on “Analysis in Society and the Natural Sciences” (5 November 2005) aimed at the general public. We also employed a video technician, which will enable us to offer (live or recorded) video feeds of seminars, lectures or conferences over the internet.

The Graduate School of Mathematical Sciences already bears the responsibility for all basic education in mathematics that takes place at the University of Tokyo. In the future we wish to play a major role in research and education in applied mathematics as well and we shall try to establish ourselves as an internationally recognized research centre in this field.



The Center’s concept



Organization

Lectures and Seminars

Lectures

Algebra	Introduction to Algebra, Algebraic Geometry, Number Theory, Automorphic Functions, Analytic Number Theory, Applied Algebra
Global Geometry	Introduction to Global Geometry, Differential Geometry, Topology, Global Analysis, Complex Manifolds, Dynamical Systems
Basic Analysis	Introduction to Basic Analysis, Linear Differential Equations, Spectral Theory, Algebraic Analysis, Stochastic Analysis, Functional Analysis
Mathematical Structures	Introduction to Mathematical Structures, Algebraic Structures, Group Structures, Lie Algebras, Infinite Dimensional Structures, Representation Theory
Mathematical Analysis	Introduction to Mathematical Analysis, Nonlinear Analysis, Stochastic Processes, Numerical Analysis, Mathematical Statistics, Mathematical Control Theory
Discrete Mathematics	Introduction to Discrete Mathematics, Mathematical Logic, Foundations of Mathematics, Information Theory, Computational Mathematics, Combinatorics
Others	Special Lectures on Mathematical Sciences

Seminars

Master's Program:
Interdisciplinary Seminar, Basic Seminar, Advanced Seminar

Ph.D. Program:
Ph.D. Seminar on Mathematical Sciences, Special Advanced Seminar

Degrees

M.S. (Mathematical Sciences)

Ph.D. (Mathematical Sciences)

Facilities

Library

●The present collection includes:

about **125,000** volumes including about **1,500** periodicals.

The library also maintains an up-to-date collection of preprints from universities all over the world.

International Exchange

●Foreign visitors between April 2005-March 2006

Long-term (more than one month) **50** persons

Short-term (less than one month) **83** persons

From

Australia, Austria, Belgium, Bulgaria, Canada, Chile, China, Denmark,

France, Germany, Greece, India, Israel, Italy, Korea, Netherlands, Poland, Romania, Russia, Singapore,

Taiwan, Tunisia, United Kingdom, U.S.A., Vietnam

Number of Students (per year)

●Undergraduate students : **45**

●Master's program : **53** (with at least **6** foreign students)

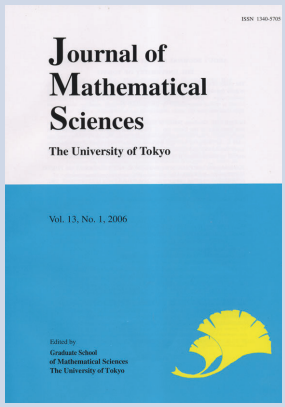
●Ph.D. program : **32** (with at least **3** foreign students)

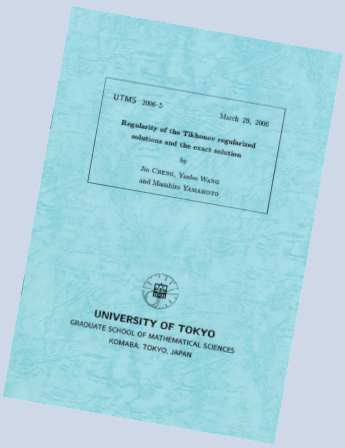
Publications

●Journal of Mathematical Sciences

●Preprint series

●Lecture Notes in Mathematical Sciences





Seminars for Researchers

The Departmental Colloquium is held once every month. It had a long history as the “Friday Colloquium” before the formation of the new department. Speakers include distinguished visitors in various areas of mathematical sciences as well as members of the department. The talks are expected to be accessible to non-specialists in the field and students are encouraged to attend it as a means of broadening their mathematical background.

In addition, the following research seminars are organized by the staff of the department according to their specialties. Most of them are held on a weekly basis and last for an hour or two. They provide opportunities for mathematicians in the Tokyo area to meet and talk face to face. Currently these include the seminars listed below.

- Algebraic Geometry
- Number Theory
- Arithmetic of Automorphic Forms
- Geometry
- Topology
- Geometric Complex Analysis
- Lie Groups and Representation Theory
- Algebraic Analysis
- Analysis
- Fanctional Analysis
- Operator Algebra
- PDE Real Analysis
- Applied Analysis
- Real and Harmonic Analysis
- Integrable System
- Mathematics for Various Disciplines
- Mathematical Finance
- Applied Mathematics
- Probability and Statistics
- Demography and Mathematical Biology
- Mathematical Past of Asia

Access

Komaba Campus

Address: Graduate School of Mathematical Sciences
The University of Tokyo
3-8-1 Komaba Meguro-ku Tokyo 153-8914 JAPAN
Tel: 03-5465-7000
(from overseas: +81-3-5465-7000)
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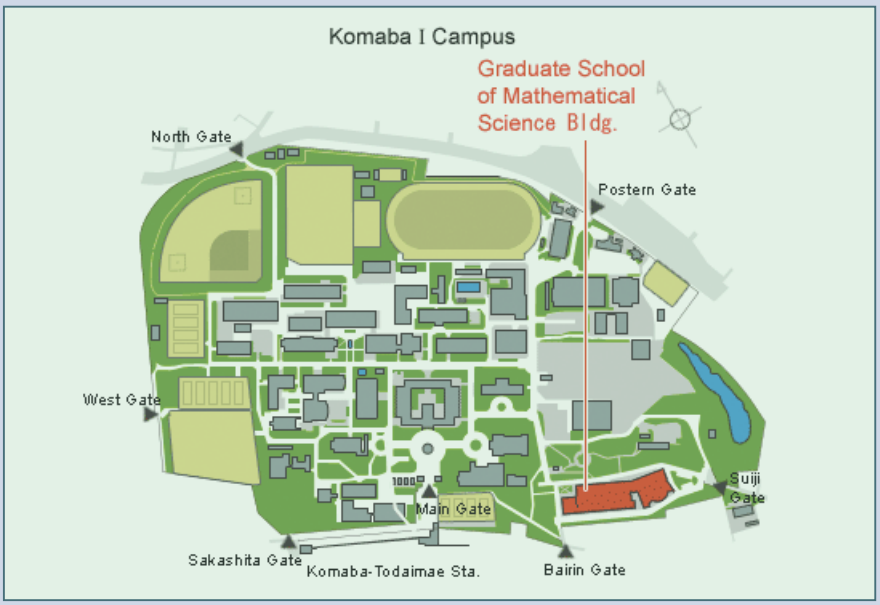
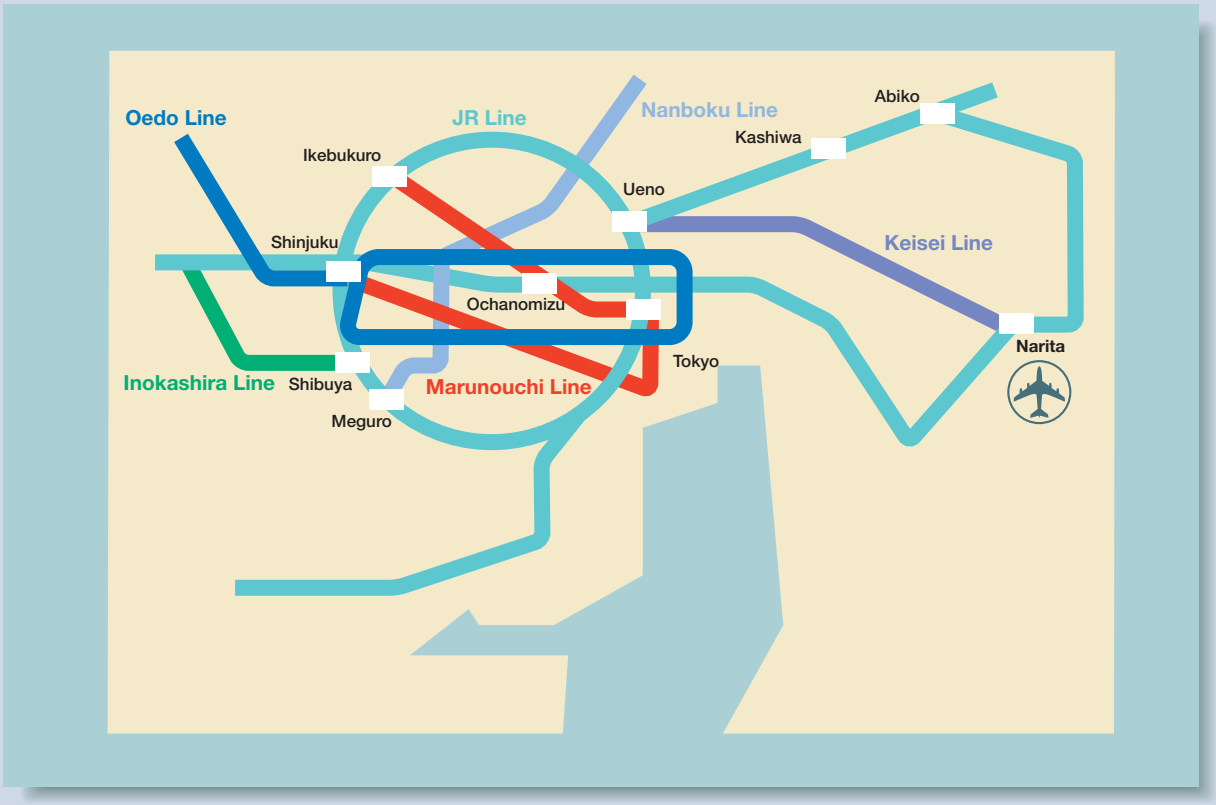
Location: Mathematical Sciences Building
2 min. walk from Komaba-todaimae Station
(Keio Inokashira Line)





KOMABA CAMPUS