The Mathematics Consortium

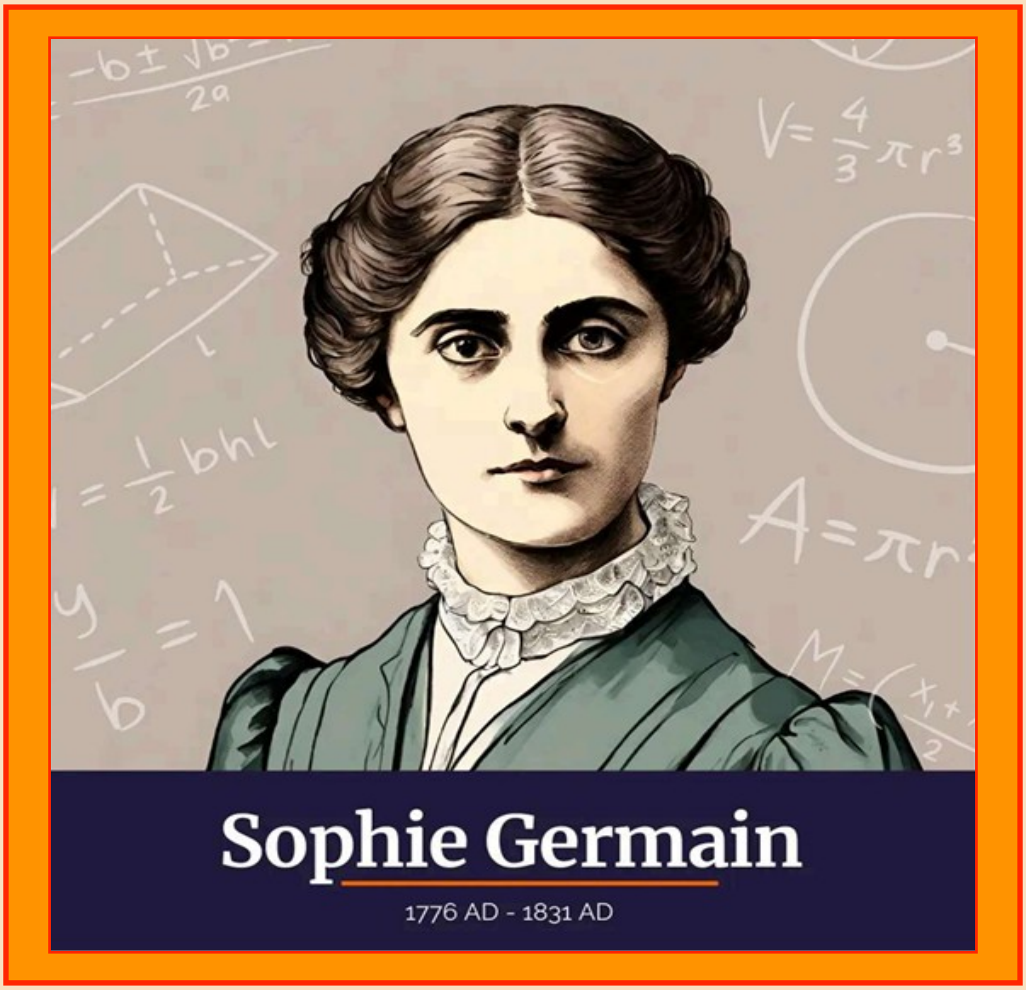
BULLETIN

July 2026 A TMC Publication Vol. 8, Issue 1

We Pay our Tributes to a Remarkable Woman Mathematician

Sophie Germain

On the occasion of her 250 th Birth Anniversary



Chief Editor: Shrikrishna G. Dani Managing Editor: Vijay D. Pathak

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Contents

About the Cover Page: *Image on the front cover is of Sophie Germain, a revolutionary mathematician and philosopher. Born in 1776, she lived in an era when women did not have the right to a formal education, especially in the sciences. Undeterred by these social and political difficulties, Sophie Germain made lasting contributions to mathematical physics and number theory. Her passion, courage, brilliance and perseverance are a source of inspiration even today.*

Typeset and designed by: Praanjala Typesettings, Contact: +91 99603 03874, Email: mr.texdoc@gmail.com.

From the Editors' Desk

A notable impact of AI tools on Mathematical research was realized in December 2021, when these tools helped mathematicians to form and prove new conjectures in knot theory and representation theory. In October 2022, DeepMind's AlphaTensor, could find faster matrix multiplication algorithms than humans had found in 50 years. In January 2024, Alpha Geometry demonstrated that AI could handle complex, multi-step deductive reasoning and later in July 2024 DeepMind developed AlphaProof, which trained AI to translate informal math problems into the strict language of the Lean theorem prover.

Now we are in a phase, where general-purpose deep reasoning models are solving long-standing open problems in mathematics, in May 2026, successfully disproved Paul Erdős's Planar Unit Distance Conjecture. Days later DeepMind's AlphaProof Nexus autonomously settled 9 open Erdős problems and dozens of other conjectures. These developments will certainly transform the ways and means of mathematical research.

In September 2025 the Lorentz Centre at Leiden University in the Netherlands hosted a conference entitled Mechanization and Mathematical Research. From among the 60 participants from 10 countries, a small group of 16 experts discussed the issue at length for about 8 months after the conference and developed a declaration, called as a Leiden declaration. In this declaration they discussed the potential threats of recent developments in AI and gave actionable recommendations (based on values of research that mathematicians in general have a joint interest in preserving) for individual mathematicians, mathematical organizations, policymakers in government and elsewhere and for commercial artificial intelligence. In any case, mathematicians have a choice about whether and how to adopt AI in the conduct of their research. They also have a responsibility to ensure the continued flourishing of the discipline.

During the Indo-European Conference in Mathematics, organized jointly by TMC, SPPU and IISER in Pune during January 12-16, 2026, Prof. Ambat Vijayakumar interviewed Michel Waldschmidt, an internationally acclaimed number theorist. An interesting conversation between them is included in the opening Article 1.

This year being 250^{th} Birth Anniversary of revolutionary French mathematician Sophie Germain, we pay our tributes to the remarkable woman mathematician by republishing the review of the book "Sophie Germain: Revolutionary Mathematician" by Dora Musielak, by Dr. Siddhi Pathak originally published in the January, 2024 issue of BHĀVANĀ, as Article 2.

In Article 3, Prof. Mohan Kumar briefly describes seminal contributions of a very influential mathematician Professor Pavaman Murthy who passed away on March 21, 2026 in Chicago.

In Article 4, Prof. S. G. Dani gives brief review on two papers, one on Egyptian pyramid volume 'formulas' of 1850 BCE, and another on the history of the four-colour problem.

In Article 5, Dr. D. V. Shah gives an account of some autonomous and AI-guided mathematical research as mentioned above and also evaluation of solution accuracy on AI-Generated Responses. Other significant developments in the world of mathematics and information on the winners of various prizes like Abel prize, the 2026 Breakthrough prizes, Shaw prize is also included in the Article. Tributes are also paid to the mathematicians, including one of TMCB editors Prof. Ravi Rao, who passed away recently. We appreciate the contribution of Prof. Rao to TMCB right from its inception.

In Article 6, the Problem Corner, Dr. Udayan Prajapati presents a solution to one of the problems posed in the October 2025 issue, and poses two problems from Number theory and Analysis, for our readers. Dr. Ramesh Kasilingam gives a calendar of academic events, planned during August, 2026 to December, 2026, in Article 7.

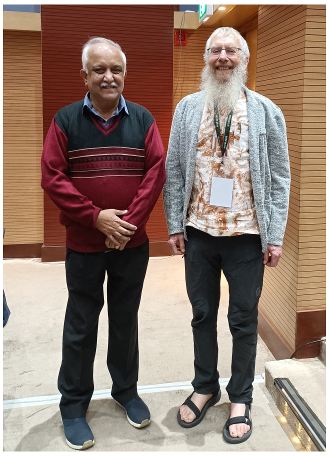
We are happy to bring out this first issue of Volume 8 in July, 2026. We thank all the authors, all the editors, Prof. Vinayak Joshi for providing photos of IECM-2026, and our designers Mrs. Prajakta Holkar and Dr. R. D. Holkar, and all those who have directly or indirectly helped us in bringing out this issue on time.

Chief Editor, TMC Bulletin

1. In Conversation with Professor Michel Waldschmidt

Ambat Vijayakumar
Emeritus Professor, Department of Mathematics,
Cochin University of Science and Technology, Cochin - 682 022, India
Email: vambat@gmail.com

I had an opportunity, yet again, to meet Michel Waldschmidt, currently an Emeritus Professor at Sorbonne University, Paris, in the 'Indo-European Conference in Mathematics' jointly organized by The (Indian) Mathematics Consortium and the European Mathematical Society, held at SPPU and IISER Pune campuses during January 12-16, 2026. Our very long association of (at least twenty years) could make this interview easier and less formal. We had long chats over the days of the conference, whenever this 'polymath' was less busy.



Author with Michel Waldschmidt

Michel was born on June 17, 1946 at Nancy, France and he was closing on eighty years at the time of this meeting. So, our conversations started with a 'Happy Eighty' wishes in advance. He had visited India more than fifty times, Cochin, at least thrice. During his visits to Cochin, he was my celebrity guest at Cochin University of Science and Technology.

Michel Waldschmidt is an internationally acclaimed number theorist specializing in transcendental number theory. Waldschmidt was educated at Lycée Henri Poincaré and the University of Nancy until 1968. In 1972 he defended his thesis, titled 'Algebraic independence of transcendental numbers', guided by Jean Fresnel of the University of Bordeaux, France.

He was a research associate of the French National Centre for Scientific Research (CNRS) at the University of Bordeaux during 1971-1972. He was then a lecturer at Paris-Sud 11 University in 1972-1973. The same year he became a lecturer at the University of Paris VI (Pierre et Marie Curie) and in 1973, became a professor there. He is a member of the Institut de mathématiques de Jussieu. He was also a visiting professor at several places including the École normale supérieure, an elite public higher education institution in France.

From 2001 to 2004, he was the President of the Mathematical Society of France. He is a member of several mathematical societies, including the European Mathematical Society, the American Mathematical Society and the Ramanujan Mathematical Society.

He has published more than 200 research papers and has advised twenty-one PhD students. From 2019-2022, he was a member of the Commission of Developing Countries of the International Mathematical Union. Also, he is Doctor Honoris Causa from Ottawa University, Canada.

Waldschmidt was awarded the Albert Châtelet Prize in 1974, the CNRS Silver Medal in 1978, the Marquet Prize of Academy of Sciences in 1980 and the Special Award of the Hardy-Ramanujan Society in 1986. In 2021, he was awarded the Bertrand Russell Prize (established in 2016, awarded every three years) by the American Mathematical Society.

The Citation of this prize reads as follows.

'The 2021 Bertrand Russell Prize is awarded to Michel Waldschmidt in recognition of his outstanding contribution to graduate schools and mathematical research in developing countries in all continents and of his sustained commitment to building bridges between mathematical communities around the world. Throughout his career, Waldschmidt has worked tirelessly to the development of graduate schools in tens of countries, both through lecturing and on advisory committees. Waldschmidt is a world expert in transcendental number theory and Diophantine approximation'.

It is quite exciting to read his response as well.

"To succeed Christiane Rousseau, who received the inaugural 2018 Bertrand Russell Prize of the AMS, is an honor and a privilege for me. Among the various ways which are recognized with this prize are our understanding of climate change, which was the topic of the first prize related with Mathematics of Planet Earth, and education in developing countries, which is the topic of the second one. I am very grateful to the AMS for attracting attention to this issue. As a member of the CIMPA, of the EMS CDC (Committee for Developing Countries of the European Mathematical Society), and of the IMU CDC (Commission for Developing Countries of the International Mathematical Union), I meet many colleagues who are committed to the improvement of mathematics in the least developed regions of the world. This prize is an encouragement for all of us to pursue. There were mathematicians in ancient civilizations in many places. There are talents all over the world. It is unfair that, because of the location of their birth, so many bright young people are not able to develop their skills. Even if programs like the IMU Program for Graduate Research Assistantships in Developing Countries (GRAID) may be a drop of water to put out the fire, like in the Legend of the Hummingbird, let us do our bit".

Having known so much about Michel, let us now get his specific answers to some of my questions.

AV 1: Can you please brief us about your parents, upbringing, school education and college days?

MW: I was born in Nancy, East of France, where I studied until I was 22 years old. I have been fortunate to have good teachers, at the high school (Lycée Henri Poincaré, where I studied during 9 years) and at the University. My mother Henriette (1920-2022) was from a peasant family, she was only 7 years old when her mother passed away, she grew up in an orphanage. My father Pierre (1913-1966) lost his father in 1914 at the beginning of world war I, later he became an engineer.

AV 2: What attracted you to Number Theory?

MW: During the academic year 1967-68, Shokichi Iyanaga (1906-2006), a renowned Japanese Number Theorist who had served in the University of Tokyo, Nagoya University etc., was invited at the University of Nancy by Jean Delsarte (1903-1968) for one full year. He was supposed to teach a course in Algebra. I liked it so much that I decided to work in this direction. Then I found that his course was based on Samuel's book Théorie algébrique des nombres (translated later from French to English as 'Algebraic theory of numbers').

Prof. Leopoldt

I had a permanent position at the University of Bordeaux in 1968, I started doing research under Jean Fresnel (1939-2025) one year later. He suggested me to investigate **Leopoldt's Conjecture (Box 1)**, named after the German mathematician Heinrich-Wolfgang Leopoldt (1927 - 2011), on the non vanishing of the p-adic regulator of a number field. After a few weeks during which he taught me how to do research, he suggested me to study the solution by Baker and Brumer of the abelian case of Leopoldt's Conjecture. This is how I started to work on transcendental number theory.

Box 1: Leopoldt's Conjecture

This conjecture, states that the p-adic regulator of a number field K does not vanish. The p-adic regulator is an analogue of the usual regulator defined using p-adic logarithms instead of the usual logarithms, introduced by H. W. Leopoldt (1962).

Leopoldt's conjecture is known in the special case where K is an abelian extension of $\mathbb{Q}$ or an abelian extension of an imaginary quadratic number field. Ax, James (1965) reduced the abelian case to a p-adic version of Baker's theorem, which was proved shortly afterwards by Brumer (1967). Mihăilescu (2009, 2011) has announced a proof of Leopoldt's conjecture for all CM-extensions of $\mathbb{Q}$. The proof uses Iwasawa's methods – especially Takagi Theory – for deriving his skew symmetric pairing, together with Kummer- and Class Field Theory.

AV 3: Did Srinivasa Ramanujan's works influence you?

MW: My first attempt to prove a new result (a very special case of Leopoldt's Conjecture) was for the first problem in Schneider's book on Transcendental Numbers (translated from German to

French by my earlier professor in Nancy, Pierre Eymard (1929-2010)). This problem is also called the **Four Exponentials Conjecture (Box 2)**, it was investigated by Alaoglu and Erdős (Trans. AMS 1944) in connection with Ramanujan's paper on Highly Composite and Similar Numbers. They asked this question to Siegel, who answered that he was not able to prove the full result but only a weaker statement, the Six Exponentials Theorem (Box 2) which was also proved by Serge Lang (1927-2005). Atle Selberg (1917-2007) told me that he tried to prove the Four Exponentials Conjecture but succeeded only to obtain the **Six Exponentials Theorem**. Atle Selberg (1917 - 2007) was a Norwegian mathematician known for his work in analytic number theory and the theory of automorphic forms, and in particular for bringing them into relation with spectral theory. He was awarded the Fields Medal in 1950 and an honorary Abel Prize in 2002, its founding year, before the awarding of the regular prizes began. He generally worked alone. **His only coauthor was Sarvadaman Chowla**.

In 1969, I thought that I had proved the Four Exponentials Conjecture, shortly after that I found a mistake. Fortunately, later, I had a new idea which enabled me to solve the eighth of Schneider's problems. As a matter of fact, this eighth problem was solved at the same time independently by Dale Brownawell. Both of us were surprised when we found that our solutions were published at about the same time in the Journal of Number Theory.

There are several other instances of my journey through number theory where Ramanujan's work occurred, for instance in connection with Yuri Nesterenko's proof of the algebraic independence of π, e^{π} and $\Gamma(1/4)$, where Ramanujan's modular functions P, Q, R play a key role.

Box 2: Four Exponentials Conjecture

In transcendental number theory, the four exponentials conjecture is a conjecture which, given the right conditions on the exponents, would guarantee the transcendence of at least one of four exponentials. The conjecture, along with two related, stronger conjectures, is at the top of a hierarchy of conjectures and theorems concerning the arithmetic nature of a certain number of values of the exponential function. The conjecture was considered in the early 1940s by Atle Selberg who never formally stated the conjecture. A special case of the conjecture is mentioned in a 1944 paper of Leonidas Alaoglu and Paul Erdős who suggest that it had been considered by Carl Ludwig Siegel. An equivalent statement was first mentioned in print by Theodor Schneider who set it as the first of eight important, open problems in transcendental number theory in 1957.

The related six exponentials theorem was first explicitly mentioned in the 1960s by Serge Lang and **Kanakanahalli Ramachandra**, and both also explicitly conjecture the above result. Indeed, after proving the six exponentials theorem Lang mentions the difficulty in dropping the number of exponents from six to four - the proof used for six exponentials "just misses" when one tries to apply it to four.

Six exponentials theorem is a result that, given the right conditions on the exponents, guarantees the transcendence of at least one of a set of six exponentials.

AV 4: How was your nomination as the President of the French Mathematical Society?

MW: When I was approached to become President of the Société Mathématique de France I was a bit reluctant; I do not regret that I accepted. During these four years from 2000 to 2004 I started to have many contacts, both in France and internationally. This is the time where I started to be involved with the CIMPA of which I served as a Vice President (from 2005 to 2009) while Michel Jambu was the Director. My connection with CIMPA goes back as early as 1983 (CIMPA was then only 5 years old) when I participated to a CIMPA School in Nice with John Coates (1945-2022). I still continue to be very active with CIMPA.

AV 5: Who all do you acknowledge your award to the Bertrand Russell prize by the American Mathematical Society?

MW: This prize that I received in 2021 is an acknowledgement of the activities of a large number of colleagues, either in CIMPA, in the CDC of EMS or IMU, in ICTP, or individually, who are devoted to the promotion of mathematics in countries which need it the most.

AV 6: Which do you consider to be your best paper?

MW:'Transcendance et exponentielles en plusieurs variables' Inventiones Mathematicae 63 (1981) N°1, 97-127. This is the paper where I answered a question of André Weil on Hecke characters of type A_0 and where I prove "half" of Leopoldt's Conjecture.

AV 7: How do you rate the Indian research in general, Number Theory in particular?

Prof. K. Ramachandra

MW: I first visited India in 1976, when I was invited by the late Professor K. Ramachandra (1933-2011) at the Tata Institute of Fundamental Research, Bombay. At that time TIFR was essentially the main centre for research in mathematics in India. Now, there are plenty of excellent research centers everywhere in the country. In particular, Number Theory is well developed; several mathematicians from abroad contributed to this development.

AV 8: There are plenty of simple looking conjectures in Number Theory. Goldbach's Conjecture (Box 3), Collatz Conjecture etc. What according to you, are major hurdles in solving such problems?

MW: I started to do research in 1969, I have witnessed amazing progress in mathematics. Among the main achievements, many have involved tools from parts of mathematics which were looking far from the precise open problem. I expect it will be the same for the solutions of the conjectures you mention. The most important point is that new ideas are needed.

Box 3: Goldbach's Conjecture

Goldbach's conjecture is one of the oldest and best-known unsolved problems in number theory and all of mathematics. It states that every even natural number greater than 2 is the sum of two prime numbers.

The conjecture has been shown to hold for all natural numbers less than 4×10^{18}, but remains unproven despite considerable effort.

The **Goldbach partition** function associates to each even integer the number of ways it can be decomposed into a sum of two primes. Its graph looks like a comet and is therefore called **Goldbach's comet**.

Goldbach's comet is the name given to a plot of the function $g(E)$, the so-called **Goldbach function** (sequence A002372 in the OEIS, see Box 4). The function, studied in relation to Goldbach's conjecture, is defined for all even integers $E > 2$ to be the number of different ways in which E can be expressed as the sum of two primes. For example, $g(22) = 3$ since 22 can be expressed as the sum of two primes in three different ways as $22 = 11{+}11$, $5{+}17$, $3{+}19$.

AV 9: Can you please share your experiences of meeting / interacting with Paul Erdős (1913-1996) and other legendary mathematicians?

MW: I met Paul Erdős several times, I invited him to have a lunch at my home - I missed the opportunity to have a joint paper with him. My Erdős number is only 2.(At this point I intervened and told him that my Erdős number is also 2, through Professor S. B. Rao, former Director of the

Indian Statistical Institute).

Often people ask me whether I had met Alexander Grothendieck; the answer is yes, but there are plenty of other famous mathematicians that I met. I wish to mention Shokichi Iyanaga, Paul Turan, Carl Ludwig Siegel, André Weil, Atle Selberg, Theodor Schneider, Kurt Mahler, Laurent Schwartz, K. Ramachandra, Alan Baker, John Coates, Pierre Cartier and many others, including some who are still alive: Enrico Bombieri, Jean-Pierre Serre, Wolfgang Schmidt.

AV 10: How was your feeling when you heard that Fermat's Last Theorem was finally settled by Andrew Wiles and Richard Taylor?

MW: There was important progress already in this direction, but the achievement by Wiles is really great.

AV 11: What according to you are major challenging problems in Number Theory and the whole of Mathematics?

MW: You have the list of Clay prizes, there are many more. For me **Schanuel's conjecture** is one of the most important challenges. You may know that, Schanuel's conjecture is about the transcendence degree of certain field extensions of the rational numbers, which would establish the transcendence of a large class of numbers, for which this is currently unknown. It is due to Stephen Schanuel and was published by Serge Lang in 1966. Schanuel received his Ph.D. in mathematics from Columbia University in 1963, under the supervision of Serge Lang. Later, he served also as a Professor Emeritus of Mathematics at University at Buffalo.

AV 12: Present generation in India are not keen on choosing Mathematics as a major topic of study. They get attracted with AI techniques. Any advice to such students?

MW: Unfortunately this is not only in India. But fortunately some members of the present generation are enthusiastic about mathematics. **I am not sure that the people who are spending their life trying to get as much money as possible have a more happy life than those who devote their time to do research in mathematics**.

AV 13: What are your thoughts on the recent AI boom? Quantum Computing?

MW: Mathematicians like Euler, Gauss and others, were also able to perform amazing computations, this was very important for their research. With the occurrence of computers, this skill is no more important for mathematicians nowadays. It seems to me that AI will have a similar effect on the way that mathematicians will do research, the skills which are essential now will not be the same as the ones which will be necessary later. We are not yet at that stage: **the answers to mathematical questions given by AI need to be checked very carefully, they often contain mistakes**.

As far as quantum computing is concerned, apparently even when quantum computers will exist, mathematics will be necessary for cryptography.

AV 14: What are your thoughts on Great Internet Mersenne Prime Search (GIMPS) project? I mean the techniques used in finding larger primes. I mean is it mathematically significant?

MW: It is an interesting project, I doubt that it will lead to significant progress. In a different vein, I often use and quote the **Online Encyclopedia of Integer Sequences (OEIS) (Box 4)** of Neil Sloane. This is a very useful tool, it helps also for making conjectures.

Box 4: On-Line Encyclopedia of Integer Sequences

The On-Line Encyclopedia of Integer Sequences (OEIS) is an online database of integer sequences. It was created in 1964, first as a handbook till 2009, by Neil Sloane, a British American Mathematician, then researching at AT & T Labs.

OEIS records information on integer sequences of interest to both professional and amateur mathematicians, and is widely cited. As of November 2025, it contains over 390,000 sequences. Every sequence in the OEIS has a serial number, a six-digit positive integer, prefixed by A. As examples A000040 -the prime numbers, A000045- the Fibonacci sequence, A000108 - the Catalan numbers etc.

A000602 is interesting to chemistry researchers also. This represents both the number of trees and alkanes. The entries, A003678, A018226, A174284 are useful to Physicists also. OEIS is a multifaceted facility. Integer sequences of interest to Economics, Biology, Linguistics etc. are also in OEIS.

Besides integer sequences, the OEIS also catalogs sequences of fractions, the digits of transcendental numbers, complex numbers and so on by transforming them into integer sequences. Sequences of fractions are represented by two sequences (named with the keyword 'frac'): the sequence of numerators and the sequence of denominators.

AV 15: Which are the institutions abroad that you recommend to a math aspirant from India to choose a math career?

MW: First of all, India is now a strong country for mathematics, there are many excellent mathematicians, going abroad may not be the best choice. On the opposite, **I suggest new Ph.D. holders from outside the global south (as one says nowadays) to look at Indian institutions for postdoc positions.**

AV 16: Any other question that you would have loved to answer had I asked you?

MW: Above, I implicitly answered this last question by replying to questions slightly different from the ones you were asking.

Both of us laughed together at the last question and the unexpected answer.

□□□

IECM-2026 (TMC Meeting)

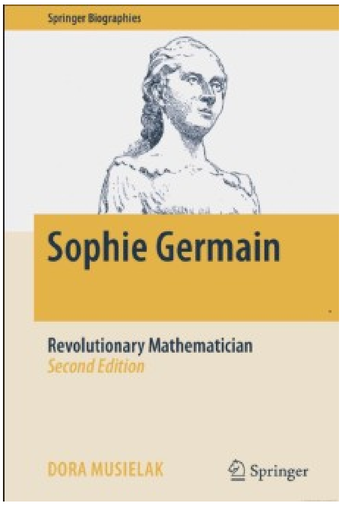
Profs. Michel Waldschmidt and Ambat Vijayakumar (President, ADMA) being felicitated by Prof. J. K. Verma. Others: Profs. Sudhir Ghorpade, Vinod P. Saxena, S. A. Katre

2. Sophie Germain: Revolutionary Mathematician

An archival account of an extraordinary individual[1]

Siddhi Pathak
Chennai Mathematical Institute, Kelambakkam, 603103.
Email: siddhi@cmi.ac.in

Preamble: This year marks the 250th birth anniversary of a remarkable woman mathematician, Sophie Germain. Born on April 1, 1776, in an ethos in which women were not only discouraged from education and academia, in terms of social practices and prejudice, but were barred from institutions of higher learning, Germain persevered to educate herself, all the way to advanced mathematics, and succeeded in meaningfully interacting with and being admired by several great mathematicians of the period, including Lagrange, Legendre, and Gauss, and contributing profoundly original mathematical ideas that would shape the trends in mathematical research over a long period, arguably extending to the present. Despite the fact that she had no recourse to professional stability or community backing to sustain a research career, and a life that was cut short at an early age of 55, she holds a rightful claim to the hall of fame of mathematics. Much of the intervening period has also not quite been conducive to due appreciation of her work, and it is only in the recent years that there is greater realization that her ideas may have contributed much more than what has been recognized so far. As an endeavour to create awareness about her we bring to our readers this review of one of her recent biographies.
– Chief Editor, TMCB



Mathematics is often perceived as an objective, impersonal subject. A famous quote attributed to the philosopher and mathematician Bertrand Russell, reads "Mathematics, rightly viewed, possesses not only truth, but supreme beauty - a beauty cold and austere, like that of sculpture, [...]". What allure does this seemingly lifeless discipline hold for the many who have spent entire lifetimes in pursuit of its truths? One insight into this mystery is offered through the words of a famous analyst, E. C. Titchmarsh. He says, "It can be of no practical use to know that π is irrational, but if we can know, it surely would be intolerable not to know." In a similar spirit is this line by Virgil, from 29 BCE:[2] "Felix qui potuit rerum cognoscere causas"- Fortunate is one who is able to know the causes of things. This is the epigraph that Sophie Germain had attached to her prize-winning memoir submitted to the Institut de France in 1815.

Sophie Germain was a mathematician, philosopher, and also, a woman. Born in 1776, she lived in an era when women did not have the right to a formal education, especially in the sciences. Undeterred by these social and political difficulties, Sophie Germain made lasting contributions to mathematical physics and number theory. Her passion, courage, brilliance and perseverance are a source of inspiration even today. It is the life and work of this remarkable savant that is the subject of this book by Dora Musielak.

Sophie Germain: Revolutionary Mathematician is not merely a biography (neither is it a hagiography!), but a well-documented account of Sophie Germain's life, the historical, social and intellectual environments of the age, along with an exposition of her mathematics along the way. The author has gone to great lengths to collect relevant papers, letters, photographs, and newspaper clippings, to the extent that reading the book creates an impression of strolling inside a Sophie Germain museum. This article attempts to give a glimpse of these (arti)facts.

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[1]The article was originally published in BHĀVANĀ, Volume 8, Issue 1, January 2024. We thank Bhavana Trust for permitting us to republish the article in this Issue of TMCB. -Managing Editor.

[2]Commonly referred to as Virgil, Publius Vergilius Maro (70 - 19 BCE), was an ancient Roman poet best known for the epic poem *The Aeneid*.

Before delving into various facets of the book, let us familiarize ourselves with highlights from Sophie Germain's life, as documented by the author. Sophie's father was a silk merchant, classified among the liberal section of the society. In 1789, at the start of the French Revolution[3], he was elected as a representative of the common people in the French court at Versailles, and later, was a member of the newly formed National Constituent Assembly. In constant contact with intellectuals, Monsieur Germain was perhaps a revolutionary himself! Sophie's childhood progressed against the backdrop of violence, upheaval and change. It is not known if she attended a school or had a tutor. Nevertheless, neither would have given her a medium to learn mathematics as it was considered 'improper' for a woman.

"Reading the book creates an impression of strolling inside a Sophie Germain museum."


Death of Archimedes by Luca Giordano. Wikimedia Commons

It is believed that her father's library was a sanctuary for Sophie during this time, a refuge from the turmoil outside. Her interest in mathematics is said to have been aroused by the story of Archimedes, who was so immersed in mathematics that he was heedless of the war raging around him and met his death at the hands of a Roman soldier in 212 BCE. It is apparent that this anecdote left a deep impression on Sophie's mind. For, later in her life, when Napoleon's armies were sent to occupy Prussia, she made a special appeal to the general of the Napoleonic forces to grant protection to the outstanding German mathematician and her correspondent, Carl Friedrich Gauss. Absorbed in his quest for mathematical truths, she was afraid that he may meet the same fate as Archimedes!


Guglielmo Libri Carucci dalla Sommaja
Wikimedia Commons

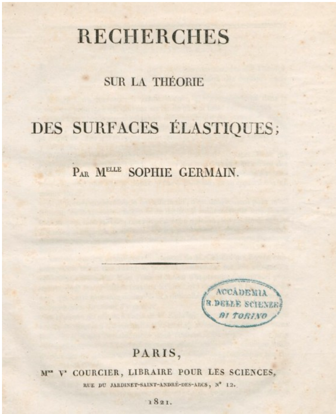
The foundation of *École Polytechnique* in 1794 brought about an unexpected opportunity for Sophie. Although women were not admitted as students or allowed to attend lectures and meetings, the scripts of the lectures were available in print in the *Journal de l'École Polytechnique*. At the end of each course, the professors would ask students to submit their observations. An Italian mathematician and one of Sophie's friends, Guglielmo Libri mentioned in Germain's obituary that on obtaining the notes for Joseph-Louis Lagrange's course in analysis, Sophie wrote to Lagrange about her thoughts on the material, signing off as Monsieur Le Blanc[4]. It is further noted that Lagrange praised her ideas and expressed his astonishment in flattering terms on learning her true name! There is no historical evidence to support this exchange. Nonetheless, Sophie's identity became known in Parisian intellectual circles, with many offering books and other material to aid her self-study.

Perhaps one of the most popular anecdotes about Sophie Germain is her correspondence with the leading mathematician and astronomer of the time, C. F. Gauss. In 1801, Gauss published the *Disquisitiones Arithmeticae*, a creative and rigorous treatise on arithmetic, especially elementary number theory. Gauss' observations have had a lasting impact on problems concerning the algebraic theory of numbers, which engage mathematicians to this date! In Sophie's first letter

[3]As a period of political and societal change in France, the French Revolution was a series of developments that unfolded between 1789 and 1799.

[4]Andrea Del Centina, Letters of Sophie Germain preserved in Florence, Historia Mathematica 32 (2005) 60-75.

to Gauss, written with the assumed name M. Le Blanc and dated November 1804, she conveyed her admiration for his work and included two proofs for a generalization of a result stated in the last chapter of *Disquisitiones*. This demonstrates her mastery over not only the number-theoretic ideas involved, but also Latin, as Gauss' text was written in Latin and no French translation was available until 1798. It is plausible that she studied Adrien-Marie Legendre's *Essai sur la théorie des nombres*, published in 1798, which contained important results by Leonhard Euler, Lagrange as well as some discoveries of Legendre himself. Notably, the law of quadratic reciprocity, which was a result very close to Gauss' heart, was recorded by Legendre in his *Recherches d'analyse indéterminée in 1785*.



RECHERCHES

SUR LA THÉORIE

DES SURFACES ÉLASTIQUES;

Par Mlle SOPHIE GERMAIN.

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Mme Ve COURCIER, LIBRAIRE POUR LES SCIENCES,

RUE DU JARDINET-SAINT-ANDRÉ-DES-ARCS, N° 12.

1821.

In June 1805, Gauss responded to M. Le Blanc that he was very pleased with the observations and in particular, with his demonstration of 2 being a quadratic residue for primes of the form $8k \pm 1$ and non-residue for primes of the form $8k \pm 3$, although the approach seems to be an isolated instance and not applicable in general. Emboldened by Gauss' reply, Sophie (posing as M. Le Blanc) continued to write to Gauss. In 1806, Napoleon's armies invaded Prussia, bringing us to the incident described earlier. Commissioned by Sophie, an officer from the French army showed up at Gauss' doorstep to ensure protection for him and his family. Baffled by the officer's words, Gauss responded that he was not familiar with any French lady named Sophie Germain! It was when this confusion was brought to Sophie's attention, that she wrote to Gauss divulging her true identity, clarifying that she was not entirely unknown to him and explained that she had borrowed the name of Le Blanc, fearing ridicule attached to the title of a scholarly woman.

Gauss' response to her includes the lines which have now been primarily associated with their exchanges. These words encapsulate the singularity of Sophie Germain's life in such beautiful and apt words, that it seems indispensable to reproduce them here:

> **How can you describe my admiration and astonishment at seeing my correspondent, M. Le Blanc, metamorphosed into this illustrious personage, who gives such a brilliant example of what I would have great difficulty believing? The taste for the abstract sciences in general and especially for the mysteries of numbers is very rare: one may be surprised; the enchanting charms of this sublime science reveal themselves in all their beauty only to those who have the courage to deepen it. But when a person of this sex, who by our manners and our prejudices, must meet infinitely more obstacles and difficulties, than men, to become familiar with its thorny researches, nevertheless knows how to overcome these obstacles and penetrate this that they have moreover hidden, it is undoubtedly necessary, that she has the most noble courage, talents quite extraordinary, a superior genius.**

The mathematical exchanges between Sophie Germain and Gauss continued until 1808, when we have the last documented letter from Gauss to Sophie, where he informs her of his move to join the University of Göttingen as a professor of astronomy and concludes by wishing her well. After this, Sophie wrote at least five letters to Gauss regarding her mathematical progress and ideas. It appears that Sophie never received a reply from Gauss, although he did send copies of at least two of his memoirs to her through his students. Be that as it may, it is certainly true that the correspondence with Gauss gave Sophie immense encouragement and confidence. The mathematical content of her letters has been well-researched and can be found in the article by Del Centina and Fiocca[5]. One curious aspect that should be noted here is that although Gauss

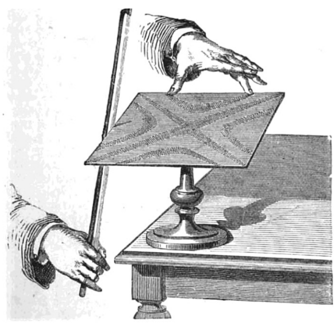
[5] A. Del Centina and A. Fiocca, The correspondence between Sophie Germain and Carl Friedrich Gauss, *Archive for History of Exact Sciences*, Vol. 66, No. 6 (2012) 585-700.

was a frontier figure in mathematical sciences at that time, he was, in fact, one year *younger* than Sophie!

“The enchanting charms of this sublime science reveal themselves only to those who have the courage to deepen it.”

Sophie’s mathematical bent of mind won her the admiration of many in the community, but what she desired was professional recognition from fellow mathematicians. An avenue to gain the latter opened up before her in the guise of the *Grand prix de sciences mathématiques* announced by the *Institut des France* in 1809. This was a public competition, the topic of which was to develop the mathematical theory of the vibration of elastic surfaces, which explains the famous experiments of Ernst Chladni about vibrating plates. The deadline of the contest was set to two years later, in October 1811, and the prize was 3000 Francs. The panel of judges consisted of stalwarts such as Legendre, Pierre-Simon Laplace, Lagrange, Sylvestre Francois Lacroix, and E.-L. Malus.

Chladni’s vibrating plates were the cause of much excitement and awe since 1777. For a metal plate that is fixed at the centre and lightly sprinkled with sand, Chladni discovered that if its edges are strummed by a violin bow, then the sand particles get arranged in remarkable symmetric patterns. At the end of 1808 and the beginning of 1809, Chladni gave demonstrations of this mysterious phenomenon to the French scientific community and to none other than the emperor Napoleon Bonaparte as well! With the phenomenon being of great scientific as well as practical significance, the members of the institute had hoped that the competition would stimulate research towards the analytical theory behind these patterns. This challenge was believed to be a formidable one, with Lagrange supposedly commenting that the required mathematical tools in analysis were not yet developed.

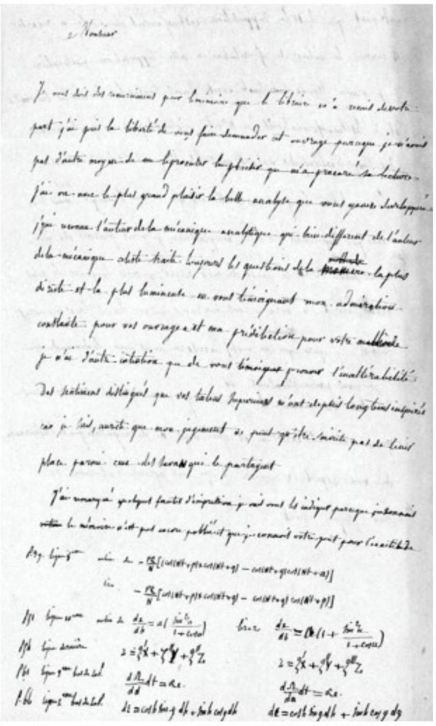


Bowing Chladni plate Wikimedia Commons

This, however, did not seem to discourage Sophie Germain. She took upon the daunting task of deriving the mathematical equations that govern these vibrations, all by herself. Building on the work of Euler, Sophie worked towards formulating an appropriate hypothesis which would lead to the correct differential equation. Since early 1811, she found a patient guide and a favourable mentor in Legendre, who provided detailed and careful explanations of several parts of Euler’s memoirs. In October 1811, Sophie was the only one who submitted an entry for the contest. But alas, she did not win! Even though her hypothesis for the formulation of a partial differential equation was correct, the application of techniques from calculus had errors, and as noted by Lagrange, her equation itself was incorrect.

The contest was renewed a second time, with a deadline of October 1813. Once more, hers was the only entry! She now worked with the corrected version of her equation, provided by Lagrange. But she could neither solve it nor substantiate her claim with experiments. She received an honourable mention for her attempt. The competition was reopened once more, with an emphasis on supporting theory with experiments and a revised deadline of October 1815. The rules of the competition required entries to be anonymous, identified only by a short quote. For her third submission, Sophie chose the quote by Virgil that was alluded to at the beginning of this article. In December 1815, the panel decided that the sole entry in the contest was worthy of the award, and found that it was submitted by none other than Sophie Germain! This was a historic moment, as Sophie became the first woman ever to receive a major prize in mathematics. The award was to be conferred on her in a public meeting in January 1816, along with another prominent master of mathematics, Augustin-Louis Cauchy, who was awarded a prize for his work on wave theory. Alas, the audience that had gathered to get a glimpse of this unusual woman had to return disappointed as Sophie was not present for the meeting.

In the following years, Sophie kept herself well-informed about the progress in her areas of interest, even providing her own viewpoints. She also corrected and revised her prize-winning essay, and self-published a summary of her research on the theory of elastic surfaces. Expecting validation for her mathematics, she sent a copy of her manuscript to the newly renamed Royal Academy of Sciences. But what she received was either flattery (as in the case of Claude-Louis Navier) or copies of their own work (as in the case of Cauchy). The absence of a rigorous objective assessment of her work (in modern terms—a referee report!) was a major impediment to Sophie's progress. Apart from her mentor Legendre and a sympathetic Joseph Fourier, she was compelled to develop her ideas in isolation. It is then even more commendable that she designed and performed experiments with very thin vibrating plates, without access to resources or laboratories. Today, there is consensus among several authors that even before Simeon Denis Poisson, Cauchy, Navier, and Gustav Kirchoff, Sophie Germain was the first to propose the formulation of a fourth-order partial differential equation governing the transverse deflections of a vibrating thin plate. The community had to wait almost a century for the general theory, until a Swiss physicist W. Ritz developed a method towards computing approximate solutions of operator eigenvalue problems and partial differential equations.



An excerpt from Sophie Germain's letter to Lagrange.
Biblioteca Moreniana – Città Metropolitana di Firenze

Apart from the theory of elastic surfaces, Sophie Germain made original contributions to the field of number theory, specifically in the context of Fermat's Last Theorem. In the seventeenth century, Pierre de Fermat had noted in his copy of Diophantus' Arithmetica that he had a marvellous demonstration of the fact that the equation $x^n + y^n = z^n$ does not have any positive integer solutions for $n \geq 3$, but the margin is too narrow to contain the argument. This claim came to be known as *Fermat's Last Theorem* and has captured the fancy of many mathematicians over centuries! Sophie was no different, and had communicated her wish to solve this mystery to Gauss. She had claimed in her first letter that she could prove Fermat's assertion when $n = p - 1$, with p being a prime of the form $8k + 7$. In the same meeting where she was awarded the *Grand prix des sciences mathématiques*, the Academy announced Fermat's last theorem as the topic of the next contest, with a submission deadline of 1818. Perhaps this challenge motivated her to renew her efforts! As we would now guess, none of the submissions of the contest succeeded in establishing Fermat's claim and the problem was withdrawn in 1820. The enigma of Fermat's last theorem continued to ensnare mathematicians and amateurs alike, until in 1995, when Andrew Wiles, along with his former student, Richard Taylor, were successful in proving the conjecture in complete generality. Their techniques relied heavily on mathematics developed earlier in the twentieth century, unavailable to Sophie Germain, and certainly beyond what was known to Fermat.

Postage stamp of the Czech Republic in 2000 for the World Year of Mathematics. Wikimedia Commons

A proof of Fermat's assertion in the cases when $n = 3, 4$ and 5 was known by 1825, with $n = 3$ established by Euler, $n = 4$ by Fermat himself and $n = 5$ by Dirichlet. It was also clear that it is sufficient to prove the claim when n is an odd prime. This is because if n is divisible by an odd prime p, and $n = pq$, then $x^n + y^n = z^n$ is solvable implies $x^p + y^p = z^p$ is solvable, since $a^n = (a^q)^p$. However, the intricate and peculiar nature of the proofs of the above special cases made it apparent that a general method to tackle all exponents at once would be quite difficult. One of the first propositions that could allow one to deal with arbitrary exponents was proposed by Sophie Germain. She demonstrated that if for an odd prime p, there exists an auxiliary prime θ such that

- p is not a p-th power $\mod \theta$
- there are no two non-zero consecutive p-th powers $\mod \theta$,

then in any integral solution to $x^p + y^p = z^p$, at least one of x, y, or z must be divisible by p^{2}[6]. To deduce the impossibility of integer solutions, her 'grand plan' was: given a prime p, find infinitely many auxiliary primes of the form $2Np + 1$ satisfying the second condition, which will lead to a contradiction! But alas, her plan proved to be futile, and she herself demonstrated its failure for $p = 3$.

"Sophie Germain made original contributions, specifically in the context of Fermat's Last Theorem."

Nevertheless, her proposition leads to the non-existence of solutions in a particular case, namely, when p is such that $2p + 1$ is also prime and p does not divide xyz. This can be seen by an application of Euler's theorem[7]. Thus, primes p such that $2p + 1$ is also a prime came to be known as Sophie Germain primes. For instance, the numbers $2, 3, 5, 11, 23, 29$ are Sophie Germain primes. These primes hold great interest for mathematicians of the modern day as well. We still have no proof of whether there exist infinitely many Sophie Germain primes! However, there is a conjecture predicting their density, which is a special case of the theme addressed by Dickson's conjecture and Schinzel's Hypothesis H. On the other hand, the companions to Germain primes, namely the prime $2p + 1$ corresponding to the prime p, are of utility in cryptography and pseudorandom number generation. Thus, we see that Sophie's mathematics continues to be relevant even today.
In 1829, Sophie was diagnosed with breast cancer and, after a painful fight with a terminal illness, the remarkable mathematician bid farewell to the world in June 1831. Not long before her death, two of her papers were published in Crelle's Journal, a testament to the fact that she sought refuge from the physical agony and suffering in the realms of the abstract and philosophical.
Dora Musielak's book does justice to present a well-rounded and thorough picture of Sophie Germain's mathematical pursuits, with the context of the historical revolution, the scientific developments and social circumstances of her time. Although the chapters are centred around events that take place in chronological order, the author has emphasised in the preface that such is not her intention. The repetitions arising from her choice of arrangement are crucial to maintaining a coherent flow of the narrative. Besides details about Germain's life, the author includes background and mathematical exposition of the two significant problems that Sophie tackled: the theory of vibrating surfaces and Fermat's last theorem. These discussions are accessible to a general audience while successfully communicating the depth of the mathematics involved.
She sought refuge from the physical agony and suffering in the realms of the abstract and philosophical.
The commentary on her life is often interjected with descriptions of the environment in France and Paris at that time. This emphasizes the fact that Sophie lived through perhaps the most tumultuous years in French history. She witnessed the fall of the *Ancien Régime*, the creation of the First Republic and the Reign of Terror, the rise of Napoleon to power, the Battle of Paris and the restoration of monarchy, the Hundred Days, the Battle of Waterloo and a second restoration of King Louis XVIII and finally, the second French revolution. This allows one to marvel at her dedication to *know the causes of things*, while being besieged by turbulent conflicts.
Several *men of mathematics* influenced Sophie's journey. With Paris being a hub of science and mathematics, her paths crossed with some of the leading researchers of her time. This list includes

[6] The result which is usually attributed to Sophie Germain is the weaker version which was recorded by Legendre, that under the above hypothesis, at least one of x, y or z is divisible by p. The stronger version, proving divisibility by p^2, was later found in her manuscripts. See *'Voici ce que j'ai trouvé': Sophie Germain's grand plan to prove Fermat's Last Theorem*, by R. Laubenbacher and D. Pengelley, Historia Mathematica, Volume 37, Issue 4 (2010), pp. 641-692. for details. [The commonly cited weaker version is the following: If p is an odd prime such that $2p+1$ is a prime, then for any solution of $x^p + y^p = z^p$, in integers, p divides xyz. — Editor]

[7] Euler's theorem states that for any positive integer $n > 1$ and an integer a coprime with n, $a^{\phi(n)} \equiv 1 (\text{mod } n)$. Here $\phi(n)$ denotes the Euler totient function, which counts the number of positive integers less than n that are coprime with n.

Lagrange, Laplace, Legendre, Fourier, Gauss, Poisson, Navier and Cauchy, names that will surely be familiar to any undergraduate student of mathematics! Some of them were mathematical mentors, some sympathetic contemporaries, and some scientific rivals to Sophie. In Chapter 11, the author includes a brief account of their biographies and contributions, along with a note about their role in Sophie's life. In my opinion, this chapter is crucial to painting a picture of the mathematical scene of the time, which enables the reader to connect with the content in the rest of the book.

Since Sophie herself did not maintain records, not much is known about her personal life and relationships. However, the author has made an honest effort to reconstruct parts of Sophie's life and events, with ample evidence to support her claims. For instance, Chapter 7 discusses Sophie's efforts to conduct experiments with thin vibrating plates to support her hypotheses. Although there are inadequate details available regarding Sophie's experimental work, with the help of her letters and memoirs, the author recreates these experiments and describes how Sophie would have proceeded with them.

The chapter *Pensées de Germain* is dedicated to Sophie's philosophical notions, with reference to her essays in which she argued the similarities between the creative process involved in science, literature and arts. In the penultimate chapter, the author records a plethora of questions about Sophie Germain, which still remain unanswered. History is riddled with examples of rare and impressive women who have established time and again that academics is not the monopoly of individuals of a single gender. The last chapter of the book includes a succinct portrayal of these figures, from Hypatia of Alexandria to Madame Paulze Lavoisier, wife and assistant of the chemist, Antoine Lavoisier.

The written correspondence between Sophie Germain and Gauss has intrigued many. The author, Dora Musielak, has translated nine of the fourteen letters exchanged between them and has included them towards the end of the book. These allow us to decipher the regard that Sophie and Gauss held for each other, be privy to their mathematical interactions, and appreciate the language which gives these formal letters a very personal touch.

In summary, *Sophie Germain: Revolutionary Mathematician* is an excellent reference for anyone yearning to learn more about the true persona behind a character, who, through her exceptional intellect and unwavering intent, was successful in leaving an impression on mathematics and history. Two hundred years hence, the legacy of Sophie Germain continues to inspire admiration and reverence. The *École normale supérieure de jeunes filles*, a high school for girls, was established outside Paris in 1880. Closer to home, one of the first schools for girls in India was opened in 1848[8]. Women working at the frontiers of mathematical research are seen in larger numbers today. Maryam Mirzakhani was awarded the Fields Medal in 2014 and Karen Uhlenbeck received the Abel Prize in 2019, becoming the first female mathematicians respectively to be honoured for their significant and impactful work. Even more recently in 2022, Maryna Viazovska became the second female recipient of the Fields Medal. Celebrating their mathematical accomplishments through workshops and conferences across the world, we have certainly come a long way since Sophie's era. On a personal note, I feel deep respect and gratitude towards courageous women mathematicians such as Sophie Germain, whose staunch and steadfast drive, and significant mathematical accomplishments paved the way for societal change, allowing women like me to be here today.

Acknowledgements: The author would like to thank C.S. Aravinda and the entire Bhāvanā team for detailed editing and insightful suggestions. She is also thankful to Ram Murty and Usha Mahadevan for helpful comments on an earlier version of this article.

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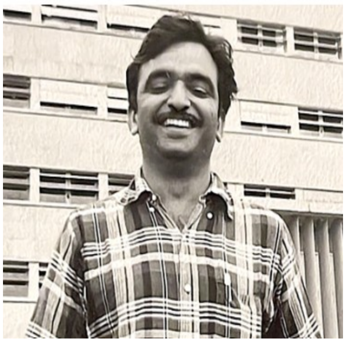
[8]The school referred to here was started by Jyotirao and Savitribai Phule at Bhide Wada in Pune. Savitribai, who was herself educated by Jyotirao, is often regarded as the first female teacher in India. Today, the University of Pune has been renamed Savitribai Phule Pune University in her honour.

3. Professor M. Pavaman Murthy - in Remembrance

N. Mohan Kumar
Department of Mathematics, Washington University in St. Louis, Missouri, 63130, U. S. A.
Email: kumar@wustl.edu

Professor Matam Pavaman Murthy passed away on March 21, 2026 in Chicago. He was a very influential mathematician who wrote his thesis under the guidance of Professor C. S. Seshadri at TIFR. I will briefly describe some of his seminal contributions in this note.



Pavaman Murthy at TIFR

Pavaman Murthy with Mohan Kumar

Murthy was born on November 3, 1935, in Hyderabd where he grew up. He did his schooling and got his undergraduate degree from Osmania University, as it was known then. He joined the School of Mathematics as a graduate student in 1958 and got his doctorate in 1966. He did his post-doctoral work with Professor Hyman Bass at Columbia in New York. After spending a year at University of Illinois at Chicago and a year in Switzerland, he joined the faculty of University of Chicago in 1971, the year he resigned from TIFR. He had been there till he retired in 2006. He spent 1978-79 as a visiting professor at ISI, Delhi and 81-83 at TIFR. Pavaman worked broadly in Commutative Algebra and Algebraic Geometry with special emphasis on Projective modules, K-theory and Chow groups.

All rings we consider will be commutative, Noetherian and all modules finitely generated. Let me start with defining some terms for those who are not familiar with it. A module P is projective if there exists another module Q such that $P \bigoplus Q$ is free. One of the first projective module which is not free that one comes across is the tangent bundle of the real sphere due to its non-orientability. One says that a projective module is P stably free, if the above Q can be taken to be free. Tangent bundle of the real sphere is stably free, but not free. Notice that the set (isomorphism classes) of projective modules of rank one forms an abelian group under tensor product, called the Picard group. For a ring A, one defines $K_0(A)$ as the free abelian group on all projective modules modulo relations $[P] + [Q] = [R]$ if $P \bigoplus Q = R$. For example, $K_0(\mathbb{Z}) = \mathbb{Z}$, given by the 'rank'. Chow group of zero cycles of a scheme X, denoted by $CH_0(X)$ is a bit more geometrical. We take the free abelian group of all (closed) points of X and go modulo rational equivalence. Somewhat loosely, take a curve $C \subset X \times \mathbb{P}^1$ and declare the zero cycles $C \cap X \times \{0\}$ and $C \cap X \times \{\infty\}$ are rationally equivalent. For example, $CH_0(\mathbb{P}^n) = \mathbb{Z}$, $CH_0(\mathbb{A}^n) = 0$ while that of an elliptic curve is big. If $\dim A = n$ and P is a projective module over A, one can define $c_n(P) \in CH_0(A)$, the top Chern class of P. If rank of $P < n$, then $c_n(P) = 0$. If rank of $P \geq n$, then by a result of Bass, we can write $P = Q \bigoplus F$, where rank of $Q = n$ and F is free. Then $c_n(P) = c_n(Q)$. Finally, for a rank n projective module Q, a general element $a \in Q$ will vanish at finitely many closed points of Spec A and thus give you a class in $CH_0(A)$ and $c_n(P)$ is closely related to this class.

Not surprisingly, Pavaman's thesis was a generalization of some important results of Seshadri. In 1955, J.-P. Serre had asked whether projective modules over polynomial rings $k[x_1, \dots, x_n]$ over a filed k are free, often referred to in the literature as Serre's conjecture. When $n = 1$, this is standard, since the ring in question is a pid. Seshadri settled the first case of two variables in 1958. In fact, he proved that projective modules over $A[X]$ are free when A is a pid. Another way of saying this is that any projective module over $A[X]$, A a pid is extended from A. So, if

P is such a projective module over $A[X]$, there exists a projective module Q over A (which of course is free) so that P is isomorphic to $Q \bigotimes_A A[X]$. Later, Hyman Bass proved the same holds when A is a Dedekind domain, though clearly they may not be free, since the Picard group of a Dedekind domain is not in general trivial. If A is not a Dedekind domain, then such results will fail. For example, if $A = k[t^2, t^3]$, then the Picard group of $A[X]$ is not trivial and thus, they are not extended from A since one can check that the Picard group of A is indeed trivial in this case. Pavaman generalized these results in his thesis. In particular, he showed that if A is the co-ordinate ring of algebraic functions on a curve, then, any projective module P of rank n over $A[X]$ is isomorphic to $A[X]^{n-1} \bigoplus L$ where L is a projective module of rank one [1].

After finishing his degree, he did post-doctoral work with Hyman Bass (who was also one of his thesis examiners) at Columbia in New York. During this time, he with Bass showed that in general K_0 of group rings of finite abelian groups is not finitely generated, settling a question of Milnor on Whitehead groups [2].

After a few years he accepted a position at University of Chicago, where he was till his retirement. He continued to work on Serre conjecture and in 1974 had the first breakthrough by proving the case of Serre's conjecture for three variables, with Jacob Towber [3]. Later, Serre's conjecture was completely settled independently by D. Quillen and A. A. Suslin in 1976.

He continued investigating whether one can classify vector bundles in terms of its Chern classes (taking values in the Chow group). For affine curves, this is well known at that time and one can write any projective module as a direct sum of a free module and a line bundle, which determines its first (and only) Chern class. Meanwhile a seminal result was proved by A. Roitman, showing that the torsion in $CH_0(X)$, the Chow group of zero cycles, where X is a smooth surface over $\mathbb{C}$ is canonically isomorphic to the torsion in the Albanese of X. This in turn lead to Pavaman's observation that proved that for any smooth affine variety X of dimension at least two over $\mathbb{C}$, $CH_0(X)$ is torsion free. It is always divisible. Using this, Pavaman with Richard Swan showed that Chern classes completely determine projective modules over smooth affine surfaces [4]. The technically difficult part is to show that if P is a projective module of rank two and $c_2(P) \in CH_0(X)$ is zero, then P has a free direct summand.

In 1978, I was offered a post-doctoral position at University of Chicago to work with Pavaman, whom I had not met. Unfortunately for me, he decided to visit ISI, Delhi for the academic year 78-79. Before I went to Chicago, I went to Delhi to meet him with some trepidation. But he and his lovely wife Prema were so friendly and kind, I lost my fears in no time. Our friendship and his mentorship lasted his lifetime and I am deeply thankful. When he came back to Chicago in 79, he was trying to classify certain singularities of rational surfaces. I was a novice in Algebraic Geometry and started learning about these. Finally, when we did classify these singularities, he insisted that the results are mine, a very generous gesture. I was young and did not object to this strongly.

In the early eighties, he visited TIFR for two years. He was still trying to see whether a rank three projective module P over a smooth affine three-fold with $c_3(P) = 0$ has a free direct summand. We settled this affirmatively [5]. After a decade, he proved this for all dimensions. That is, if X is an affine variety of dimension n and P a projective module of rank n with $c_n(P) = 0$, then it has a free direct summand of positive rank. Let me give a more geometric reason for interest in these questions. If X is a smooth affine variety over say complex numbers, these results say that a point of X is a complete intersection if and only if its class in $CH_0(X)$ is zero. For example, this holds for rational varieties.

I have not touched upon his work on rational singularities on rational surfaces, complete intersections, his excellent lecture notes on Commutative Algebra and many other works, but hope have given you a flavour and importance of his contributions.

As a human being, Murthy was exceptional. His kindness and generosity were legendary. He was one of the most sociable and humble people you will ever meet. He considered himself to be a Marxist. He always stood for the underdog. He deeply enjoyed classical Hindustani music and Chicago Blues. He started training for marathons when he was fifty and completed his first marathon in a year! He was married to Prema Murthy, for forty three years, who passed away in 2011. He is survived by Lynn Narasimhan, his partner for last ten years, two sons, Viren, a professor at University of Wisconsin, Madison, Niren, professor at University of California, Berkeley, and his granddaughter Aurora.

He will be deeply missed by everyone who experienced the joy of his company.

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Indo-European Conference (IISER Pune Photos)

Informal discussions during Tea-break

Active session by Prof. Michel Waldschmidt

Prof. J. K. Verma (President, TMC) felicitating Prof. Ravindra Kulkarni

4. A Peep into History of Mathematics

S. G. Dani
UM-DAE CEBS, University of Mumbai, Vidyanagari Campus, Santacruz (E), Mumbai 400098
Email: shrigodani@cbs.ac.in

Here we review two papers on historical themes, one relating to ancient Egyptian mathematics and another on the history of the four color problem.

Reinhard Sigmund-Schulze, Another look at the two Egyptian pyramid volume 'formulas' of 1850 BCE, British Journal for the History of Mathematics, Vol. 37 (2022), No. 3, 171-178.

The Moscow mathematical papyrus, which surfaced at the end of the nineteenth century, has been one of the major resources of our knowledge of mathematics from ancient Egypt. The papyrus is believed to be from around 1850 BCE and was studied extensively during 1930s by several historians. The contents of the papyrus are in the form of problems and solutions, and the present paper concerns Problem 14, which was noted, during the early studies, to amount to calculating the volume of a symmetrical frustum with a square base, by the formula $\frac{1}{3}h(a^2+ab+b^2)$, where a and b are the sides of the squares at the base and the top respectively, and h is the height. A much debated question in the area is how they would have arrived at the formula. In the works around 1930, historians, including Gunn, Peet, and Neugebauer adopted a model for the proof, based on dissection of the frustrum into 9 parts, a cuboid in the middle, 4 pieces along the sides and 4 along the corners, but there are issues about whether the calculations involved in it would have been accessible to the ancient Egyptians. A more intuitive possibility was proposed by Paul Shutler, in 2009, involving taking three copies of the frustrum and dissecting and reassembling them to form a three boxes with volumes ha^2, hab and hb^2 respectively. Interestingly, it turns out that Shutler's suggestion coincides with a historically documented proof of the formula by the ancient Chinese mathematician Liu Hui (3rd c. CE), unknown to Shutler. The paper under review provides an analysis of what is involved in the question from a historical point of view.

Robin Wilson, The four color problem - 1852-1976, Notices of the American Mathematical Society, Vol. 73, No. 3, March 2026, 216-228.

The four color problem, to show that four colors suffice to color any planar map, had a long life as an unsolved, widely known problem, attempted by numerous mathematicians and innumerable amateurs, before it was resolved in 1976, by Kenneth Appel and Wolfgang Haken. The present article recounts, on the occasion of the 50th anniversary of its resolution, the story of the proof, focusing especially on the individuals involved along the way.

The story begins with a letter written by Augustus De Morgan on October 23, 1852 to Sir William Rowan Hamilton saying "a student of mine asked me today to give him a reason for a fact …", which marks the genesis of the four color problem. The student alluded to was Francis Guthrie, later a polymath of renown.

Another renowned mathematician from the early period appearing in the story is Arthur Cayley. Apart from publishing some useful mathematical observations on it he raised the question at a meeting of the Cambridge Mathematical Society, on 13 June 1878. Alfred Kempe, a former student of Cayley who attended the meeting was to pursue the problem vigorously. Though he did not succeed in giving a valid proof, his work constituted ground-breaking progress, and his papers earned him the Fellowship of the Royal Society of London.

In continuation the article goes over the significant role played by a string of mathematicians, Peter Guthrie Tait, Percy Heawood, Paul Wernicke, Oswald Veblen, George Birkhoff, Philip Franklin, and Heinrich Heesch, before getting to the work of Haken and Appel which dealt the final blow; a graduate student John Koch also comes into play near the end. Their individual context, their successes and failures, and the interrelations are well brought out in the narrative.

In the concluding section, titled "Aftermath", there is a discussion on the unique aspect of the reliance of the proof on computer calculations, and the response of the mathematical community to it. It is noted that in the subsequent period there have been improvements in terms of cutting down the part left to the computers and other means of enhancing reliability.

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5. What is Happening in the Mathematical World?

Devbhadra V. Shah
Department of Mathematics, VNSGU, Surat;
Email: drdvshah@yahoo.com, vshah@yahoo.com

5.1 The AI Revolution in Mathematics has Arrived

The early months of 2026 have proven to be an extraordinary inflection point in the history of mathematics. Rather than human effort alone driving the discipline, the defining theme of early 2026 is autonomous and AI-guided mathematical research. Below are some of the top groundbreaking mathematical discoveries, solutions to open problems and innovations achieved since January 2026.

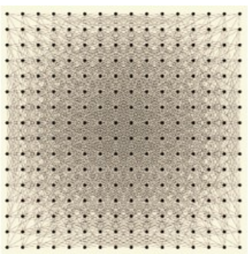
5.1.1 AI Disproves Erdös Unit Distance Conjecture

In 1946, Paul Erdös asked a fundamental question about how many pairs of points in a finite set can be exactly one unit apart (Erdös Problem Number Ninety). The Erdös Unit Distance Conjecture states that, if $u(n)$ denote the maximum number of unit-distance pairs you can possibly create by placing n distinct points on a flat two-dimensional plane, then for any $\epsilon > 0$ and sufficiently large n, $u(n) \leq n^{1+\epsilon}$.

In his original work in 1946, Erdös proved that $u(n)$ is at most $O(n^{3/2})$. While using a $\sqrt{n} \times \sqrt{n}$ grid and arranging n points so that the most frequent distance becomes exactly 1, and applying number-theoretic results about how many ways an integer can be written as the sum of two squares, he showed that: $u(n) \geq n^{1+c/\log\log n}$.

In 1984, Joel Spencer, Endre Szemerédi, and William Trotter made a major breakthrough using the Szemerédi-Trotter theorem on point-line incidences, improving the upper bound to:

$$[u(n) \leq cn^{4/3} \approx O(n^{1.333})]$$



Erdös assumed that it was impossible to significantly improve upon such a lattice configuration, even with a very large number of points.

For nearly 80 years, mathematicians believed the best possible solutions looked roughly like square grids. An OpenAI model has now disproved that belief, discovering an entirely new family of constructions that performs better.

OpenAI's model avoided traditional geometric intuition entirely. Instead of attempting to work with Euclidean shapes or apply brute-force coordinate searches, the model autonomously drew structural links from algebraic number theory, creating a connection that human researchers later admitted was greatly surprising. By recognizing hidden symmetries within algebraic fields, the AI model constructed an entirely new, highly non-trivial family of point arrangements that yielded far more pairs at a unit distance than the classical square lattice, directly violating Erdös' predicted limit. The following result is due to an internal model at OpenAI.

New Result: *There exists $\epsilon > 0$ such that the following holds. There exists a sequence of point sets $\mathcal{P}_i$ in $\mathbb{R}^2$ such that $|\mathcal{P}_i| \to \infty$ and the number of unit distances in $\mathcal{P}_i$ is at least $|\mathcal{P}_i|^{1+\epsilon}$ for all i.*

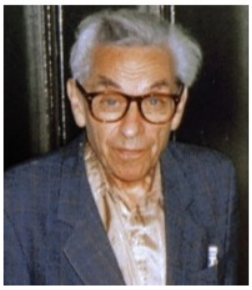
Mathematician Noga Alon, Thomas F. Bloom, W. T. Gowers, Daniel Litt, Will Sawin, Arul Shankar, Jacob Tsimerman, Victor Wang, and Melanie Matchett Wood have presented a short, digested, human-verified version of the AI proof and a sequence of reflections on it, in [1].

While the work has excited mathematicians, the absolute theoretical upper bound for the planar unit distance problem remains an open hunt because the AI did not come up with a new answer for how fast the pairs of dots rise, but merely showed that the limit Erdös proposed was too low.

Source: *arXiv:2605.20695v1 [math.CO] 20 May 2026*

5.1.2 Resolution of Erdös-1051 Conjecture

One of the earliest independent breakthroughs of 2026 came via DeepMind's *Aletheia, a specialized mathematics research agent developed by Google DeepMind and built on* ***Gemini Deep Think***, which settled a long-neglected open problem of computational number theory named as *Erdös-1051 conjecture* which refers to a specific entry in Thomas Bloom's *ErdosProblems.com* database, which catalogs the vast legacy of unsolved math conjectures left by Paul Erdös (1913-1996), (Feng et al., 2026).



The Erdös-1051 conjecture, concerning criteria for irrationality reciprocal infinite series linked to recursive sequences, appeared in the form of an open question (believing that answer to be affirmative) in the above-referred database in 1980. DeepMind's *Aletheia* in 2026, specifically, proved the following result thus settling the conjecture:

Theorem 1. *If $1 \leq a_1 < a_2 < \ldots$ is a strictly increasing sequence of integers satisfying the condition: $[\liminf_{n\to\infty} a_n^{1/2^n} > 1]$, then the corresponding reciprocal series converges to an irrational number: $\sum \frac{1}{a_n} \notin \mathbb{Q}$.*

Mathematicians had avoided the problem for decades due to its insignificance within the vast Erdös database. Now, Aletheia deployed high-level mathematical reasoning and systematically targeted the question. Experts who reviewed the proof noted that the system independently avoided standard drawbacks by shifting its analysis directly to the tail of the series, where it elegantly applied a classical metric known as *Mahler's criterion* to seal the proof. The validity of the independent solution has since been verified by experts and fully formalized within the proof assistant environment.
Crucially, the discovery did not stop at a machine-generated text. The elegant simplicity of Aletheia's proof allowed human mathematicians to step in, collaborate with the model, and generalize the underlying framework. This hybrid collaboration directly ended in a new collaborative research paper, designated in literature as *BKKKZ26 (k. Barreto, j. Kang, s. Kim, v. Kovac, and s. Zhang)* [1]. The generalized result proved by them is as follows:

Theorem 2. *Fix a positive integer d and let $\psi > 1$ be the unique positive solution to $\psi^d = \psi^{d-1} + 1$.*

1. *If a monotonically increasing sequence of positive integers $\{a_n\}_{n=1}^{\infty}$ satisfies*

$$\lim_{n\to\infty} a_n^{1/\psi^n} = \infty, \text{ then } \sum_{n=1}^{\infty} \frac{1}{a_n a_{n+1} \ldots a_{n+d-1}} \quad \ldots\ldots\ldots\ldots \quad *$$

   is an irrational number. (Note that if $d = 2$ then ψ is the golden ratio $\phi = (1+\sqrt{5})/2$).

2. *For every $C \in (1, \infty)$ there exists a strictly increasing sequence of positive integers $\{a_n\}_{n=1}^{\infty}$ satisfying $\liminf_{n\to\infty} a_n^{1/\psi^n} = C$ such that the infinite sum (*) is a rational number.*

The successful resolution of Erdös-1051 marks a structural shift, proving that advanced scaling laws can produce mathematical discoveries that have otherwise escaped human attention.
Source: *https://arxiv.org/pdf/2601.21442v2 [math.NT] 2 Feb 2026*

5.1.3 The 80-minute Miracle: AI Solves Erdös Problem #1196

Mathematician *Jared Lichtman* spent eleven years of his life working on a special group of mathematical puzzles on "primitive sets", especially, Erdös Problem #1196.
A set of integers $A \subset 2, 3, 4, \ldots$ is called a **primitive set** if no element in the set divides another (i.e., for any distinct $a, b \in A, a \nmid b$). In 1935, Paul Erdös proved that for any primitive set A, the "Erdös sum" is uniformly bounded:

$$\sum_{a\in A}\frac{1}{a\log a}<C.$$

In 1960, Erdös, Sárközy, and Szemerédi conjectured:
Suppose that $A\subset[x,\infty)$ is a primitive set of integers. Then, as $x\to\infty$,

$$\underset{A\subset[x,\infty)\text{ primitive}}{\text{Sup}}\sum_{a\in A}\frac{1}{a\log a}=1+0(1)$$

Lichtman spent years proving a major rule about primitive sets, but he got completely stuck on *Erdös Problem #1196.*
For nearly 90 years, every mathematician who tried to solve these problems used the exact same opening move: they changed the problem from whole numbers into the world of continuous calculus fractions. This practice was so normal that it blinded humans to an easier path.
In April 2026, an AI model called GPT-5.4 was given the problem. In just 80 minutes, the AI broke away from the traditional human way of thinking. It stayed entirely within the world of whole numbers and used an old tool called the *von Mangoldt function* in a completely unexpected way.
The **von Mangoldt function**, denoted by $\Lambda(n)$, is a classical arithmetic function defined as:

$$\Lambda(n)=\begin{cases}\log p & \text{if } n=p^m \text{ for some prime } p \text{ and integer } m\geq 1,\\ 0 & \text{otherwise.}\end{cases}$$

A fundamental and elegant property of the von Mangoldt function, which is used in proving the conjecture, is its identity regarding divisors:

$$\sum_{d|n}\Lambda(d)=\log n.$$

The mathematical breakthrough linking the von Mangoldt function to the resolution of **Erdös's Problem #1196** features a remarkable connection to Artificial Intelligence.
The foundational method of using Markov chains with von Mangoldt weights - which ultimately cracked the Erdös-Sárközy-Szemerédi conjectures - was explicitly **suggested by the output of an AI model** (GPT-5.4 Pro) before being fully developed into a rigorous publication by a collaborative research team (Alexeev et al., 2026 [1]).
The breakthrough resolution in April 2026 proved this exact statement to be true:

$$\underset{A\subset[x,\infty)\text{ primitive}}{\text{Sup}}\sum_{a\in A}\frac{1}{a\log a}=1+0\left(\frac{1}{\log x}\right)$$

Source: *Alexeev, B., Barreto, K., Li, Y., Lichtman, J. D., Price, L., Shah, J. I., Tang, Q., & Tao, T. (2026). Primitive sets and von Mangoldt chains: Erdös Problem #1196 and beyond. arXiv preprint arXiv:2605.00301.*

5.1.4 Mathematicians' Evaluation of Solution Accuracy on 200 AI-Generated Responses

A team of mathematicians, AI experts led by investigators Quoc V. Le and Thang Luong usingcustom mathematics research agent built upon Gemini Deep Think, internally codenamed *Aletheia* at Google DeepMind [FTB+], carried out a case study in semi-autonomous mathematics discovery, using Gemini to systematically evaluate 700 conjectures labeled 'open' in Thomas Bloom's Erdös Problems database the (As on February 2026, database tracks 1,179 problems, with 483 (41%) classified as solved). Crucially, Aletheia includes a (natural language) verifier mechanism2 that helped narrow the pool of problems to examine: from the original 700 problem prompts, 200 responses came back as potentially correct. A team of human mathematicians then filtered these responses to eliminate incorrect solutions. Ultimate findings were that 137 (68.5%) of responses were fundamentally flawed, while 63 (31.5%) of responses were technically correct, but only 13 (6.5%) were meaningfully correct. (9 through identification of previous solutions in the existing literature, and 4 through seemingly novel argument).

These results indicate that there is low-hanging fruit among the Erdös problems, and that AI has progressed to be capable of harvesting some of them. While this provides an engaging new type of mathematical benchmark for AI researchers, the team cautions against overexcitement about its mathematical significance. Any of the open questions answered here, perhaps with the exception of Erdös-1051, could have been easily dispatched by the right expert. On the other hand, the time of human experts is limited. AI already exhibits the potential to accelerate attention-bottlenecked aspects of mathematics discovery, at least if its reliability can be improved.

Sources:

1. *https://arxiv.org/html/2601.22401v2 [cs.AI] 02 Feb 2026*
2. *2601.22401v3-Erdos's problems.pdf*

5.2 "Crazy" Dice Resolved A 150-Year-Old Mystery in Boltzmann's Law of Randomness

This discovery proves that a famous 150-year-old mathematics rule is the absolute best and only correct way to explain how independent parts behave in a random system.

When you look at the air around you, billions of tiny molecules fly around unpredictably. To make sense of this chaos, scientists use a 150-year-old mathematical rule called the 'Boltzmann distribution', named after an Austrian scientist *Ludwig Boltzmann*. This rule (also known as the Maxwell-Boltzmann distribution) is a fundamental principle in statistical mechanics. It describes how a system of particles distributes itself among various energy states when it is in **thermal equilibrium** at a specific absolute temperature. The law states that the probability P_i of a system being in a specific state i with energy E_i is $P_i = \frac{1}{z}e^{-\frac{E_i}{K_B T}}$, where K_B is the Boltzmann constant ($1.38 \times 10^{-23} J/K$), T is the absolute temperature T and $Z = \sum_j e^{-\frac{E_j}{K_B T}}$ is the partition function.

This rule is used everywhere today, from physics and artificial intelligence to economics, predicting what items shoppers will buy. But for a long time, scientists wondered: Is Boltzmann's rule the only one that works perfectly, or are there others?

To find out, two researchers *Omer Tamuz* (left), a professor of economics and mathematics at Caltech, and *Fedor Sandomierski* (right), a former Caltech postdoc who is now an assistant professor of economics at Princeton University revisited this foundational concept and reached an unexpected conclusion.

A key issue explored in the research is how to model independent behavior. For example, an economist studying how people choose between two cereal brands would want to avoid models that produce unrealistic links. If the model suggested that cereal preferences depend on unrelated choices, such as which dish soap someone buys or what color shirt they wear, it would clearly be flawed. While the Boltzmann distribution already satisfies this requirement, Tamuz and Sandomirskiy wanted to know whether any other theories could do the same and for that they designed new ways to test the underlying logic and explain their approach using dice.

Note that any individual roll of a single die is uncertain, however, repeating the experiment many times reveals a stable pattern, with each number appearing about one sixth of the time. This pattern represents the probability distribution of a single die. We can think of a die as a system and a number appearing on the die after rolling can be regarded as a state of the system. When two dice are rolled together and their totals are recorded (regarded as state of the system), a different

distribution appears. Note that there are 36 outcomes of the experiments and 11 different states of the system.
Crucially, the result of one die does not influence the other. These are independent systems. In the earlier example, one die represents a cereal choice and the other represents a dish soap choice, and neither decision should affect the other. To push this idea further, the researchers introduced an unusual pair of dice known as Sicherman dice, created in 1977 by puzzle designer Col. George Sicherman. The faces of these dice contain unconventional numbers. One die is labeled 1, 3, 4, 5, 6, 8, while the other shows 1, 2, 2, 3, 3, and 4. Despite their unusual design, when both dice are rolled, and only the total is recorded, the results match those produced by standard dice, i.e. the chance of rolling a same sum, in both the cases remains the same.
This identical distribution of sums gave Tamuz and Sandomirskiy a powerful testing tool. They compared how different mathematical theories handled both standard dice and these unconventional dice. If a theory produced the same distribution of sums for both, it successfully preserved independence; if it generated different results, it failed. In the end, they created a solid proof showing that Boltzmann's rule is the only one that stays completely logical and works perfectly every single time. This establishes the Boltzmann distribution as the mathematically unique framework for modeling true system independence, bridging abstract economic choice theory and statistical physics.

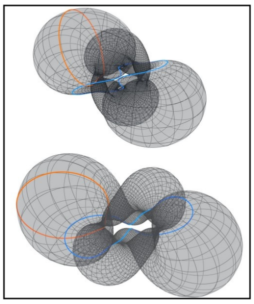
Sources:

1. *https://scitechdaily.com/crazy-dice-help-scientists-prove-only-one-150-year-old-theory-about randomness-works/*
2. *arXiv:2307.11372v3[math.PR] 6 Aug 2025*

5.3 Solving A 150-Year-Old Shape Puzzle by Constructing Compact Bonnet Pair

A long-standing assumption in differential geometry has been overturned by mathematicians who found that key local properties of a surface may not uniquely define its overall shape.
For more than a century and a half, students learning geometry have been taught a famous rule created by a French mathematician named *Pierre Ossian Bonnet*. His rule says that if you know two local things about a smooth surface - its 'metric' (how you measure distances on it) and its 'curvature' (how much it bends) - you can know its exact global shape.
But Bonnet also knew there were exceptions to his rule. Sometimes, two completely different shapes can have the exact same local measurements. Mathematicians call these rare exceptions 'Bonnet pairs'. For 150 years, people had only found these exceptions on open surfaces, like a flat sheet of paper or a shape that stretches out forever. No one knew if a completely closed surface, like a continuous ball or a solid donut, could ever be a Bonnet pair.

Now, a trio of mathematicians - *Alexander Bobenko* (right) from Technical University of Berlin, Germany, *Tim Hoffman* (center) from the Technische Universität München, Germany, and old geometry puzzle. By using advanced mathematics on computers, they successfully created two *Andres Sageman-Furnas* (left) from North Carolina State University, USA demonstrated that the donut shape provides a new answer to an distinct torus-shaped Bonnet pairs (called tori) [1]. See the team's final compact Bonnet pair on left.
The figure shows two non-congruent immersed real analytic tori that are related by a mean curvature preserving isometry. Corresponding generators are shown on each surface in orange and blue. Note that the two large bubbles on the top are closer together than the corresponding bubbles



on the bottom, and both surfaces have 180∘ rotational symmetry. These Bonnet pair tori arise as conformal transformations from an isothermic torus with one family of planar curvature lines. The orange generators come from the planar curves and are therefore congruent, while the blue generators are not congruent.

This discovery broke the old 150-year-old problem in differential geometry for surfaces. It proves that local measurements are not always enough to tell you the final global shape of a closed object, solving a mystery that had been stuck since the 19th century.

Sources:

1. *https://link.springer.com/article/10.1007/s10240-025-00159-z#preview*
2. *https://www.quantamagazine.org/two-twisty-shapes-resolve-a-centuries-old-topology-puzzle-20260120/*

5.4 Mathematicians Established an Explicit Upper Bound on the Number of Rational Points on Algebraic Curves

A team of three Chinese mathematicians have reportedly made a groundbreaking advance on a 2,000-year-old problem concerning the number of rational points on a curve. This discovery creates a new master formula that sets a strict limit on the number of rational points on complex curves, making digital security and cryptography easier to study.

Since the times of ancient Greece, mathematicians have been fascinated by special points on algebraic curves (A curve defined by a polynomial equation in two variables, such as $f(x, y) = 0$), called 'rational points'. These are the points on a graph where both coordinates are rational numbers. Finding these points is not just a game; it is highly useful in real life. For example, the rational points on elliptic curves are the secret key behind modern data encryption, which protects everything from your smartphone messages to online shopping transactions.

In 1922, a British mathematician *Louis Mordell* conjectured that if the degree of a curve's equation is four or higher (any algebraic curve of "genus" 2 or greater, defined over the rational numbers), has only a finite number of rational points. Roughly speaking genus is a geometric property of the curve when viewed over complex numbers. Visually, you can think of the genus as the number of "holes" in the surface of the curve.

Gerd Faltings proved this conjecture in 1983 using highly advanced tools in modern algebraic geometry, earning him the prestigious **Fields Medal** in 1986.

Faltings theorem proved that the rational points are finitely many, but it did not reveal how many. Since then, mathematicians have been searching for a formula to determine this number.

Recently, a trio of Chinese mathematicians, including Prof. Xinyi Yuan (photo on left) of Peking University, Jiawei Yu, and Shengxuan Zhou has achieved a historic milestone in number theory by presenting a brand-new revolutionary formula for the upper bound of rational points on algebraic curves. Their framework extracts absolute constants based solely on genus g of the curve and the degree of the number field $[K : \mathbb{Q}]$. The upper bound tends to increase as the degree gets larger. An upper bound is a strict theoretical limit that the total number of rational points can never cross.

This incredible formula gives scientists a single, unified way to understand how many special points can exist on these complex curves, wrapping up a problem that humans have been studying for thousands of years.The result itself is important, but the methodology used in the proof will also be helpful for solving other problems.

Source: *https://doi.org/10.48550/arXiv.2602.01820*

5.5 Talagrand's Convexity Conjecture Proved

By transforming a hard geometry puzzle into a problem about random statistics, a trio of researchers solved Talagrand's 1995 convexity conjecture, once thought impossible, using a novel probabilistic approach. They transformed a high dimensional geometry problem into one about random vectors, enabling a successful proof. This will help improve AI and advance algorithms in data science, machine learning, and logistics optimization.

In 1995, an Abel Prize-winning mathematician *Michel Talagrand* made a guess about geometry and shapes. He asked a difficult question about a geometric concept called 'convexity' - which is the mathematics that describes smooth, outward-bulging shapes. He wondered if convexity could be created in a fixed number of steps in any dimension, even in spaces with thousands of dimensions.

The Formal Talagrand Conjecture: If γ_n is the standard Gaussian measure (the normal bell-curve distribution extended to n dimensions), then there exists a fixed positive integer q such that for any dimension $n > 1$ and any closed set $A \subset \mathbb{R}^n$ with a large Gaussian volume (say, $\gamma_n(A) \geq 2/3$), there exists a **convex body** K inside the sum qA that still holds a massive chunk of the volume ($\gamma_n(K) \geq 1/2$).

Talagrand himself thought his guess was so incredibly hard that it might be impossible to solve, so he offered a 2,000-dollar cash reward to anyone who could prove it. For decades, the puzzle remained completely untouched, and most researchers were highly doubtful that an answer would ever be found.

Now, a team of three brilliant researchers *Dongming Hua* (left) from National University of Singapore, *Antoine Song* (middle), a Caltech Professor, and *Stefan Tudose* (right) of Princeton University has delivered that missing proof. To solve it, they did something ingenious. They took the difficult shape problem out of geometry and completely transformed it into a question about random chance and statistics. The team changed the geometric challenge into a probabilistic framework and proved that this purely geometric question is mathematically equivalent to a beautiful question in probability theory regarding random vectors. Instead of looking at geometric shapes, look at a **subgaussian random vector** X (a vector whose tail probabilities decay at least as fast as a standard Gaussian/normal distribution).

The equivalent question becomes: Can *every* centered, 1-subgaussian random vector X in $\mathbb{R}^n$ be decomposed cleanly as the sum of a fixed q of standard Gaussian vectors G_i?

i.e.$X = G_1 + G_2 + \cdots + G_q$?

The team proved that any one subgaussian random vector in n dimensions can be written as the sum of three standard Gaussian random vectors. This equivalence allowed them to confirm the conjecture in Gaussian space and its combinatorial analog, bridging continuous and discrete mathematics.

By using this new view, they proved that the guess was 100% correct in both continuous and discrete mathematics. While this sounds very abstract, it has huge practical value for the modern world. This breakthrough is expected to help computer scientists design much faster computer algorithms, optimize machine learning systems, and make shipping and delivery logistics a lot more efficient.

Sources:

1. *https://doi.org/10.48550/arXiv.2605.10908*
2. *https://www.msn.com/en-us/news/insight/mathematicians-solve-talagrand-s-decades-old-convexity-conjecture/gm-GMB74E1304?gemSnapshotKey=GMB74E1304-snapshot-3*

5.6 Awards

5.6.1 German Researcher Gerd Faltings Receives the 2026 Abel Prize

German mathematician Gerd Faltings, director emeritus at the Max Planck Institute for Mathematics in Bonn, has been awarded the 2026 Abel Prize on May 26, 2026 in Oslo, Norway. Faltings is the first German researcher to win the Abel Prize. He is also one of the few mathematicians in the world to win both the Abel Prize and the Fields Medal (which he received in 1986). The award is endowed with 7.5 million Norwegian kroner (approximately 6,70,000 euros or $7,70,000 USD).

Citation: He was recognized "for introducing powerful tools in arithmetic geometry and resolving long-standing Diophantine conjectures of Mordell and Lang".

Gerd Faltings stands as one of the most transformative figures in modern mathematics. By bridging abstract algebraic geometry with number theory, he solved problems that had baffled researchers for decades.

Gerd Faltings was born on July 28, 1954, in Gelsenkirchen-Buer, Germany. His father was a physicist and his mother a chemist. He pursued mathematics and physics at the University of Münster, completing his doctorate in 1978 and his habilitation in 1981 under the supervision of *Hans-Joachim Nastold*. Faltings quickly gained a reputation for rapid, profound knowledge. In 1982, at the remarkably young age of 27, he was appointed a full professor at the University of Wuppertal, making him the youngest mathematics professor in Germany at the time.

Faltings achieved international stardom in 1983 by proving the Mordell Conjecture. Faltings did not just solve the conjecture; he revolutionized the tools used to approach it. Building upon the geometric frameworks of *Alexander Grothendieck* and the ideas of *S. Ju. Arakelov*, he proved several foundational theorems (including what is now known as Faltings' Theorem). His work on the finiteness of Galois representations and Tate modules provided the exact machinery needed to crack the problem. This breakthrough was a crucial stepping stone that later enabled *Andrew Wiles* to prove Fermat's Last Theorem in the 1990s.

Beyond the Mordell Conjecture, Faltings reshaped the landscape of arithmetic geometry. He extended his finiteness results to higher-dimensional spaces (abelian varieties), proving major cases of Serge Lang's conjectures. He developed "Faltings' Riemann-Roch Theorem" - a cornerstone of modern arithmetic intersection theory. He also introduced nearly Hodge structures, fundamentally altering how mathematicians study the Cohomology of Algebraic Varieties.

In 1986, he was awarded the Fields Medal. Shortly after, he moved to Princeton University, where he taught as a professor from 1985 to 1994. Faltings returned to Germany in 1994 to become a Director at the Max Planck Institute for Mathematics in Bonn. He spent the next three decades anchoring the institution as a global hub for geometry. Over his life, he has received numerous major honors in the field, including the Gottfried Wilhelm Leibniz Prize (1996), the King Faisal International Prize (2010), the Shaw Prize (2015), and culminating in the 2026 Abel Prize in Oslo.

Sources:

1. *https://www.mpg.de/26279645/gerd-faltings-2026-abel-prize?c=2249*
2. *https://www.zmescience.com/feature-post/natural-sciences/mathematics/gerd-faltings-abel-prize-2026/*

5.6.2 The 2026 Breakthrough Prizes in Mathematics

The Breakthrough Prize Foundation on April 18 announced the winners of the 2026 Breakthrough Prizes (the "Oscars of Science"), honoring scientists whose discoveries are significantly driving growth of human knowledge. The Breakthrough Prizes were created to celebrate the wonders of our scientific age. Co-founded by Sergey Brin, Priscilla Chan and Mark Zuckerberg, Julia and Yuri

Milner, and Anne Wojcicki, the prizes are now in their 14th year. This year, six Breakthrough Prizes of $3 million each were awarded. In addition, the Foundation recognized 15 early-career physicists and mathematicians, who share six $100,000 New Horizons Prizes. Three women mathematicians recently completing PhDs each receives a $50,000 Maryam Mirzakhani New Frontiers Prize.

The $3 million grand prize: Frank Merle: The prestigious 2026 Breakthrough Prize in Mathematics was awarded to French mathematician *Frank Merle* for his monumental work in nonlinear evolution equations. His work has significantly advanced the modern understanding of **nonlinear evolution equations** - the mathematical descriptions of how waves, fluids, and other dynamic systems change over time. His work has a particular focus on **singularities**: points where solutions to the equations surge to infinity. Alone and in collaborations, he has solved several fundamental problems, including proving that certain equations long thought to be well-behaved actually "**blow up**" - become infinite - in finite time. Perhaps most remarkable is his work on the nonlinear version of the famous **Schrödinger equation** from quantum physics. In early work, he made a complete classification of all the ways this equation's solutions can blow up.

New Horizons in Mathematics ($1,00,000 Prize): Recognizing brilliant early-career researchers who settled long-standing problems. 2026 recipients are:

Otis Chodosh (Stanford) has settled several questions in differential geometry that had been open since the 1970s and 1980s. With Chao Li, he proved a central conjecture in the field concerning a broad class of higher-dimensional spaces known as "aspherical manifolds." With Christos Mantoulidis, he resolved a key problem in geometric analysis of minimal surfaces - surfaces that locally minimize their area, like soap films.

Hong Wang (NYU / IHES) has resolved or made advances on a family of notoriously difficult problems in harmonic analysis - a branch of mathematics that studies functions by decomposing them into fundamental components. With Josh Zahl, she proved the Kakeya conjecture in three dimensions, one of the most famous open problems in the field: it concerns how much space is needed to rotate a needle through every possible direction.

Vesselin Dimitrov (Caltech) & *Yunqing Tang* (UC Berkeley) have solved long-standing problems in number theory that had resisted all previous approaches. With Frank Calegari, they proved the "unbounded denominators conjecture," about a fundamental class of objects known as modular forms, using methods that surprised experts in the field. Most recently, again with Calegari, they proved the irrationality of a number related to a basic infinite series - the first result of its kind since Apéry's celebrated work forty-five years ago.

Maryam Mirzakhani New Frontiers prize ($ 50,000 Prize): Honoring exceptional early-career women mathematicians. 2026 recipients are:

Amanda Hirschi (Institut de Mathématiques de Jussieu-Paris Rive Gauche) at Sorbonne Université has produced a number of significant papers in symplectic topology, a field studying higher- dimensional surfaces with a geometric structure that generalizes the mathematics of classical mechanics. With co-authors, she developed a powerful new framework that leads to major simplifications in the foundations of Gromov-Witten theory.

Anna Skorobogatova (ETH Zurich) has made notable contributions in geometric measure theory, which uses techniques from analysis to tackle geometric problems such as finding surfaces of minimal area. In a series of papers with collaborators, she resolved a long-standing question about the structure of singularities of area-minimizing surfaces, completing a program that spanned over sixty years.

Mingjia Zhang (Princeton / IAS) works on higher-dimensional objects in number theory called Shimura varieties. She provided a way to better understand the geometry of Mantovan's celebrated "product formula" in number theory.

Source: *https://breakthroughprize.org/News/98*

5.6.3 Stanford, IAS Scholars Win 2026 Shaw Prize in Mathematical Sciences

Stanford University professor *Emmanuel Candès* (left) and *Camillo De Lellis* (right) of the Institute for Advanced Study (IAS) have been named the co- recipients of the 2026 Shaw Prize in Mathematical Sciences. The prestigious international honor recognizes their groundbreaking advancements that have fundamentally reshaped the fields of signal processing, data science, and fluid dynamics.

Established in 2004 by the late Hong Kong media tycoon *Run Run Shaw*, the annual award celebrates exceptional achievements in astronomy, life science and medicine, and mathematical sciences. The two laureates will split a $1.2 million prize alongside receiving a medals and certificates.

Candès, 56, a French-born statistician at Stanford University, was cited for his pioneering role in developing "compressed sensing". This revolutionary mathematical method allows computers to accurately reconstruct high-resolution signals and images from highly incomplete data, far exceeding the limits of traditional techniques. In simple terms, compressed sensing makes it possible to recover accurate information from far fewer measurements.

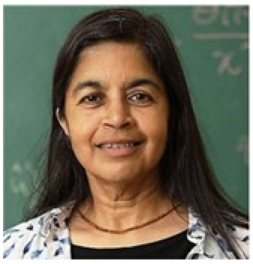
Candès later expanded this framework to allow the reconstruction of low-rank matrices from partial observations, a breakthrough that has become foundational to modern machine learning. Recently, he and his students introduced a new statistical filtering method designed to minimize false discoveries in large-scale data analysis, promising a major shift in contemporary statistics.

De Lellis, 50, an Italian-born mathematician based at the Institute for Advanced Study in Princeton, New Jersey, was honored for his profound contributions to geometric analysis and fluid dynamics. He famously tackled the 19th-century Plateau problem, which examines minimal surfaces. Building upon a massive, 1,700-page foundational text by American mathematician *Frederick Almgren*, De Lellis successfully simplified, completed, and extended the theory to complex geometric settings.

Furthermore, De Lellis and his collaborators fully resolved the long-standing Onsager conjecture regarding the Euler equations of fluid motion. By pioneering a "convex integration" method, they proved that energy conservation law fails when fluid flow becomes sufficiently rough or turbulent.

Source: *https://e.vnexpress.net/news/tech/personalities/stanford-ias-professors-awarded-1-2m-shaw-prize- for-mathematics-breakthroughs-5079984.html*

5.6.4 Global Pride: Indian-Origin Mathematician Nalini Joshi Named NSW Scientist of the Year



In a historic milestone, Indian-origin mathematician *Prof. Nalini Joshi* has been named New South Wales' scientist of the year, becoming the first mathematician to win Australia's prestigious top science honor. Currently holding the chair of applied mathematics at the university of Sydney, she previously broke barriers as the university's first female mathematics professor.

Prof. Joshi is a world leader in integrable systems, solving complex nonlinear equations that govern chaotic, real-world phenomena. Though deeply theoretical, her pioneering research directly drives critical real-world innovations:

Data Networks: Optimizing fibre-optic communications that form the backbone of the global internet.

Climate Science: Enhancing advanced mathematical models to track sensitive environmental systems.

Quantum Security: Developing post-quantum cryptography to protect digital banking and infrastructure from future quantum computer hacks.

A passionate mentor, Prof. Joshi continues to advocate for long-term mathematical research as the foundational pillar for all technological progress.
Source: *https://www.indiatoday.in/education-today/gk-current-affairs/story/how-mathematics-helped-nalini- joshi-earn-new-south-wales-scientist-of-the-year-title-2850057-2026-01-11*

5.7 Obituary

5.7.1 Groundbreaking mathematician Heisuke Hironaka passes away at 94

Prof. Heisuke Hironaka, an influential Japanese mathematician passed away in Tokyo on March 18, 2026 at the age of 94. He is celebrated for his revolutionary 1964 proof regarding the resolution of singularities, which earned him the prestigious Fields Medal in 1970. Hironaka was awarded the highest honor in mathematics in 1970 for his proof on the resolution of singularities for algebraic varieties over fields of characteristic zero.
This groundbreaking work provided solutions for complex geometrical spaces and analytic functions. The work of *Gerd Faltings* and *Masaki Kashiwara*, the past two winners of the Abel Prize relied on insights built directly on Hironaka's breakthrough ideas.
Heisuke Hironaka was born in a village in Japan on April 9, 1931. He received a bachelor's degree from Kyoto University in 1954. He stayed on for graduate work when *Oscar Zariski*, a Harvard mathematician in the field of algebraic geometry, visited Kyoto and, impressed by the work the student had done in algebraic geometry, suggested that he pursue his doctorate at Harvard. With Zariski as his adviser, he completed his Harvard doctoral thesis in 1960 and began teaching at Brandeis University. He later taught at Columbia University from 1964 to 1968 and then joined Harvard, where he remained on the faculty until becoming emeritus in 1992.

Returning to Japan, he served as the director of the Research Institute for Mathematical Sciences at Kyoto University (1983-1985) and as president of Yamaguchi University (1996-2002). In 1984, he founded the Japan Association for Mathematical Sciences to support the seminars and also an exchange program that allowed Japanese students and early career researchers to study in the United States. In Japan, Hironaka gave lectures and wrote popular books.
Sources:

1. *https://www.math.harvard.edu/in-memory-of-professor-emeritus-heisuke-hironaka/*
2. *https://www.nytimes.com/2026/03/25/science/heisuke-hironaka-dead.html*

5.7.2 Gladys West, mathematician whose work made GPS possible, passes away at 95

Gladys West, the pioneering mathematician whose critical satellite geodesy work shaped the foundation of modern GPS technology passed away on January 17, 2026 at the age of 95. Her mathematical algorithms and modeling of the Earth's shape remain a quiet, daily pillar of global navigation.

Born in 1930 and raised on a farm in an isolated rural Virginia, she broke barriers by graduating as high school valedictorian. She earned bachelor's and master's degrees in mathematics from Virginia State College (now Virginia State University). In 1956 Gladys Mae Brown was hired as a mathematician by the U. S. Naval Proving Ground (later the Naval Surface Warfare Center), a weapons laboratory in Dahlgren, Virginia. Over a 42-year career, she programmed massive early computers and processed satellite data.

In the 1980s, her painstaking mathematical calculations produced an extremely precise, geodetic model of the Earth's shape. Her algorithms became the mathematical backbone that allows GPS satellites to calculate exact, real-time positions on Earth. Despite playing a foundational role

in technology billions use daily, she worked in near-secrecy for decades. She retired in 1998 and went on to earn a Ph.D. from Virginia Tech at age 70. She was later inducted into the Air Force Space and Missiles Pioneers Hall of Fame in 2018.
Source: *https://thezebra.org/2026/01/18/dr-gladys-west-mathematician-whose-work-made-gps-possible- dies-at-95/*

5.7.3 An eminent Indian mathematician Ravi Achutha Rao passed away at 72

An eminent Indian mathematician and a former Professor and Dean of Mathematics Faculty (during 2014-2016), Tata Institute of Fundamental Research (TIFR), Mumbai passed away on 5th May 2026 at the age of 72.

Born on April 14, 1954, had his early education in Mumbai. He completed his doctoral studies (Ph.D.) from TIFR, Mumbai, joined the Faculty of Mathematics at TIFR in 1977 and became professor in August 1991, with a highly productive tenure till he retired in 2019.
Prof. Ravi Rao's research focuses primarily on Classical Algebraic K- Theory, Commutative Algebra, and advanced Linear Algebra.
His work heavily interfaces with some of the most profound problems in affine geometry and matrix theory, building directly upon the foundational work of Fields Medallists Daniel Quillen and Andrei Suslin. Prof. Rao is highly celebrated for his work extending the Quillen-Suslin theorem (which settled Serre's conjecture that every finitely generated projective module over a polynomial ring is free). His papers generalized these local-global principles to classical groups, general linear groups, and relative variants. His breakthrough improvements on these structures have been published in top- tier mathematical journals, including the highly prestigious Publications de l'IHÉS and Mathematische Annalen.
Beyond his direct algebraic contributions, Prof. Rao played a monumental role in preserving and distributing Indian mathematical heritage. He spearheaded the digitization and free soft-copy availability of the prestigious TIFR Lecture Note Series. Furthermore, he was fundamentally involved in the digital preservation and publication of the Collector's Edition of the Notebooks of Srinivasa Ramanujan. He was also actively involved in outreach activities towards promoting mathematics, through Bombay Mathematical Colloquium and other similar platforms.
He was a Fellow of the Indian Academy of Sciences as well as the Indian National Science Academy. Ravi Professor Rao had a lifelong interest in discovering and nurturing mathematical talent and touched many lives. He was a caring human being.
He had a warm and loving family. His wife Dhvanita, a Professor of Mathematics and a devoted partner in his outreach activities, sadly predeceased him in 2022. He is survived by a son, Chinmay, and a daughter, Deepna, and many grateful friends and students.

5.7.4 A distinguished mathematician Ameer Athavale passed away at 71

Professor Ameer Athavale (1955-2026) A distinguished mathematician, teacher, and mentor passed away on June 4, 2026, at the age of 71. Dr. Athavale was a notable Indian mathematician specializing in Functional Analysis and Operator Theory, particularly known for his extensive research into subnormal operator tuples. He spent a significant portion of his academic career as a Professor in the Department of Mathematics at IIT Bombay and had also been affiliated earlier with Savitribai Phule Pune University.
Professor Athavale earned his B.Sc. from S. P. College, Pune, M.Sc. from University of Poona, and doctoral degree from Indiana University in 1987 under the supervision of Professor J. B. Conway. His research interests lay in functional analysis and multivariable operator theory. He made pioneering contributions to the theory of commuting subnormal operators. In particular, his fundamental result establishing the subnormality of spherical isometries led to

substantial advances in multivariable operator theory. His research, published in leading mathematical journals, had a profound and lasting impact on the development of modern multivariate operator theory.
Professor Athavale was also a highly respected teacher and mentor who inspired and guided several generations of mathematics students. His passing is a profound loss to the mathematical community, both in India and around the world. His dedication to research, teaching, and the advancement of mathematics will be remembered for years to come, and his enduring contributions to operator theory will continue to inspire future generations.

5.7.5 Professor Ravindra Bhalchandra Bapat, a distinguished Indian mathematician passed away at 72

A renowned mathematician and former President of Academy of Discrete Mathematics and its Applications (ADMA), Prof. Ravindra B. Bapat passed away on 27th June, 2026 in Mumbai, following a heart attack.

Born on December 20, 1954, Bapat had his early education in Mumbai. He earned his B.Sc. From University of Mumbai, M.Stat from ISI Delhi and Ph.D. in 1981 from University of Illinois, USA under the guidance of Prof. T. E. S. Raghavan.
After a short stint of teaching at Northern Illinois University and returning briefly to the Department of Statistics at the University of Mumbai, Prof. Bapat dedicated most of his academic life to ISI Delhi, where he became a senior Professor in the Stat-Math Unit, and later served as the Head of the ISI Delhi Centre (2007-2011). He has also taught as a Visiting Professor at Ashoka University.
His contributions to matrix theory, linear algebra, combinatorial matrix theory, matrices and graphs, generalized inverses, and statistics are remarkable. He was a Fellow of the Indian Academy of Sciences, the Indian National Science Academy, and was awarded the prestigious J. C. Bose Fellowship in 2009. He served as the president of the Indian Mathematical Society during 2007-2008 and as the President of ADMA during 2014-2016. It was during his tenure as the President of IMS that a postal stamp on IMS was released. He also acted as the National Coordinator for the Mathematics Olympiad Program in India for several years, mentoring generations of young mathematical talent.
He played a key role in the ICLAA series and in the early development of CARAMS (MAHE). Apart from authoring several outstanding research articles, he used to write on various aspects of Mathematics in Marathi language. His book 'Graphs and Matrices' is a highly rated book.
He is survived by his wife Aruna and son Sudeep, who is a faculty member in the School of Management at IITB.
With his demise, the mathematical community has lost one of its finest scholars.

□□□

6. Problem Corner

Udayan Prajapati
Mathematics Department, St. Xavier's College, Ahmedabad
Email: udayan.prajapati@gmail.com

In the October 2025 issue of TMC Bulletin, we posed two problems, one from Algebra and other form Number Theory. We give below a solution to the problem from Number Theory, provided by the problem proposers. As yet no solutions are received for some of the problems of past issues. We hope we will get solutions of some of them for inclusion in the forthcoming issues.
Also, in this issue we pose two problems, one from Number Theory and one from Analysis for our readers. Readers are invited to email their solutions to Dr. Udayan Prajapati (*ganit.spardha@gmail.com*), Coordinator, Problem Corner, before 30th August, 2026. Selected innovative solutions will be published in a subsequent issue of the bulletin.
Problem from Number theory posed in the October issue by K. B. Subramaniam from Bhopal and Amarnath Murthy from Ahmedabad:
Prove that for a given prime p there exists a corresponding positive integer n_0 such that for all integers n greater than n_0, there exists some positive integer k (depending on n) such that $n - kp$ is a prime.
Solution: Let s be any integer such that $1 \leq s < p$. Then p and s are relatively prime and hence by Dirichlet's theorem there are infinitely many primes of the form $s + up$, where u is some positive integer. For $s = 1, 2, \dots, p-1$, choose any prime say p_s of the form $s + up$.
Let $S = \{p_1, p_2, \dots, p_{p-1}\}$ and $n_0 = Max(S)$.
Let $n > n_0$.
If n is a multiple of $p, n = pm$, then as $n > n_0, n > p$, so $n - kp$ is p, a prime, for $k = m - 1 > 0$.
If n is not a multiple of p then $n \equiv s \pmod p$ for some s such that $1 \leq s \leq p - 1$.
For this $s, p_s \equiv s \pmod p), p_s$ is a prime number and $n > n_0 \leq p_s$.
Therefore, $0 < n - p_s$ and $n - p_s \equiv 0 \pmod p$ and hence, there exists a positive integer k such that $n - p_s = kp$, i.e. $n - kp = p_s$. Thus, in any case we get that for $n > n_0$, $n - kp$ is a prime for some positive integer k.

Problems for this issue

Problem 1: Problem 1: (Posed by K. B. Subramaniam from Bhopal and Amarnath Murthy from Ahmedabad) Prove that there are infinitely many perfect squares with the property that the sum of their digits is also a perfect square taking infinitely many values nontrivially.

Problem 2: (Posed by Udayan Prajapati from Ahmedabad)
Prove that every real number x can be expressed as $x = \pm c_1 \pm c_2 \pm c_3 + \dots \pm c_n$ for some positive integer n and some elements $c_1, c_2, c_3, \dots, c_n$ of the Cantor set.

□□□

7. International Calendar of Mathematics Events

Ramesh Kasilingam
Department of Mathematics, IITM, Chennai; Email: rameshk@iitm.ac.in

August-2026

- August 2-7, 2026, 3rd International Conference on AI Sensors and Transducers (AIS 2026) Jeju, Korea. *sciforum.net/event/AIS2026*
- August 3-7, 2026, Partial Differential Equations for Many Particles Systems, ICERM/ Brown University, Providence, Rhode Island. *icerm.brown.edu/program/topical_workshop/tw-26-mps*
- August 3-14, 2026, Poisson 2026 Summer School and Conference, Antwerp and Leuven (Belgium). *wis.kuleuven.be/events/2026_poisson/poisson2026*
- August 10-14, 2026, AIM Workshop: Gibbsian Line Ensembles, American Institute of Mathematics, Pasadena, California. *aimath.org/workshops/upcoming/gibbsianline/*
- August 17-19, 2026, International Conference on Enumerative Combinatorics and Applications, ICECA 2026, Virtual, August 17-19, 2026, Virtual Event, Hosted by the University of Haifa. *ecajournal.haifa.ac.il/Conference/ICECA2026.html*
- August 17-21, 2026, Teaching Higher Category Theory with Computers, Brown University, Providence, Rhode Island. *icerm.brown.edu/program/topical_workshop/tw-26-thc*
- August 17-21, 2026, 28th International Summer School on Global Analysis and its Applications: Mathematical Foundations of Physical Field Theories, Transilvania University of Brasov, Romania. *www.lepageri.eu/summer-school-2026*
- August 17 - December 18, 2026, Representation Theory Under the Influence of Quantum Field Theory, SL Math 17 Gauss Way Berkeley CA 94720. *www.slmath.org/programs/381*
- August 17 - December 18, 2026, Motivic Homotopy Theory: Connections and Applications, SL Math 17 Gauss Way Berkeley CA 94720. *www.slmath.org/programs/384*
- August 24-28, 2026, AIM Workshop: Geometric Properties of Hilbert Schemes, American Institute of Mathematics, Pasadena, California. *aimath.org/workshops/upcoming/geometrichilbert/*
- August 20-25, 2026, The 16th Symposium on Generating Functions of Special Numbers and Polynomials and Their Applications (GFSNP 2026) Baotou City, Inner Mongolia, China. *https://gfsnpsymposia.com/*
- August 31 - September 5, 2026, XVI International Conference of The Georgian Mathematical Union Batumi Shota Rustaveli State University, Batumi, Georgia. *https://gmu.gtu.ge/conferences/*

September-2026

- September 2-6, 2026,10th International Conference of Mathematical Sciences (ICMS 2026) Marmara University, Istanbul, Türkiye. *https://etkinlik.marmara.edu.tr/icms*
- September 8-10, 2026, 13th International Congress on Fundamental and Applied Sciences 2026, Biruni University, Topkapi Campus, Istanbul, Türkiye. *https://icfas2026.intsa.org*
- September 10-12, 2026, International Conference on Mathematics and Mathematics Education, Sivas Cumhuriyet University, Sivas, Türkiye. *https://theicmme.org/*

- September 24-26, 2026, 5th International Conference on Numerical Analysis, Approximation Theory and Stochastic Methods, Babes-Bolyai University, Faculty of Mathematics and Computer Science, Cluj-Napoca, Romania. *https://math.ubbcluj.ro/naatsm2026/*
- September 25-26, 2026, International Conference on “Innovation in Nonlinear Science and its Applications” & 35th Annual Conference of Rajasthan Ganit Parishad Anand International College of Engineering, Jaipur, Rajasthan, India. *https://icinsa-2026.vercel.app/index.html*
- September 26 - October 3, 2026, 8th International Conference on Analysis and Applied Mathematics, Antalya, Türkiye. *https://icaam-online.org*
- September 28 - October 2, 2026, Mirror Symmetry, Calabi-Yau Three folds, and Connections to Physics Brown University, Providence, Rhode Island, USA. *https://icerm.brown.edu/program/semester_program_workshop/sp-f26-w1*

October 2026

- October 3-4, 2026, 2026 Fall Eastern Sectional Meeting, George Washington University, Washington, DC, USA. *https://www.ams.org/meetings/sectional/2332_program.html*
- October 3-4, 2026, Quebec-Maine Number Theory Conference Laval University, Quebec City, Quebec, Canada. *https://maine-quebec.mat.ulaval.ca/*
- October 3-4, 2026, Palmetto Number Theory Series (PANTS) XLI, Georgia Tech, Atlanta, Georgia, USA. *https://sites.google.com/view/pants-xli-gt/home*
- October 5-9, 2026, XI International Meeting ALTENCOA11-2026, Universidad de Nariño, San Juan de Pasto, Colombia. *https://www.udenar.edu.co/altencoa-11-2026/*
- October 10-11, 2026, 2026 AMS Fall Southeastern Sectional Meeting, Kennesaw State University, Kennesaw, Georgia, USA. *https://www.ams.org/meetings/sectional/2339_program.html*
- October 24-25, 2026, 2026 AMS Fall Central Sectional Meeting, University of Minnesota Duluth, Duluth, Minnesota, USA. *https://www.ams.org/meetings/sectional/2333_program.html*
- October 25-28, 2026, Modular Forms, Geometry, Complex Analysis and Applications Monastir, Tunisia. *https://oulednaj.github.io/modular-forms-complex-analysis-2026/*
- October 28-30, 2026, Recent Outcomes in Birational and Complex Algebraic Geometry (ROB-AG), Stony Brook University and the Simons Centre for Geometry and Physics, Stony Brook, New York, USA. *https://nathanchenmath.github.io/ROB-AG*

November 2026

- November 5-8, 2026, The Mediterranean International Conference of Pure & Applied Mathematics and Related Areas (MICOPAM 2026), Sherwood Dreams Resort Hotel, Antalya, Türkiye. *https://micopam.com/*
- November 7-8, 2026, 2026 AMS Fall Western Sectional Meeting, Arizona State University, Tempe, Arizona, USA. *https://www.ams.org/meetings/sectional/2335_program.html*
- November 16-19, 2026, SIAM Conference on Imaging Science (IS26), Salt Palace Convention Centre, Salt Lake City, Utah, USA. *https://www.siam.org/conferences-events/siam-conferences/is26/*
- November 16-20, 2026, SIAM Conference on Mathematics of Data Science (MDS26), Salt Palace Convention Centre, Salt Lake City, Utah, USA. *https://www.siam.org/conferences-events/siam-conferences/mds26/*

- November 19-20, 2026, SIAM International Conference on Data Mining (SDM26) Salt Palace Convention Center, Salt Lake City, Utah, USA.
https://www.siam.org/conferences-events/siam-conferences/sdm26/

- November 19-21, 2026, International Conference on Global Trends in Mathematics and Ethno-Mathematics: Pure and Applied Perspectives, Department of Mathematics, Dibrugarh University, Assam, India. *https://icgem.in*

- November 26-28, 2026, International Conference on Differential Geometry, Mathematical Physics, General Relativity and Computing 2026, The Bhawanipur Education Society College, Kolkata, West Bengal, India. *https://sites.google.com/view/icdg2026*

- November 27-29, 2026, Global Conference on Mathematics and Applications (GCMA) Online. https://bscihub.com/e/GCMA November 30, - December 4, 2026, Derived Categories in Geometry and Representation Theory, Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU), The University of Tokyo, Kashiwa, Japan.
https://indico.ipmu.jp/event/515/

December 2026

- December 7-11, 2026, Computational Methods and Function Theory (CMFT 2026): International Conference, Indian Institute of Technology Madras, Chennai, Tamil Nadu, India. *https://ge.iitm.ac.in/cmft-2026*

- December 9-11, 2026, The International Conference on Mathematics, Statistics and Their Applications (ICMSA 2026), Information Technology Service Centre (ITSC), Chiang Mai University, Thailand. *https://iasc-ars2026.icdi.cmu.ac.th/ICMSA_IMT*

- December 14-18, 2026, Workshop on Euler Systems and p-adic L-functions, University of Santiago de Compostela, Galicia, Spain.
https://sites.google.com/view/workshop-on-euler-systems-and-/

- December 14-16, 2026, MathConnect2026 - 2nd International Conference on Mathematics and its Applications, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia. *https://mathconnect26.com/en*

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Indo-European Conference (at S. P. Pune Univ.): Prof. Manjul Bhargava with Profs. T. Venkatesh, Ravindra Kulkarni, M. M. Shikare, S. Kendre, V. V. Joshi, S. B. Dhotre, Y. M. Borse

INDO-EUROPEAN CONFERENCE ON MATHEMATICS, JANUARY, 2026

Poster presentation & Informal Discussion

Interactive Session at IISER, Pune

Informal Discussions during Lunch hour

INDO-EUROPEAN CONFERENCE ON MATHEMATICS – JANUARY 2026

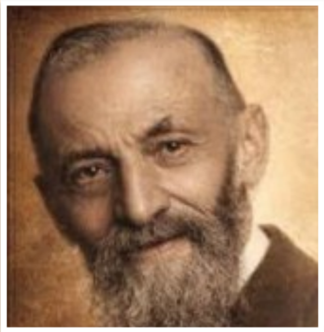
Inaugural function - releasing of souvenir at SPPU

Student participants with Prof. Manjul Bhargava

Valedictory function -IECM-2026 at IISER, Pune

William Burnside (02 July 1852 - 21 Aug. 1927)

An English mathematician. His early research was in hydrodynamics which involved the group of linear fractional transformations of a complex variable. He was elected as a Fellow of the Royal Society in 1893. Known mostly as an early researcher in the theory of finite groups. In 1897 he published The Theory of Groups of Finite Order. Burnside conjectured that every finite group of odd order is soluble which was proved by Feit and Thompson in 1962.



Giuseppe Peano (27 Aug. 1858 - 20 April 1932)

An Italian mathematician and glottologist. The founder of symbolic logic. His interests centred on the foundations of mathematics and on the development of a formal logical language. Known for Peano axioms of the natural numbers. Made key contributions to the modern rigorous and systematic treatment of the method of mathematical induction. In 1888 he published the book Geometrical Calculus. Invented 'space-filling' curves.

Charles Sanders Peirce (10 Sept. 1839 - 19 April 1914)

An American philosopher, logician and mathematician. Appreciated largely for his contributions to logic, mathematics, philosophy, scientific methodology, semiotics. Known as "the father of pragmatism". Defined the concept of abductive reasoning, rigorously formulated mathematical induction and deductive reasoning. As early as in 1886, he saw that logical operations could be carried out by electrical switching circuits.

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43/16, Gunadhar Bungalow, Erandawane, Pune 411004, India.
Email: tmathconsort@gmail.com   Website: themathconsortium.in

Contact Persons

Prof. Vijay Pathak   Prof. S. A. Katre
vdpmsu@gmail.com (9426324267)   sakatre@gmail.com (9890001215)

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