BRAZILIAN MATHEMATICS 2018

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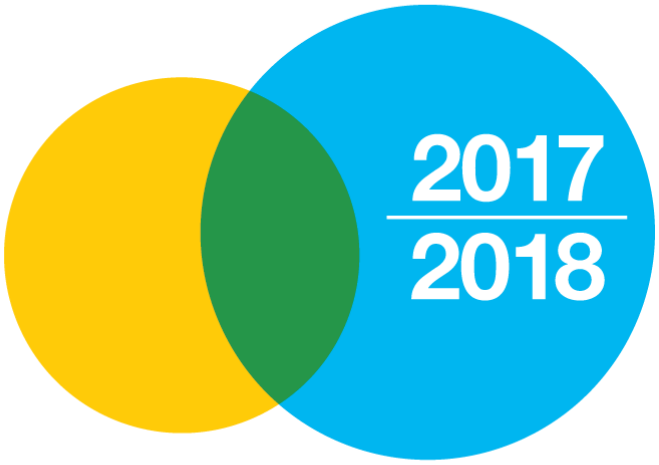
SBM



BIÊNIO DA MATEMÁTICA

BRASIL

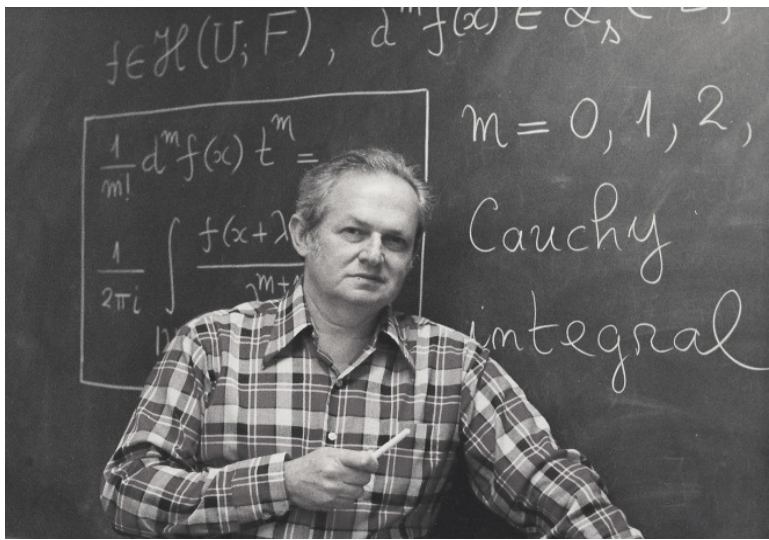
Contents

Brief history

Brazil is a relative newcomer to the world of science, largely due to the late development of its institutions of higher education and research. Early progress, around the beginning of the 20th century, focused on specific fields such as public health or agriculture. Mathematics was no priority at that stage.

The first mathematics seminar was organized in 1935 by the Faculty of Philosophy, Sciences and Letters of the University of São Paulo. The Faculty had been founded in the previous year and also launched a mathematics journal. In the 1940's and 1950's, this institution hired in visiting positions several distinguished foreign mathematicians, including André Weil, Oscar Zariski, Jean Dieudonné and Alexander Grothendieck.

A turning point at the national level was the creation, in 1951, of the two major federal research agencies, CNPq and CAPES. The Institute for Pure and Applied Mathematics (IMPA) was founded by CNPq in 1952, and Brazil joined the International Mathematical Union (IMU) in 1954. The Brazilian Mathematics Colloquium was created by IMPA in 1957 and has been organized biennially ever since. Much of Brazilian mathematics grew around it.



Leopoldo Nachbin: first Brazilian mathematician to address the International Congress of Mathematicians, in 1962.

Group photo for the first Brazilian Mathematics Colloquium, held in Poços de Caldas, state of Minas Gerais, on July 1-20, 1957. **Mauricio Peixoto, ICM 1974 invited speaker** is third from the left on the front row

In 1962, Leopoldo Nachbin became the first Brazilian to deliver an invited lecture at the International Congress of Mathematicians (ICM), in Stockholm. He was followed by Mauricio Peixoto at ICM 1974, in Vancouver. The Brazilian Mathematical Society (SBM) was created during the 7th Brazilian Mathematics Colloquium, in 1969, and soon became the country's adhering organization to the IMU.

Within the IMU structure, Brazil moved to Group II in 1978 and to Group III in 1981. The latest development was in 2005, when Brazil was promoted to Group IV. Throughout, Brazilian mathematicians have been giving significant contributions to the functioning of the Union.

Jacob Palis was the IMU secretary in 1991-1998 and the IMU president in 1999-2002. Paulo Cordaro was a member of the IMU Commission for Development and Exchange in 2007-2010. Marcelo Viana was an IMU vice-president in 2011-2014 and served as a member-at-large of the IMU Executive Committee in 2007-2010.

Jacob Palis: invited speaker at ICM 1978, IMU secretary (1991-1998) and IMU president (1999-2002).

In 2014, Artur Avila, a researcher and former graduate student from IMPA, was awarded the Fields Medal.

In that same year, Brazil was honored with the right to organize the International Congress of Mathematicians, ICM 2018, and the International Mathematical Olympiad, IMO 2017. Both events will take place in Rio de Janeiro, respectively, on August 1 – 9, 2018 and July 12 – 23, 2017.

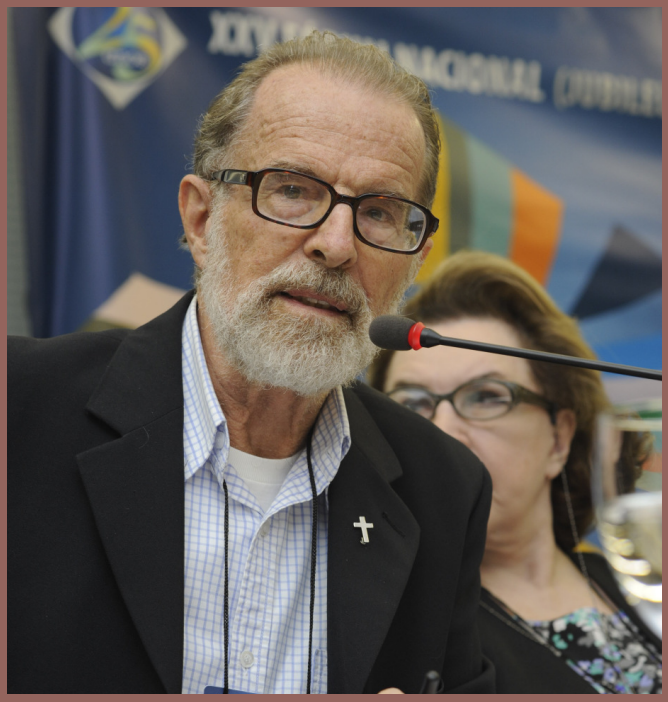
Artur Avila: plenary speaker at ICM 2010 and Fields Medalist 2014.

Mathematical research

Analysis and dynamical systems were among the very first mathematics research fields developed in Brazil. They were soon followed by differential geometry, calculus of variations, which naturally led to partial differential equations, and algebra and algebraic geometry. Next came statistics, control, optimization and probability theory. More recent additions include discrete mathematics, especially combinatorics, and several areas of applications: numerical analysis, fluid dynamics, computer vision and inverse problems, to mention just a few.

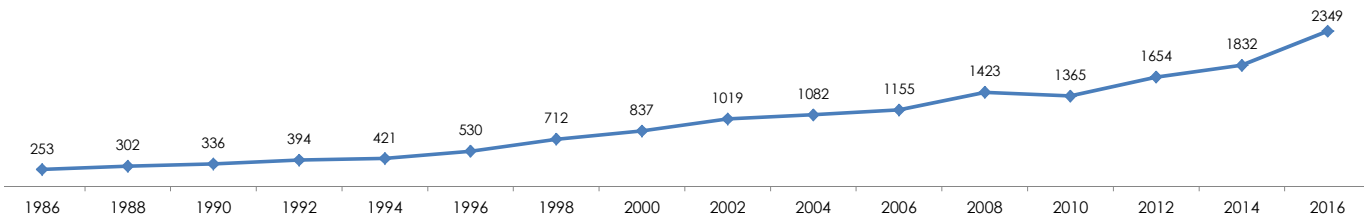
Among the most interesting recent developments one should highlight the rise of a new generation of mathematicians working in modern trends of geometry (symplectic, complex etc.), algebra (non-commutative, non-associative etc.) and discrete mathematics, as well as the creation of sizable research groups in operator algebras, Lie theory and certain areas of mathematical physics, including gauge theory and string theory.

IMPA (Rio de Janeiro), the state universities of São Paulo (at São Paulo and São Carlos) and Campinas, the federal universities of Rio de Janeiro, Brasília, Minas Gerais (Belo Horizonte) and Ceará (Fortaleza), and the catholic university of Rio de Janeiro are considered the main national mathematics research centers. High profile research groups exist also at the federal universities of Pernambuco (Recife), Paraíba (João Pessoa), Campina Grande, Paraná (Curitiba), Rio Grande do Sul (Porto Alegre) and Fluminense (Niterói) and the state universities of Maringá and São Paulo at Rio Preto. Especially since the late 1990's, smaller yet very productive groups have been installed at the federal universities of Pará (Belém), Bahia (Salvador), Alagoas (Maceió), Goiás (Goiânia), Santa Catarina (Florianópolis), ABC (Santo André) and São Carlos.



Manfredo do Carmo and Paul Schweitzer: invited speakers at ICM 1978 and ICM 1982, respectively.

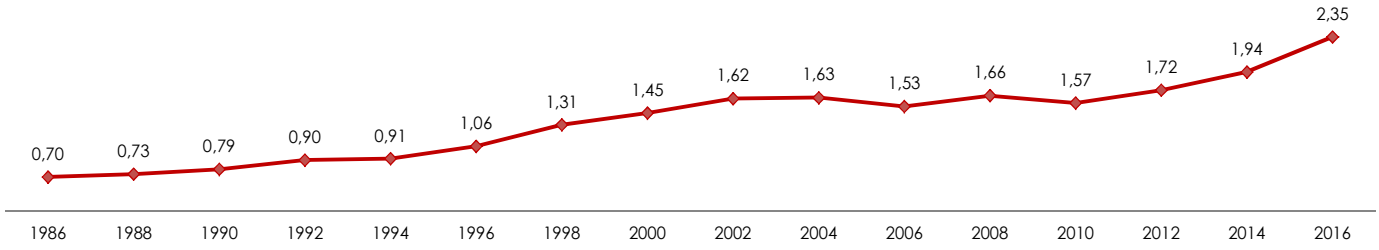
All these institutions offer doctoral degrees in mathematics and/or statistics to Brazilian and international students. Thus research in mathematics is now fairly well distributed in the Brazilian territory.



A striking consequence of this growth is that the Brazilian contribution to the world's mathematics output has been increasing rapidly, both in absolute terms and in percentage.

For example, in 2006, right after Brazil moved to the IMU Group IV, it accounted for 1.53% of the world's production (1043 math papers). By 2016, that had grown to 2.35% (2076 papers). As a comparison, both the gross domestic product (GDP) and the population of Brazil stand at about 2.9% of the corresponding world's totals.

In 2016 a total of 2349 math papers were authored by Brazilian mathematicians, up from 253 in 1986, 530 in 1996, and 1155 in 2006 (source: MathSciNet).

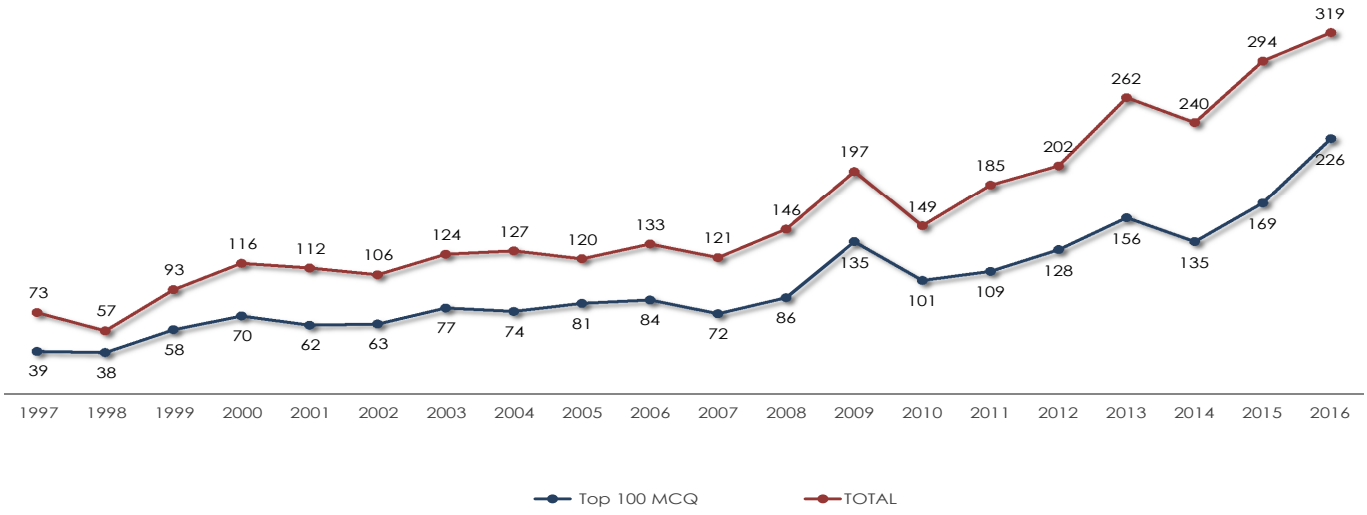


In 2016 the percentage of math papers by Brazilian authors reached 2.35% of the world's total output, up from 0.70% in 1986, 1.06% in 1996 and 1.53% in 2006 (source: MathSciNet).

From a more qualitative viewpoint, research papers by Brazilian mathematicians appear regularly in most top journals. Indeed, not only the number of such premium publications has increased substantially over the last two decades, but the list and profiles of high level journals where Brazilian authors publish regularly have also been widening, reflecting the growing diversity of the mathematics created in the country.

Top 100 MCQ (Mathematical Citation Quotient)			
	papers		papers
Publications Mathématiques de l'IHÉS	5	Computer Methods in Applied Mechanics and Engineering	103
Cambridge Journal of Mathematics	1	Journal of Functional Analysis	77
Annals of Mathematics	17	Annals of Applied Probability	20
Acta Mathematica	6	Mathematisch Annalen	48
Journal of the American Mathematical Society	7	Proceedings of the National Academy of Sciences USA	5
Communications in Pure and Applied Mathematics	18	Compositio Mathematica	8
Inventiones Mathematicae	21	ACM Transactions on Mathematical Software	5
Archive for Rational Mechanics and Analysis	36	Journal of Algebraic Geometry	3
Memoires of the American Mathematical Society	1	Journal of the ACM (Association for Computer Machinery)	1
Duke Mathematical Journal	14	SIAM Journal on Imaging Sciences	2
Annales Scientifiques de l'École Normale Supérieure	7	Mathematics of Computation	22
Journal of the European Mathematical Society	16	Mathematical Programming	78
Annales de l'Institut Henri Poincaré - Analyse Non Linéaire	40	Journal of Scientific Computing	13
Archives of Computational Methods in Engineering	2	Annali della Scuola Normale Superiore di Pisa – Scienze	14
Dissertationes Mathematicae (Rozprawy Matematyczne)	1	Journal of Topology	3
Mathematical Models and Methods in Applied Sciences	13	ESAIM: Mathematical Modelling and Numerical Analysis	5
Foundations of Computational Mathematics	6	Proceedings of the London Mathematical Society	15
SIAM Journal of Optimization	66	Transactions of the American Mathematical Society	127
Communications in Partial Differential Equations	30	Selecta Mathematica	10
Geometric and Functional Analysis	4	Mathematical Programming and Computation	6
Journal of Differential Geometry	24	Revista Matematica Iberoamericana	8
Calculus of Variations and Partial Differential Equations	45	Advances in Nonlinear Analysis	7
Journal de Mathématiques Pures et Appliquées	27	Journal of Computational Physics	60
Probability Theory and Related Fields	26	Mathematical Finance	1
Annals of Probability	41	Annales de l'Institut Henri Poincaré - Probabilité et Statistique	17
SIAM Journal of Numerical Analysis	23	Journal of Mathematical Fluid Mechanics	6
Analysis and Partial Differential Equations	5	SIAM Journal of Control and Optimization	49
Journal of Differential Equations	274	Communications in Number Theory and Physics	1
Advances in Mathematics	60	International Mathematical Research Notes (IMRN)	19
Annals of Statistics	8	Journal d'Analyse Mathématique (Jerusalem)	8
Journal für die Reine und Angewandte Mathematik	28	Journal de l'Institut de Mathématiques de Jussieu	10
Transactions of the London Mathematical Society	2	Astérisque	23
American Journal of Mathematics	11	Journal de l'École Polytéchnique – Mathématiques	2
Communications in Mathematical Physics	100	Journal of Nonlinear Science	4
Journal of the Royal Statistical Society - Series B	4	Communications in Contemporary Mathematics	43
IMA Journal of Numerical Analysis	14	Proceedings of the Royal Society of Edinburgh - Section A	35
Numerische Mathematik	13	Journal of Symplectic Geometry	4
SIAM Journal on Matrix Analysis and Applications	14	Communications in Analysis and Geometry	33
Geometry and Topology	9	Algebra and Number Theory	3
SIAM Journal on Mathematical Analysis	38	Commentarii Mathematici Helvetici	34
SIAM Journal on Scientific Computing	13	Bulletin of the American Mathematical Society	3
TOTAL Top 100 MCQ = 2025			

Other important journals			
	papers		papers
ACM Transactions on Graphics	18	International Journal for Numerical Methods in Engineering	81
Advances in Computational Mathematics	8	Inverse Problems	39
Annales Henri Poincaré	16	Israel Journal of Mathematics	61
Annals of Applied Statistics	8	Journal of Algebra	244
Bayesian Analysis	11	Journal of Combinatorial Theory. Series A	12
Bernoulli (Andover)	7	Journal of Combinatorial Theory. Series B	23
Biometrics (Washington)	12	Journal of the London Mathematical Society	37
Bulletin de la Societé Mathématique de France	8	Mathematics of Operations Research	7
Ergodic Theory and Dynamical Systems	160	Mathematische Zeitschrift	78
ESAIM: Control Optimization and Calculus of Variations	18	Nonlinearity	130
IEEE Transactions on Geoscience and Remote Sensing	56	Physical Review Letters	28
IEEE Transactions on Image Processing	4	SIAM Review	6
IEEE Transactions on Information Theory	49	Statistica Sinica	6
IEEE Transactions on Power Systems	9	Statistics and Computing	8
IEEE Transactions on Reliability	12	The Asian Journal of Mathematics	19
Indiana University Mathematics Journal	39	The Journal of Geometric Analysis	40
TOTAL = 3279			



(source: MathSciNet)

That has also been reflected in a steadily growing presence of Brazilian invited and plenary speakers at the International Congress of Mathematicians:

Brazilian speakers at ICMs

1962	Invited: L. Nachbin.
1974	Invited: M. Peixoto.
1978	Invited: M. do Carmo and J. Palis.
1982	Invited: P. Schweitzer.
1986	Invited: R. Mañé.
1990	Invited: C. Camacho.
1994	Invited: R. Mañé and M. Viana.
1998	**Plenary: M. Viana.** Invited: W. de Melo.
2002	Invited: E. Pujals
2010	**Plenary: A. Avila.** Invited: F. Codá Marques.
2014	**Plenary: F. Codá Marques.** Invited: M. Belolipetsky, C. G. Moreira and V. Sidoravicius.
2018	**Plenary: C. G. Moreira.** Invited: C. Araújo, R. Exel, V. Futorny, L. J. Díaz, U. Hryniewicz, A. Koropecki, C. Landim, H. N. Lopes, R. Morris, T. Roque, C. Sagastizábal and P. Salomão.

Enrique Pujals: invited speaker at ICM 2002. Fernando Codá Marques: invited speaker at ICM 2010 and plenary speaker at ICM 2014. Both are Ramanujan prize winners.

Several of the people on this list actually originate from other countries: it is to be noted that Brazilian universities and research institutes regularly hire faculty members from all over the world, with no citizenship constraints.

Brazilian mathematicians have been distinguished with prestigious international prizes, including the 2010 Balzan Prize (Balzan Foundation, Italy) for Jacob Palis and the 2016 Grand Prix Scientifique Louis D. (Institut de France) for Marcelo Viana.

Also, the Ramanujan Prize (IMU and ICTP) was four times awarded to Brazilian mathematicians: Marcelo Viana (2005), Enrique Pujals (2008), Fernando Codá Marques (2012) and Eduardo Teixeira (2017).

Marcelo Viana: invited speaker at ICM 1994, plenary speaker at ICM 1998, IMU vice-president (2011-2014) and chair of the ICM 2018 Organizing Committee.

A small sample of math meetings held in Brazil

International Congress of Mathematical Physics, 2006

International Congress on Minimal and Constant Mean Curvatures Surfaces, 2007

Worshop on Partial Differential Equations: Theory, Computation and Applications, 2007

First Indo-Brazilian Symposium in Mathematics, 2008

International Conference on the Analysis of Algorithms, 2008

Mathematical Methods and Modeling of Biophysical Phenomena, 2009

Workshop on Conservative Dynamics and Symplectic Geometry, 2009

Clay Mathematics Institute Summer School, 2010

Poisson 2010 – Poisson geometry in Mathematics and Physics, 2010

Mathematical Modelling and Calibration in Commodities and Energy, 2011

Arithmetic of Modular forms and Elliptic Curves, 2011

Quantum Groups and 3-Manifold Invariants, 2012

Arithmetic and Geometry of Picard-Fuchs Differential Equations, 2012

International Conference on Dynamical Systems, 2013

Symmetries in Mathematics and Physics II, 2013

International Symposium on Generalized Convexity and Monotonicity, 2014

Discrete Markov Chains: mixing times and beyond, 2014

Latin American School of Algebraic Geometry and Applications, 2015

International Conference in Number Theory and Physics, 2015

SAET Conference on Current Trends in Economics, 2016

International Conference on Stochastic Programming, 2016

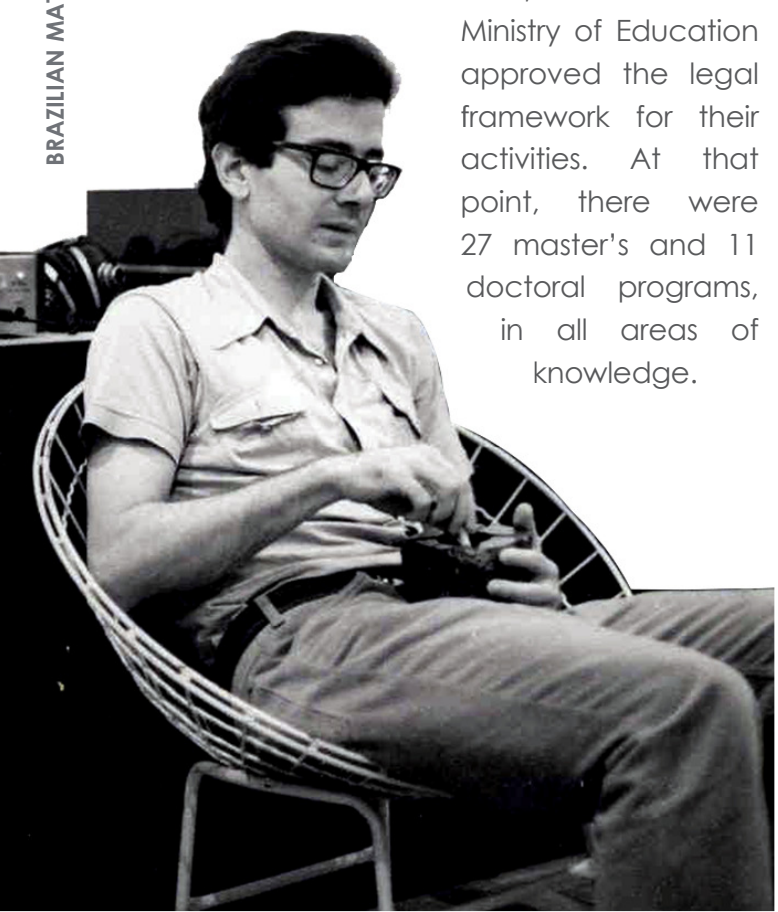
International Mathematica Olympiad, 2017

Graduate studies

The history of graduate studies in Brazil is closely related to that of the two main agencies for the promotion of science, CNPq and Capes, both created by the federal government in 1951. CNPq provides support to individual researchers and research groups, whereas CAPES both funds and evaluates graduate programs, on quadrennial cycles.

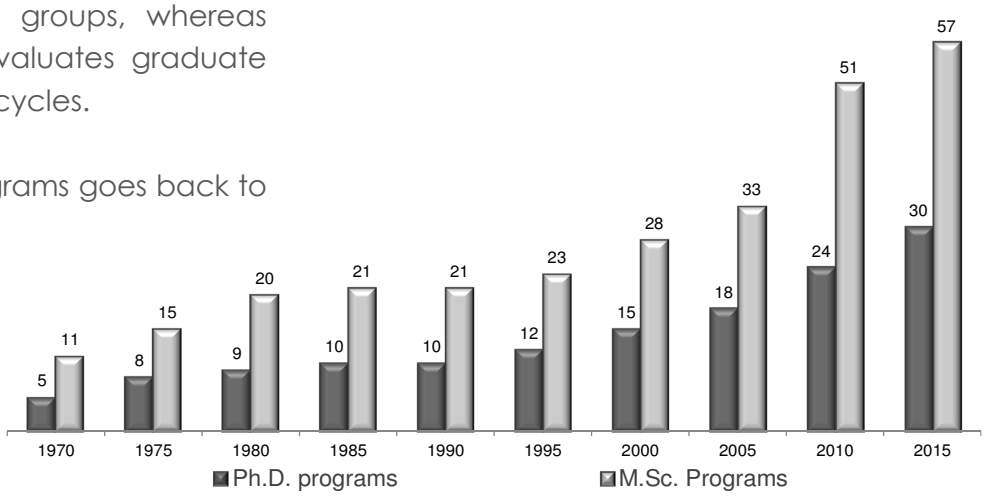
The origin of graduate programs goes back to the so-called University Program, launched by CAPES in 1953, which offered grants, scholarships, and support to the organization of scientific events, in order to foster visits by foreign scholars and cooperation among institutions.

Graduate programs were formally recognized in 1965, when the Ministry of Education approved the legal framework for their activities. At that point, there were 27 master's and 11 doctoral programs, in all areas of knowledge.



Further regulations were issued by the end of that decade, and National Programs for Graduate Studies have been formulated by the federal government since 1975. The fifth such Program is currently active, for the period 2011-2020.

The first graduate program in mathematics started at IMPA in 1962. By the end of that decade, doctoral programs were still scarce and mostly concentrated around Rio de Janeiro and São Paulo, with a few master's level programs scattered in other cities. Despite a slow start, the system grew steadily so that by the turn of the century graduate programs in mathematics existed in all five major geographic regions of Brazil: South, Southeast, Midwest, Northeast, and North. Since then, several of these programs have been upgraded from master's to doctoral level, and the system as a whole has more than doubled in size.

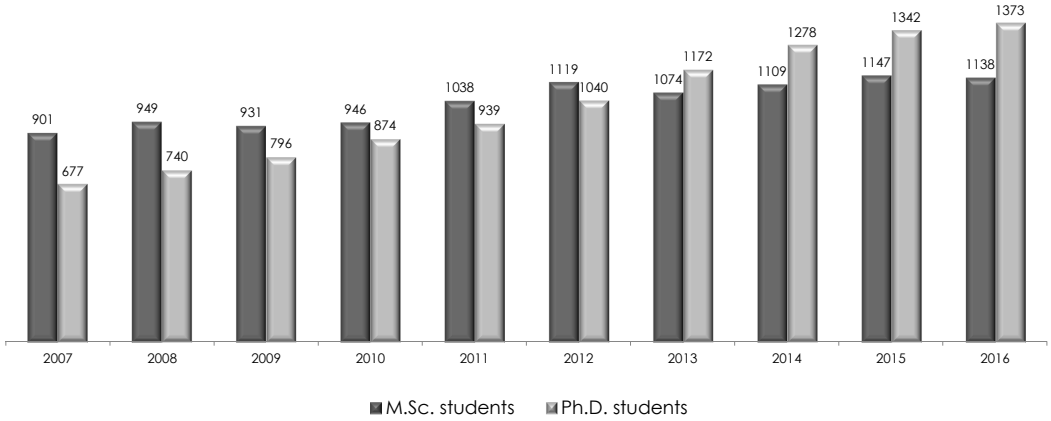


Number of graduate programs in mathematics, probability and statistics. Currently, there exist 57 master's and 30 doctoral programs, in all five major geographic regions of Brazil

source: CAPES

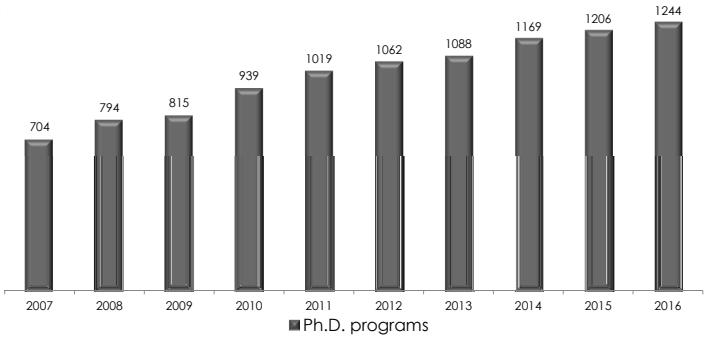
Historically, the vast majority of graduate programs were designed for academia, namely, for training university professors and researchers. That trend started to change in the 1990s, with the creation of so-called "professional" programs, whose aim is to qualify human resources to work in non-necessarily academic environments.

Ricardo Mañé: invited speaker at ICMs 1986 and 1994.



NUMBER OF STUDENTS ENROLLED IN GRADUATE PROGRAMS IN MATHEMATICS, PROBABILITY AND STATISTICS. [PROFMAT NOT INCLUDED]. BY 2016 THERE WERE 1373 DOCTORAL STUDENTS, UP FROM 677 IN 2007. THE NUMBER OF MASTER'S STUDENTS HAS GROWN MORE SLOWLY: 1138 IN 2016, UP FROM 901 IN 2007.

SOURCE: CAPES



NUMBER OF FACULTY ACTIVE IN BRAZILIAN GRADUATE PROGRAMS, EITHER TEACHING COURSES OR DIRECTING THESES.

SOURCE: CAPES

There are currently six professional master's programs in mathematics, in such areas as industrial mathematics, mathematical methods in finance and the training of school teachers. Among the latter, the nationwide network PROFMAT takes 1,600 new students every year, in about 100 campuses in all Brazilian states.

It should be noted that the total number of students in doctoral programs has doubled over the last decade, so that by 2013 it had overtaken the number of students in master's programs.

Furthermore, a significant number of Brazilian students get their degrees abroad, most of the times sponsored by either CAPES or CNPq through graduate scholarships. A popular model, called sandwich doctorate, allows for students enrolled in Brazilian doctoral programs to visit centers of excellence in other countries for a one-year period, to carry part of the research with distinguished international experts.

The number of Brazilian students abroad, both graduate and undergraduate, was much augmented by the Science without Borders program, launched by the federal government in 2011. Science without Borders also offered a substantial number of fellowships for both young and senior outstanding international researchers to visit Brazilian research centers.

CÉSAR CAMACHO: INVITED SPEAKER AT ICM 1990.

Brazilian Mathematical Society

The Brazilian Mathematical Society (SBM) represents Brazil in the International Mathematical Union (IMU) and the Mathematical Union for Latin America and the Caribbean (UMALCA), besides being a founding member of the Mathematical Council of the Americas (MCofA). After its foundations, in 1969, other mathematical societies were created: the Brazilian Society for Applied and Computational Mathematics (SBMAC), the Brazilian Statistics Association (ABE), the Brazilian Society for Mathematics Education (SBEM), the Brazilian Society for the History of Mathematics (SBHMat) and the Brazilian Computation Society (SBC).

The SBM's mission includes contributing to the development of mathematics throughout the country; bringing together mathematicians and mathematics teachers; stimulating high level mathematics research and the dissemination of mathematical knowledge in the Brazilian society; contributing to the improvement of mathematics education; encouraging international exchange between mathematicians based in Brazil and abroad; defending the freedom of teaching and research, as well as the professional interests of mathematicians; offering advice and collaboration in mathematics to all institutions.

The SBM has about 2,000 associates, young and senior, and is a nonprofit publishing house for mathematics books and journals. It organizes scientific meetings and schools, both domestic and international, and supports the mathematical Olympiads.

Pedro Salomão (São Paulo) and Umberto Hriniewicz (Rio de Janeiro) receiving the SBM Prize 2015. They have since been invited to lecture at ICM 2018.

Since 2013, it offers a biennial research prize. It also runs several broad interest initiatives, such as PROFMAT, the nationwide master's program for school teachers.

SBM Prize - It rewards the best original research paper in mathematics published in the last three years by a young mathematician working in Brazil. It is awarded in biennialy, during the Brazilian Mathematics Colloquium, by a five-member international committee whose judgement is based on originality, relevance, depth and potential impact in the field.

It says much of the SBM Prize's quality that all winners thus far have then been ICM invited speakers.

SBM Prize winners:

2013: On the regularization of conservative maps, published by Artur Avila (IMPA) in Acta Mathematica.

2015: A Poincaré-Birkhoff theorem for tight Reeb flows on S^3, published by Umberto Hryniewicz (UFRJ) e Pedro Salomão (USP), jointly with Al Momin, in Inventiones Mathematicae.

2017: Independent sets in hypergraphs, published by Robert Morris (IMPA), jointly with József Balogh and Wojciech Samotij, in the Journal of the American Mathematical Society.

SBM book series: The Brazilian Mathematical Society is a nonprofit publishing house for mathematics books in Portuguese.

SBM book collections

Fronteiras da Matemática (2014): Advanced texts in all areas of mathematics addressing topics important for graduate students and researchers and reaching the frontiers of current knowledge.

Textos Universitários (2004): Mathematical texts at the undergraduate and graduate levels, with a special focus on the first years of college education, including calculus, analytic geometry and linear algebra.

Professor de Matemática (1985): An extended series of books covering the material taught in high school. In addition to contents, a main concern is to discuss the classroom practice, so as to provide the teacher with the instruments to highlight connections between different topics.

PROFMAT (2012): Textbooks for training elementary through high school teachers in all aspects of mathematics, its teaching practice, its history and its applications. It includes the bibliographic references for the professional master's program.

Matemática Aplicada (2000): Aiming to disseminate and stimulate the use of mathematics in the applied sciences, as well as to encourage interest for mathematics among students in related areas. In partnership with the Brazilian Society for Applied and Computational Mathematics (SBMAC).

Iniciação Científica (1985): A series of books in mathematics and related fields aimed at students and offering content – from classic to modern and theoretical to applied - in addition to the current curricula.

Olimpíadas de Matemática (2003): A collection of texts and problems directed to the preparation for mathematical contests, targeting school and college students and teachers.

Matemática para o Ensino (2015): This series offers the teacher a careful, broad and deep approach to school mathematics, highlighting the connections between mathematics as a science and its practice in the classroom.

História da Matemática (2016): Texts offering a dynamic perspective of the advancement of mathematics throughout the ages, focusing on the genesis and consolidation of its concepts.

The Brazilian Mathematical Society also distributes three book series published by IMPA:

IMPA book collections

Projeto Euclides (1976): Textbooks on graduate topics, mostly arising from current research areas carried out in the country.

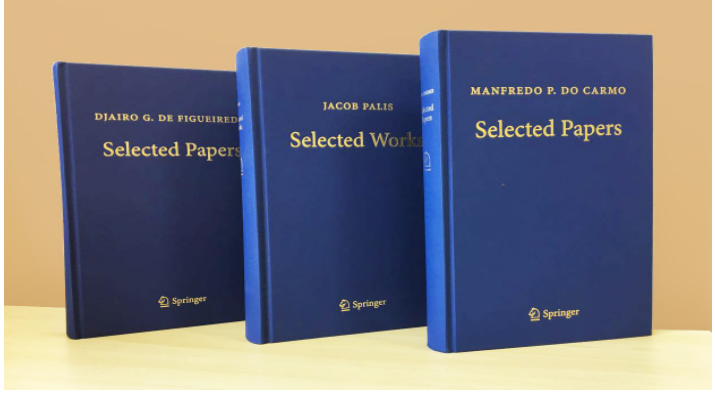
Matemática Universitária (1991): Offers college professors and students the possibility to use books in Portuguese fully adapted to the Brazilian curricular structure.

Matemática e Aplicações (2005): Books employed in graduate and undergraduate courses, dealing mostly with techniques from other branches of science associated with mathematical models.

Welington de Melo, invited speaker at ICM 1998 and doctoral supervisor of Fields Medalist Artur Avila.

Selected works of Brazilian mathematicians: IMPA and SBM signed an agreement with Springer-Verlag for the publication of the selected research papers of renowned Brazilian mathematicians. The following volumes of selected papers already appeared Manfredo do Carmo (2012), Djairo de Figueiredo (2013), Jacob Palis (2014), Ricardo Mañé (2017). A few more are in preparation.

SBM Journals: The Brazilian Mathematical Society publishes a wide range of academic journals, targeted at different audiences: researchers, college professors and students and school teachers.



The Selected Works/Papers of Jacob Palis, Manfredo do Carmo and Djairo de Figueiredo.

Meetings: The SBM organizes periodic meetings, to help disseminate mathematics at all levels and in all parts of the country:

SBM journals

Bulletin of the Brazilian Mathematical Society (1970): The most prominent Brazilian research journal in mathematics. Indexed by ISI and distributed by Springer Verlag, it publishes four issues per year with about 180 pages per issue.

Matemática Contemporânea (1991): A venue of choice for proceedings of mathematics meetings. Each volume has an associate editor and typically includes refereed research and survey articles.

Ensaios Matemáticos (1989): Conceived as a vehicle for authoritative review and state-of-the-art papers and surveys of areas of mathematics in vigorous development.

Matemática Universitária (1985): Publishes articles geared towards professors and college students, either with a scientific content or on various themes pertaining to college life in Brazil.

Eureka! (1998): Run by the Brazilian Mathematical Olympiads Committee, this series publishes articles related to mathematics competitions, including problems and ingenious solutions.

Revista do Professor de Matemática (1982): A quarterly journal targeted at school teachers, containing articles of general interest concerning the school curriculum in mathematics, and beyond.

Professor de Matemática On-line (2013): An electronic vehicle for the publication of academic articles concerning the training of school teachers, in all aspects of mathematics, including education, history and applications.

SBM meetings

Bienal da Matemática (2002): Aims to foster students' interest in mathematics research and teaching. It has a very broad target audience, including students at all levels and mathematics teachers and researchers.

Colóquios de Matemática das Regiões (2011): This cycle of meetings, held biennially in each of Brazil´s five major geographic regions, extends the scope of the Bienal to the whole national territory.

Simpósios da Formação do Professor de Matemática (2013): Devoted to the training of school teachers, these symposia are also held in a biennial cycle: a national meeting smaller ones in each of Brazil´s five regions. A partnership with the National Association of Mathematics Teachers (ANPMAT).

Visitoes gather in front of the SBM booth at Bienal de Matemática 2017 in Rio de Janeiro .

Joint Meetings: In addition to the relations with neighboring countries, strong ties have been established to some of the countries in the Northern Hemisphere. SBM, SBMAC and IMPA run a cycle of joint meetings with their counterparts in some of these partners:

International joint meetings

1st AMS – SBM Joint Meeting, June 2008
http://www.sbm.org.br/amssbm

1st Brazil – India Joint Meeting in Mathematics, July 2008
https://impa.br/sobre/memoria/reunioes-cientificas/2008-2/first-indo-brazilian-symposium-in-mathematics/

2nd Brazil – India Joint Meeting in Mathematics, December 2009
http://math.tifrbng.res.in/~indobrazil/12.html

3rd Brazil – India Joint Meeting in Mathematics, August 2012
https://impa.br/sobre/memoria/reunioes-cientificas/3rd-indo-brazilian-symposium-in-mathematics/

1st Brazil – Spain Joint Meeting in Mathematics, December 2015.
http://www.sbm.org.br/jointmeeting-spain

1st Brazil – Italy Joint Meeting in Mathematics, September 2016.
http://www.sbm.org.br/jointmeeting-italy

2nd Brazil – Spain Joint Meeting in Mathematics, December 2018
http://www.rsme.es/content/view/2207/91/8

1st Brazil – France Joint Meeting in Mathematics, August 2019.
http://www.sbm.org.br/jointmeeting-france

Keeping in mind that the year of 2022 will mark the 200th anniversary of Brazil's independence from Portugal, the Brazilian Mathematical Society has started a discussion with the Portuguese Mathematical Society about the possibility of a joint celebrative event.

Agreements: The SBM has reciprocity agreements with the: American Mathematical Society (USA), Canadian Mathematical Society (Canada), Société Mathématique de France (France), Real Sociedad Matemática Española (Spain), Unione Matematica Italiana (Italy), Sociedad Matemática Peruana (Peru), Sociedade Portuguesa de Matemática (Portugal), and all the Brazilian societies in the mathematical sciences: Applied and Computational Mathematics (SBMAC), Statistics (ABE), Mathematics Education (SBEM), History of Mathematics (SBHMat) and Computation (SBC).

[3]

Carlos Gustavo Moreira: IMO gold medal 1990, invited speaker at ICM 2014, plenary speaker at ICM 2018.

math olympiads

Brazil has two major mathematical Olympiads. The Brazilian Mathematical Olympiad (OBM) was founded by the Brazilian Mathematical Society in 1978. The OBM organizers a national contest and several state and regional ones, involving about 500,000 students every year, from 6th grade to the undergraduate level. In addition, it OBM represents Brazil in the main competitions around the world, including the International Mathematical Olympiad (IMO).

Brazil has been participating in the IMO since 1979, when it ranked 22nd among 23 countries, uninterruptedly to this date. Thus far, Brazilian students have brought home 9 gold medals, 43 silver and 73 bronze medals. The country´s best collective result was 15th among 109 countries, at the 2016 IMO in Hong Kong.

The 2017 International Mathematical Olympiad took place in Rio de Janeiro, Brazil, from July 12 through 23. It was the largest to date, with 615 contestants and a total of 1560 participants, from 112 countries. The organization of IMO 2017 in Brazil was widely considered a great success.

At the initiative of IMPA, in 2005 the Brazilian government launched the Brazilian Mathematical Olympiad of Public Schools, an ambitious effort to promote interest in mathematics and identify talented students across the country. The OBMEP reaches virtually every student from 6th grade to the end of high school, totaling around 18 million children in over 53,000 schools. This makes it, by far, the largest school competition in the world.

The competition itself is accompanied by scholarships and various training programs for teachers and students, especially the medal winners, sponsored by the national agencies CAPES and CNPq. While the OBMEP has shown to be a very helpful recruitment channel for math majors, it has also been particularly successful in channeling resources for the mathematics training of students in various careers, from engineering and technology to the life sciences and even the human sciences.

Group photo of the 2017 International Mathematical Olympiad, on the beach of Rio de Janeiro: 615 students from 112 countries attended the largest IMO to date.

A number of independent studies have demonstrated that mathematical Olympiads do have a significant impact in school performance. For instance, it has been observed that schools which participate actively in the OBMEP exhibit performance rates well above those with a less active stance. The difference correlates to an additional 1.5 year of education, which is truly impressive.

Starting from 2017, the national contests of OBM and OBMEP have been merged into a single Olympiad, open to all Brazilian schools – public or private – which enhanced even further its breadth and scale. The OBM committe remains responsible for the final stage, which includes the selection of the Brazilian representatives in international competitions. Another big challenge for the near future is to start extending the Olympiad to elementary school, that is, 1st to 5th grade.

Students of indigenous school Tuparã, at Nova Ubiratã, state of Mato Grosso, participating in the Brazilian Mathematical Olympiad.

Contestants of the 2017 International Mathematical Olympiad starting the first day of the competition in Rio de Janeiro.

MATH EDUCATION

The report on the 2012 PISA (Program for International Student Assessment) highlighted Brazil as "the country with the largest performance gains [in the mathematics test] since 2003". The report also emphasized that during that period "Brazil also expanded enrolment in primary and secondary schools". While the ratings declined somewhat in the latest test, the net gain from 356 points in 2003 to 377 points in 2015 remains very significant. However, Brazil still scores significantly below the OECD (Organization for Economic Cooperation and Development) average and it is clear that much remains to be done.

About 40% of Brazilian school students did not reach level 1 in mathematics, which means that they do not master the four operations with whole numbers. To be maintained, this would be very damaging for the nation's development prospects: on the one hand, the level of mathematical literacy of the society as a whole is clearly inadequate; in addition, there is a lack of professionals to occupy key positions in mathematics-based professions.

Additional official data about the performance of students just released by the Ministry of Education show that progress has stalled at the high school level, while there has been some meaningful improvement at the elementary school level. These facts have prompted the federal government to propose a reform of high school education that is currently being implemented.

There is a consensus that a key factor for the improvement of school education lies in the training of school teachers. Several educators, both in Brazil and elsewhere, have pointed out the existence of a body of mathematical knowledge that is specific to teaching as a profession, and that cannot be regarded as a simplified version of mathematical knowledge per se.

Thus there have been vigorous calls for the development of teachers' education models grounded on the knowledge needed for classroom practice. At the same time, the alienation between teachers' pre-service and in-service training, on the one hand, and the classroom practice, on the other hand, has been widely denounced.

In response to this scenario, various institutions and organizations, including the scientific societies SBM, SBEM and SBMAC, have been actively promoting initiatives whose goal is aim to improve the training of school teachers, both pre-service and in-service. A highlight is the nationwide professional master´s program PROFMAT.

WHILE BRAZIL STILL UNDERPERFORMS THE OECD AVERAGE, SOME SIGNIFICANT PROGRESS HAS BEEN OBTAINED IN THE PROGRAM FOR INTERNATIONAL STUDENT ASSESSMENT (PISA) EVALUATIONS IN MATHEMATICS SINCE 2003 (SOURCE: OECD).

The 500 gold medalists of the 2015 Brazilian Mathematical Olympiad, from all over the country, attending the award ceremony in Rio de Janeiro.

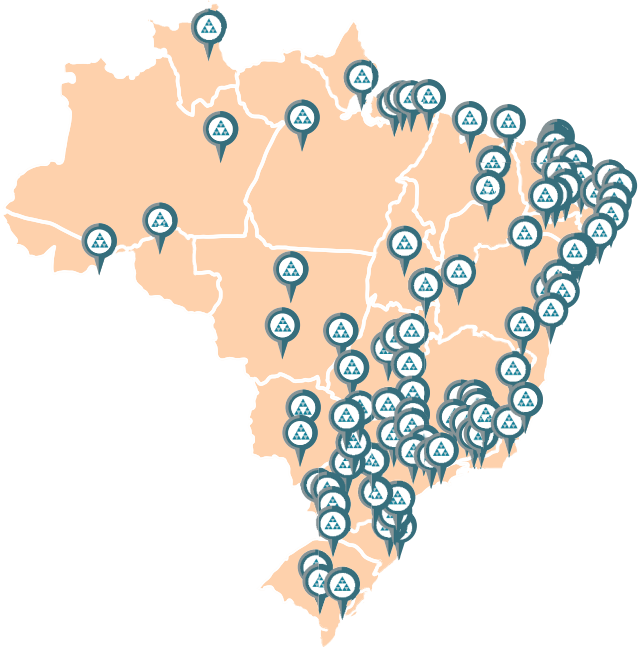
PROFMAT is offered by a network of 71 institutions of higher education (universities and institutes), in 100 campuses located in all 26 Brazilian states and the Federal District. The SBM is responsible for the overall supervision of the master's program, defining its guidelines, appointing its main officers, and monitoring its execution throughout the network. The associated institutions offer the courses as well as the supervision of research and dissertations, besides granting the final degree.

PROFMAT provides in-depth mathematical training for school teachers, from elementary to high school, and is funded by the high education federal agency CAPES. Initiated in 2011, it has already granted master's degrees to more than 3,200 school teachers who are now taking on a leadership role in changing the educational landscape in the country. Indeed, PROFMAT has become a model for similar programs in many other academic fields: Portuguese, physics, chemistry, history, geography, arts and many others.

In this way, this program is also helping bring university and school together for a dialogue that had been missing for decades, and is crucial for dealing with the challenges of education. This has materialized, in particular, in the creation of the National Association of Mathematics Teachers (ANPMat) which is led by PROFMAT alumni and aims to provide new opportunities for the training of mathematics teachers, in collaboration with the universities and the scientific societies.

Among these, special emphasis is given to the Simpósios da Formação do Professor de Matemática, a cycle of meetings organized biennially by the ANPMat and the SBM in all major regions of Brazil, devoted to the discussion of all subjects relevant to the mathematics teacher and which are held biennially on all major regions of Brazil.

Furthermore, Brazil has produced a sound body of research in mathematics education, focusing on issues that are particularly relevant to the country's educational context, and keeps a lively exchange with the international research community in the field. There are currently more than 50 graduate programs in mathematics education in the country.



PROFMAT, the professional master's program for school teachers operates on 100 campuses, in all 26 Brazilian states plus the Federal District (Brasília).

Regional and international cooperation

Brazilian mathematics was born open to international cooperation, by necessity as much as by design. While the first generation of professional mathematics researchers have been trained in and kept strong ties with the United States, equally strong connections with France were woven over the years, especially from the late 1970s and remain crucial to present date.

Through the 1980's and 90's several of the brightest young French mathematicians - Pierre Bérard, Étienne Ghys, Jean-Christophe Yoccoz, Christian Bonatti and many others - visited IMPA for 1-2 years under the "coopération" program of the French government, which replaced their military service.

Cooperation with other major countries has also been growing and is reflected in the joint meetings cycle organized by the SBM and SBMAC in collaboration with their counterparts in Spain and Italy, for example.

Needless to say, relations with the neighboring Latin-American countries have always been a top priority. In this context Brazil has played a substantial role over the decades. The *report Mathematics in Latin America and the Caribbean: challenges and opportunities*, published in 2014 by the IMU Commission for Developing Countries highlights its role

Jean-Christophe Yoccoz' first visit to Brazil took place in 1981, as a replacement to his military service in France. He became a long time visitor and a honorary researcher of IMPA.

Besides the spectacular progress of Mathematics in Brasil in the last years, the Brazilian mathematical community has been very important for the development of Mathematics in the whole of Latin America. For several decades, Brasil has attracted many students from the region by offering them very good working conditions. Most Latin American mathematicians have visited the country for collaboration at some stage of their career, so that the influence of Brazilian mathematics extends all over the region. Last but not least, the most important series of mathematical books and monographs published in the region are originally produced in Brazil. Many of them were translated from Portuguese into Spanish, and are the textbooks for courses of advanced mathematics in several Spanish-speaking countries.

Andrés Navas (president),
Chilean Mathematical Society

Some characteristics of this country make it necessary to distinguish it from the rest of Latin America. The degree of development of mathematical research in some institutes and universities in Brazil is remarkable, according to the number of publications, number of doctorates granted and other indicators. Brazil has played an important role as a training center of mathematicians from neighboring countries such as Peru, Venezuela and Paraguay.

Brazil has played an important role for the development of mathematics in Mexico and in the region. For instance, the research groups in dynamical systems that exist in various countries all have their origin in Brazil. From the viewpoint of the Latin American cooperation, Brazil has always played a key role. That cooperation started decades ago, mostly through the Latin American Schools of Mathematics, ELAM, which were started in Brazil. That cooperation paved the way for the creation of UMALCA and the organization of the first the Latin American Congress of Mathematics, which was held in 2000 in Rio de Janeiro.

José Seade (director),
Instituto de Matemáticas, Universidad Nacional Autonoma de México

The Brazilian mathematical community has been very active in promoting mathematics in Latin America in a number of ways. IMPA played an important role in disseminating the newest developments in the region, with generous support to colleagues from our countries. The importance of the initiative of Brazilian colleagues in establishing UMALCA and more recently the Mathematical Council of the Americas cannot be overestimated. The organization of the ICM 2018 in Rio de Janeiro is felt as a success of the whole region.

N. Andruskiewitsch (president),
Argentinean Mathematical Union.

as a center of training for young researchers from all over the region:
Indeed, Brazil´s general policy of granting graduate scholarships to students from all over the world, with no citizenship constraints and no strings attached, has attracted substantial numbers of the best Latin American young mathematicians to its graduate schools. For example, almost 50% of IMPA´s doctoral alumni originated from a Latin American Country other than Brazil.

Another significant role has been in the building-up of regional organizations and cooperation networks. In particular, the Mathematical Union for Latin America and the Caribbean (UMALCA) was formally constituted at IMPA´s headquarters in 1995, and several Brazilian mathematicians have served in its ruling bodies since.

Brazil also has a very significant part in the launching of the Mathematical Congress of the Americas (MCA), for instance by hosting at IMPA the 2011 meeting of organizations and institutions from all over the Americas where the organization of the Congress was formally approved, and by supporting in many ways the recently created Mathematical Council of the Americas (MCofA).

Étienne Ghys was among the very first young French mathematicians who replaced their military service with a one-year visit to Brazil. He also became a close colaborator of Brazilian mathematics and a honorary researcher of IMPA.

Brazil has had a great influence on mathematics in Latin America and, especially, in Uruguay. A considerable number of Uruguayan mathematicians obtained their Ph.D.s from Brazilian institutions, and even more have kept strong ties of collaboration with Brazilian colleagues over the last 30 years or so. Brazil has also played a key role in the creation of UMALCA, and remained a strong supporter of the Union up to present day.

Robert Markarian (rector),
Universidad de la República, Uruguay.

Members of the Brazilian mathematical community are very active in assisting with the aims of the Mathematical Council of the Americas: to highlight the excellence of mathematics in the Americas and to foster scientific integration between all mathematical communities in the Continent. Brazilian mathematicians played an essential role in establishing the MCofA in 2010 and have been fully committed to regional cooperation.
Activities sponsored by the MCofA include the quadrennial Mathematical Congress of the Americas where Brazil plays a very important role. MCA2017 takes place in July 2017 in Montreal, and Brazil is one of the leading supporting countries including Canada, the USA and Mexico. The international stature of the Brazilian mathematical community informs the bid of Brazil to join Group 5 of the IMU.

Susan Friedlander (chair),
Mathematical Council of the Americas

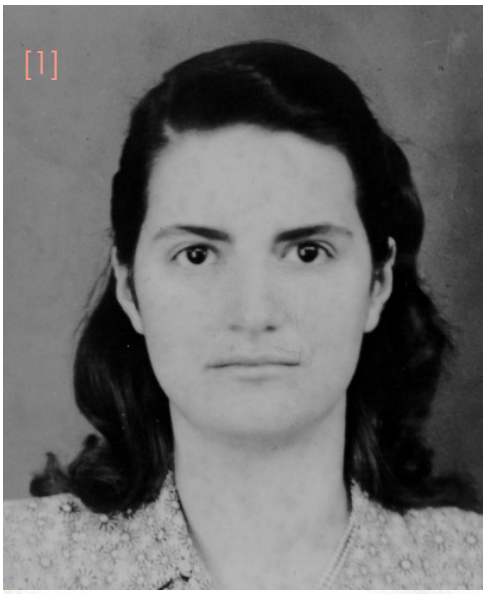
Women in Mathematics

The history of women in mathematics research in Brazil had its start around 70 years ago. The first woman to obtain a doctoral degree in mathematics was Marília Chaves Peixoto, in 1948, followed by two other pioneers in the field, Maria Laura Mouzinho Leite Lopes and Elza Furtado Gomide, who graduated in 1949.

Despite this late start, the country's current statistics about women in mathematics are quite reasonable when compared with those of many European or North American countries. Women constitute about 42% of the starting undergraduate students in mathematics and around 48% of those who finish the degree. When it comes to graduate studies, around 27% of the degrees are obtained by women. Also, around 40% of faculty members at federal and state universities are female.

The new millennium has brought a stark increment in the number of actions towards balancing gender in numbers and role. CNPq, one of the main federal research funding agencies, initiated in 2005 the program Women and Science, whose main goal is to promote the participation of women in sciences and stimulate the scientific production and debate around gender relations and issues. It features a biennial call for research projects that focus on gender equality, and an annual prize, Building gender equality, directed to students at various levels.

[1]



[2]

[3]

[1] Marília Chaves Peixoto
[2] Elza Furtado Gomide:
[3] Maria Laura Mouzinho Leite Lopes
first women to earn a Ph.D. in Mathematics in Brazil. The three went on on to play very significant roles in the Brazilian Mathematical community.


[1]


[2]


[3]


[4]

Groups of women mathematicians, both professors and students, established at several universities promote debates on the subject, aiming at identifying the issues faced by women in the field, as well as at helping find solutions, pointing out how to improve the presence of women at all levels of the career.

In addition to specific meetings, such as the Paulista meeting of women in mathematics, and round tables held around the country on various occasions, we have witnessed actions to bring out female mathematicians as role models, such as the exhibit Women: Brazilian mathematical expressions, featured in 2017 at universities, public open spaces and the Bienal de Matemática.

The years 2017 and 2018 will be special when it comes to women in mathematics in Brazil, with a countrywide cycle of debates and round tables, entitled Mathematics: a feminine noun, planned to take place at several federal and state universities. This was partly sparked by - and may be thought of as a build-up to - the coming World Meeting for Women in Mathematics (WM2), which is expected to have about 600 participants.

[1] Tatiana Roque, [2] Helena N. Lopes, [3] Claudia Sagastizábal and [4] Carolina Araujo: first Brazilian female invited speakers at an ICM.

The Olympic Girls IMPA Awards were created at the 2017 International Mathematical Olympiad to highlight and encourage the participation of female contestants, and will become a permanent feature of the contest. In their very first edition, the awards went for Garam Park (Botswana), Violeta Naydenova (Bulgaria), Qi Qi (Canada), Carolina Ortega (Colombia) and Dain Kim (South Korea).

MATH IS FUN

Math popularization and outreach – Biennium of Mathematics 2017-2018

While popularization had traditionally been been largely neglected in the Brazilian scientific scenario, and even more so for mathematics, the situation has improved in more recent years, as some of the funding agencies have started assigning value to outreach initiatives, causing funding for science museums and fairs to be available on a more regular basis.

The circumstance that Brazil is hosting two major events, the 2017 International Mathematical Olympiad and the 2018 International Congress of Mathematicians, offered a historical opportunity to bring math popularization to the forefront, and the mathematical community has been taking advantage of this.

At the proposal of IMPA, the Brazilian national parliament enacted a formal proclamation of the years 2017 and 2018 as the Biennium of Mathematics in Brazil, thus opening the way for a broad and ambitious series of activities aiming at disseminating and popularizing mathematics in the whole society, children and their families, students and their teachers.

The Math Festival, held for the first time in Rio de Janeiro in April 2017, fully embodied these goals. Offering a wide range of activities, from lectures and exhibits to workshops and games, designed for all audiences, the Festival attracted more than 18,000 visitors in four days, and was considered a huge success.

In July 2017, Rio de Janeiro welcomed the 112 delegations taking part in the 2017 International Mathematical Olympiad. The event also attracted quite a lot of attention from all major vehicles in the Brazilian press, including prime time television news.

Also at the initiative of IMPA, the Ministry of Science and Technology has agreed to devote the 2017 National Science and Technology Week to the theme "Math is everywhere". As the Week mobilizes the whole national system of higher education and research, this will surely be yet another highlight of the Biennium of Mathematics.

The first Brazilian Math Festival, held in April 2017, attracted 18,000 visitors, of all ages, curious to check the organizers claim that "Math is fun!" The lectures of Adrián Paenza, winner of the 2014 Leelavati Prize, were among the highlights.

On the beaches of Rio de Janeiro, the members of the South Korean delegation celebrate their six gold medals and collective first place in the IMO 2017

In addition to the many activities organized by IMPA and the SBM, the Biennium´s website records an intense program of initiatives by schools, universities, science museums and other institutions across the Brazilian territory, to disseminate mathematics in the society, with an emphasis on children.

Last but not least, the country is gearing up for the ICM 2018, the first ever International Congress of Mathematicians to be held in the Southern Hemisphere, as well as for the 2018 IMU General Assembly. Preparations are well under way: venues have already been booked, detailed plans are being set, including the scientific program, the Open Arms funding program for mathematicians from the developing world, the submission of communications proposals, and the recruitment of volunteers.

MATH in the Media

Substantial effort is devoted to enhancing the presence of mathematics in the Brazilian media, from major newspapers and television chains to the social networks.

The annual award ceremony for the Brazilian Mathematical Olympiad is covered by by most communication organizations, including prime time TV news shows. TV Globo alone aired life stories of medal winners on 5 different shows.

November, 2016.

Interview with IMU president Shigefumi Mori for Veja, Brazil's main news magazine.

July 8, 2017.

Interview with Étienne Ghys for Época, Brazil´s second best-selling weekly magazine.

July 19, 2017.

Over 35 national media outlets reported on the the International Mathematical Olympiad. Five TV networks, including two Globo news shows, also broadcast stories about it.

July 17-23, 2017

UOL educação

Brasileiras rompem machismo na matemática e disputam Olimpíada europeia

Bruna Souza Cruz
Do UOL, em São Paulo 01/02/2017 | 04h00 > Atualizada 02/02/2017 | 09h07

Divulgação

Jamile, Júlia, Ana Karoline (vice-líder da equipe) e Mariana (da esq. para dir.)

In 2017 Brazil sent for the first time an all-girl team to the European Girls Mathematical Olympiad in Zurich, Switzerland. The story was on television, newspapers and websites across the country.

April, 2017.

Jornal Nacional

A series of four 6+ minutes episodes about mathematics broadcast by Globo TV with Marcelo Viana as the main character. Jornal Nacional is a multiple Emmy-winning program and the leading national TV news evening show, with an audience of around 20 million viewers.

November, 2017.

FOLHA DE S.PAULO

UM JORNAL A SERVIÇO DO BRASIL

SEXTA-FEIRA, 1º DE SETEMBRO DE 2017 12:29

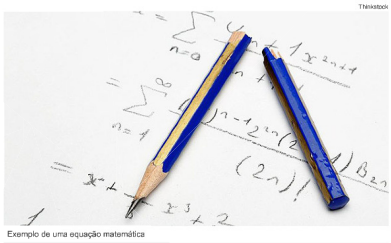
colunistas

marcelo viana

Matemático e diretor-geral do Impa, é ganhador do Prêmio Louis D., do Institut de France. Aqui, mostra como a matemática pode transformar vidas e ser divertida. Escreve às sextas-feiras.

Frações são as vilãs da matemática?

Thinkstock



Exemplo de uma equação matemática

02/06/2017 11h07

Compartilhar 88 OUVIR O TEXTO Mais opções

Em 1858, o jovem antiquário escocês Alexander Henri Rhind comprou no Egito um papiro -documento escrito num tipo de papel feito com o caule de uma planta aquática - que fora encontrado nas ruínas de Tebas, a antiga capital dos faraós. Rhind esperava que o clima do país ajudasse a curar a sua tuberculose, mas não deu certo: morreu cinco anos depois, e o papiro foi vendido ao British Museum, de Londres.

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@impaoficial

EM COLUNISTAS

+ LIDAS	+ COMENTADAS	+ ENVIADAS	ÚLTIMAS
1	Mônica Bergamo: JBS entrega extratos de contas atribuídas a Lula e Dilma		
2	Mônica Bergamo: Joesley Batista decide entregar novos áudios de seu gravador a PGR		
3	Tati Bernardi: Dr. Machismo		
4	Patrícia Campos Mello: Como uma trapalhada poderia levar à Terceira Guerra Mundial		
5	Bernardo Mello Franco: Marina sai da toca		

Marcelo Viana writes a weekly column in Folha de S.Paulo, the best-selling newspaper in Brazil. The Folha de São Paulo website monthly audience reaches 30 million people.

Since March 3, 2017.

The Math Festival was announced in various media, from radio channels and news magazines to outdoor adds all over Rio de Janeiro.

April, 2017.

Outside back cover caption: Riocentro complex in Barra da Tijuca, Rio de Janeiro, the venue of ICM 2018.