SIR ISAAC NEWTON

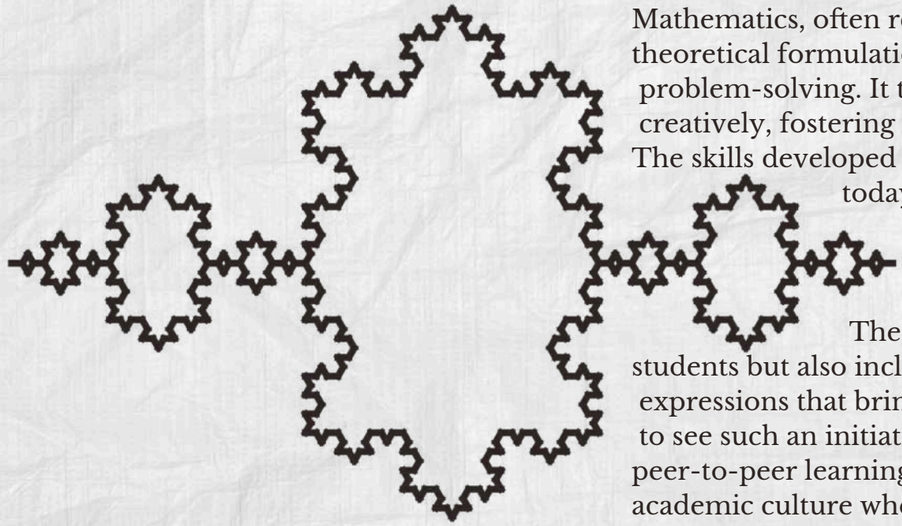
(1643–1727)
English polymath active as a mathematician, physicist, astronomer, alchemist, theologian, and author.

Artwork by HARLEEN KAUR
Batch of 2025

The Scrolls of MatheMAGIC Have Been Unleashed!

Hidden within these pages are a few ancient scrolls of mathematical mystery. Solve them all, face the Final Trial, and claim your place in the MatheMAGIC Wall of Fame. To face the Final Trial, there is a QR code on the back cover. Scan it and get a chance to be featured on our social media handles.

Principal's Note



IT GIVES me immense pleasure to extend my warm greetings to the Department of Mathematics on the occasion of releasing its departmental magazine. This publication stands as a reflection of the department's consistent pursuit of excellence, innovation, and intellectual curiosity.

Mathematics, often referred to as the queen of sciences, transcends theoretical formulations and enters the very core of logical reasoning and problem-solving. It trains the human mind to think analytically and creatively, fostering a mindset that is both disciplined and imaginative. The skills developed through mathematical thinking are indispensable in today's world, where data-driven decisions, technological advancements, and interdisciplinary approaches increasingly rely on mathematical applications.

The magazine not only showcases the scholarly work of students but also includes thought-provoking articles, puzzles, and creative expressions that bring out the versatility of mathematics. It is heartening to see such an initiative that encourages academic expression and inspires peer-to-peer learning within the college community. It reflects a vibrant academic culture where knowledge is not only acquired but also shared and celebrated.

I commend the efforts of the editorial team, faculty mentors, and student contributors whose collective enthusiasm and hard work have made this magazine a reality. As you turn the pages, I hope you will discover ideas that challenge your thinking, deepen your understanding, and ignite your curiosity.

PROF. GURMOHINDER SINGH

Principal

Sri Guru Tegh Bahadur Khalsa College

Scroll I: The Time Loop Riddle

I'm a number. Multiply me by 4, add 6, divide by 2, and subtract 3 — you'll get me back.

A. 2 B. 3 C. 4 D. 6

Fun Fact: Self-referential problems are like the math version of time travel. Solve it, and you're right back where you started!

Convenor's Note

I'M DEEPLY honoured and delighted to launch the inaugural edition of Shoonya's magazine. This magazine marks a new beginning for our society, providing a platform to showcase the creativity, ideas, and achievements of our members. It is a reflection of the hard work, enthusiasm, and spirit that define Shoonya. I extend my heartfelt congratulations to the entire team for their dedication in bringing this vision to life. I am confident that this magazine will inspire many more contributions in the future and strengthen the bond within our vibrant community.

A special word of appreciation goes to our student editors — Naman Taggar, Krishna Sharma, Shrish Kumar Sinha, Gurnihal Singh, and Rudravisek — whose initiative, commitment, and hard work have been instrumental in bringing this magazine to life. From conceptualising the idea to carefully curating each section, their dedication has been truly commendable. It is through their relentless efforts and passion that we have reached such an amazing outcome for our inaugural edition. We are proud to have such inspiring leadership among our students and look forward to many more milestones together.

DR. RUCHI KAUR
Convener
Department of Mathematics

NAMAN TAGGAR

KRISHNA SHARMA

SHRISH KUMAR SINHA

GURNIHAL SINGH

RUDRAVISEK SAHU

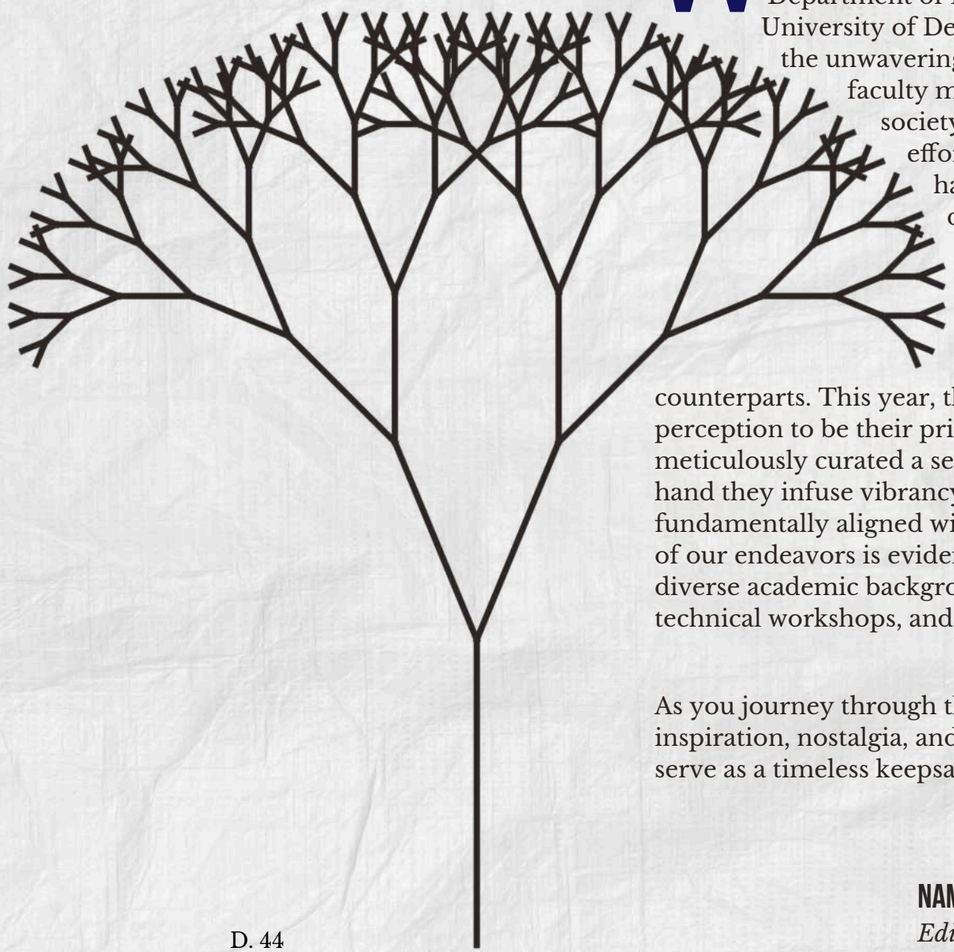
Scroll II: The Secret Sequence

Can you break the pattern? 2, 6, 12, 20, 30, ___

A. 36 B. 40 C. 42 D. 44

Fun Fact: Hidden formulas are the magic behind sequences. Detecting them is like uncovering a spell!

Editors' Note



WE ARE absolutely thrilled to unveil the inaugural edition of MATHOS, the annual magazine proudly brought to you by Shoonya, the society of Department of Mathematics, Sri Guru Tegh Bahadur Khalsa College, University of Delhi. This cherished publication stands as a testament to the unwavering support and motivation provided by our esteemed faculty members, the cohesive and cooperative spirit of our society, and above all, the collective dedication and tireless efforts of our entire Editorial Team. It is through the harmonious synergy of these integral elements that this document has evolved into the precious representation of our Mathematics Department and Shoonya that it embodies today.

Often, departmental societies are perceived as mundane compared to their arts and cultural counterparts. This year, the members of our society adopted challenging this perception to be their primary goal. With this objective in mind, Shoonya meticulously curated a series of events and activities designed such that on one hand they infuse vibrancy and excitement, while on the other are also fundamentally aligned with the subject of Mathematics. The resounding success of our endeavors is evident by the overwhelming participation of students from diverse academic backgrounds in all our events ranging from fun activities to technical workshops, and most definitely in the flagship fest — Wronskian.

As you journey through the pages of MATHOS, we invite you to relive the inspiration, nostalgia, and camaraderie that define our year. May this magazine serve as a timeless keepsake of our collective memories and achievements.

NAMAN TAGGAR
Editor-in-Chief

KRISHNA SHARMA
Associate Editor

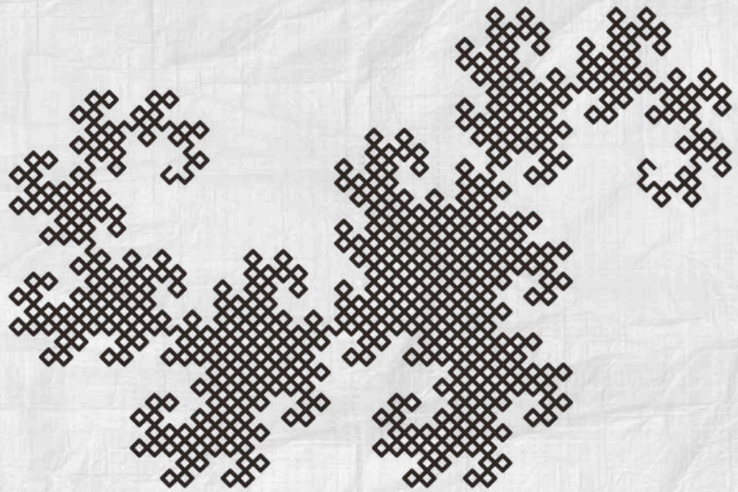
SHRISH KUMAR SINHA
Associate Editor

GURNIHAL SINGH
Editor

RUDRAVISEK SAHU
Editor

GURSHEEN KAUR

DIVYA SHARMA



Scroll III: The Puzzle of the Golden Balance

Only three weighings to reveal the heavier orb among eight. Can you do it?

A. 2 B. 3 C. 4 D. 5

Fun Fact: This ancient logic challenge is said to be solved by kings and philosophers. Welcome to the art of smart!

From President & Vice-President

It feels truly special to write this note as the President of Shoonya. This year has been a wonderful journey — full of learning, laughter, challenges, and growth. At Shoonya, we have always tried to create a space where everyone feels welcome, where ideas are shared freely, and where we all can celebrate the beauty of mathematics in our own unique ways. From academic events to fun activities, each moment has been about coming together as a community and making memories.

I am deeply thankful to our teachers for their constant support, and to every student who contributed with their time, energy, and spirit. It's because of all of you that Shoonya continues to grow stronger every year. As you flip through the pages of this magazine, I hope you can feel the passion and teamwork that went into everything we did. Here's to the wonderful journey so far and to many more milestones ahead.

GURSHEEN KAUR
President

"With great power comes great responsibility."

Words, when used thoughtfully, are like X-rays — they cut through everything and leave a lasting impact. It is with immense pride that I present MATHOS — the inaugural edition of the Department of Mathematics' annual magazine. More than just a collection of articles, it is a reflection of curiosity, hard work, passion, and the relentless spirit of our department's students. MATHOS invites readers to view mathematics not just as a subject, but as a living journey filled with creativity and wonder.

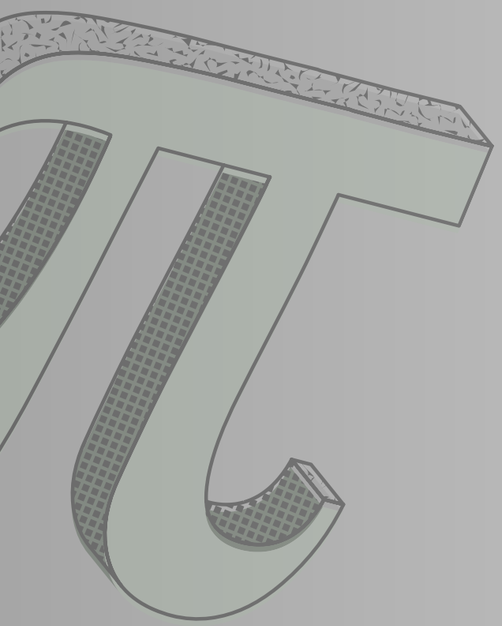
Serving as Vice President has been a profound honour. This journey taught me that leadership is rooted not in titles, but in values, morals, manners, and character — the true measures of a person. True strength is standing firm when challenges arise, unshaken by the odds.

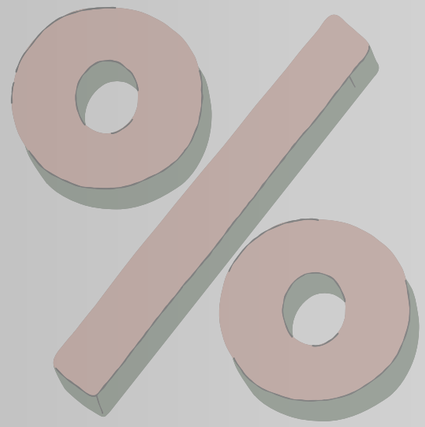
This magazine would not have been possible without the support of our convenor, Mrs. Ruchi Kaur Ma'am, whose guidance has been our constant strength. I am also deeply grateful to my beloved friend Naman Taggar and his dedicated team, whose tireless efforts brought MATHOS to life.

I hope this magazine will be as memorable for you as it has been for us — a milestone in the journey of the Department of Mathematics. May we continue to move forward, unafraid and undefeated.

DIVYA SHARMA
Vice-President

Table of Contents





Scroll IV: Diagonal Dimensions

A square hides a mystical length inside — its diagonal. Find it if the area is 144 cm^2.

A. 12 B. 144 | C. 12 2 D. 6 2

Fun Fact: Geometry unveils secrets with every corner. Pythagoras would be proud.

Scroll V: Horse-Trading Trickery

He buys and sells again — but what's his total treasure gained?

A. ₹10 B. ₹20 C. ₹30 D. ₹50

Fun Fact: Profit puzzles train your mind in real-life math wizardry — the kind merchants once used on scrolls and sand!

1

FACULTY GALLERY

Scroll VI: Wordsmith's Code

"FOUR" = 4, "FIVE" = 5. So what's "NINE"?

A. 9 B. 4 C. 3 D. 2

Fun Fact: Language and math are closer than they seem. This riddle hides in plain sight!

Mrs. Daljeet I. P. Singh
Associate Professor

"The most inspiring teacher I meet in college. Women like her are making ways for women like us. Her resilience, dedication, politeness and calmness is her strength and I learned that how important these qualities are to be a good leader and a good human being. From you ma'am I learned that life is a full circle and one will definitely get what they work hard for in one way or other. Thank you for being supportive in everything and a sense of home and security away from home.

Mr. Virendra Kumar Mehra
Associate Professor

"VKM Sir is an exceptional educator who blends deep knowledge with a student-friendly approach. Always motivating us to give our best and believe in ourselves

Mrs. Sunderjeet Kaur Bhatia
Associate Professor

"Sunderjeet mam is one of the most loving and caring teachers. She is extremely polite and gentle, and always approachable with any doubt or question.,

Mrs. Amarpreet Kaur Sabherwal
Assistant Professor

"She is one of the best teachers of our college. She always guides in right way. She not just teach us the concepts but always try to make us understand concepts and relate it to our previous knowledge.

Prof. Satish Verma
Professor

"He is very hardworking and intelligent teacher. His knowledge of subject is unbeatable. I really like his will to learn more and more. I wish Sir that in Future I will become as confident and knowledgeable as you.

Mrs. Jasvinder Kaur Bhalla
Associate Professor

"She is one of the sweetest members of the faculty, teaching in a way that is easy and simple to understand for all. Stories she shares during class are equally as interesting to hear.

Prof. Charanpreet Kaur
Professor

"She is the most positive, supportive and caring teacher I have met. Her guidance and outlook towards life makes her different than most people. She doesn't only teach the syllabus but also teaches how to live life. I hope she lives a happy and healthy life.

Prof. Dharmendra Kumar
Professor

"So, It was the final core announcement by teachers for session 2022-2023 and I was selected as the *[REDACTED]* and when I went on the stage, I just gave my brief introduction but Dharmendra sir asked to tell about that you are member at *[REDACTED]* and your contribution there, and that made me feel too good and an appreciation from sir meant a lot to me. Also, whenever there is some work of either getting the application signed or filling up a recommendation, Sir has been always very supportive and helped in the best ways possible. So, I just wanted to say Thank you so much sir for your consideration and support.

Dr. Ruchi Kaur
Assistant Professor

"In the college, our very second lecture was with Ruchi mam. Three years later, I still remember the way mam would teach in detail making sure everyone learns... and it only continues to this day. Mam's hardworking and enthusiastic nature never fails to inspire and motivate us. Not only in academics, but otherwise too, whenever we need help, she is always there with her continued support.

"A wonderful and the sweetest teacher I have ever seen. What a dedication and sincerity she has, is just commendable. The most hardworking and workaholic teacher. She is an inspiration to all of us. I feel blessed to have her as my mentor. There are no words to express my gratitude towards her.

Mr. Daljeet Singh Bajaj
Assistant Professor

"Mr. Daljeet Singh is a young member of our faculty, but is a joy to interact with and learn from. He comes to every lecture with preparation, and teaches to the point, in an efficient manner. Outside of class, all my interactions have been positive, as he is usually in a good mood.

Ms. Sheetal
Assistant Professor

"She is one of the bestest teachers of our department. She is very helpful and extremely polite. Her way of teaching is best and I am really inspired from her way of teaching and her hardworking nature. I really wish I could teach like her.

Mr. Ajay Dabral
Guest Faculty

"Ajay sir is passionate about the subject and his love towards mathematics has been both admirable and inspirational for me. He is equally invested in the students' success. His calm and composed approach towards students is really commendable.

Ms. Manvi Grover
Guest Faculty

"A wonderful mentor whose teaching style makes even the most difficult topics feel easy.

Mr. Devendra Kumar
Guest Faculty

"Sir is an incredibly dedicated teacher who explains concepts with great clarity and patience.

Academic Toppers

(For the Academic Session 2023-24)

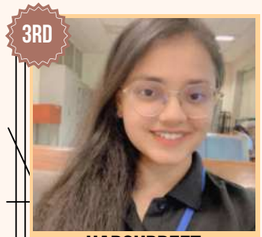
IIIrd year

1ST

SARVAGYA N. TRIPATHI

2ND

RONIT MEHTA



3RD

HARSHPREET

IInd year

1ST

DIPANSH CHAUDHARY

2ND

MAAHIR SADH

3RD

DEEPANITA

Ist year

1ST

MEHARBAN SINGH

2ND

RAMJOT KAUR

3RD

GURNIHAL SINGH

Student Achievements

NAMAN TAGGAR

B.Sc. (Hons.) Mathematics
III yr.

Secured first prize out of 60+ abstracts and 8 shortlisted teams, in paper presentation competition held at JMC College, DU on 27 February, 2025.

Editor, Tegh: college's annual magazine.

Head of student organising team, ICMSA 2024.

DIPANSH CHAUDHARY

B.Sc. (Hons.) Mathematics
III yr.

Won first prize in continuous evaluation during National Workshop on *Python Programming and its Applications* organised by DDU College, DU during 18–20 September, 2024.

Head of student organising team, ICMSA 2024.

KRISHNA SHARMA

B.Sc. (Hons.) Mathematics
II yr.

Dedicated volunteer at Nanhe Sapne, an NGO committed to providing educational support, since January, 2021.

DIVYA SHARMA

B.Sc. (Hons.) Mathematics
III yr.

Completed the Vice Chancellor Internship Scheme, Summer Internship 2024.

Member of student organising team, ICMSA 2024.

GURLEEN KAUR

B.Sc. (Hons.) Mathematics
II yr.

Graphics Designer, Tegh: college's annual magazine.

Volunteer, ICMSA 2024

SIMAR MAKEN

B.Sc. (Hons.) Mathematics
I yr.

Certificate of star performer from Sankalp Organization (NGO).

ISHMEET KAUR

B.Sc. (Hons.) Mathematics
III yr.

Presented paper in ICMSA 2024.

Volunteer, ICMSA 2024.

KUNWAR PARNEET SINGH

B.Sc. (Hons.) Mathematics
II yr.

Won 1st Prize at Sustain-A-Spark. A B-plan competition organized by Bennett University.

2

ART & ARTISTS

Scroll VII: Euler's Watchtower

Spot the number that doesn't belong — only one is a traitor to the primes!Spot the number that doesn't belong — only one is a traitor to the primes!

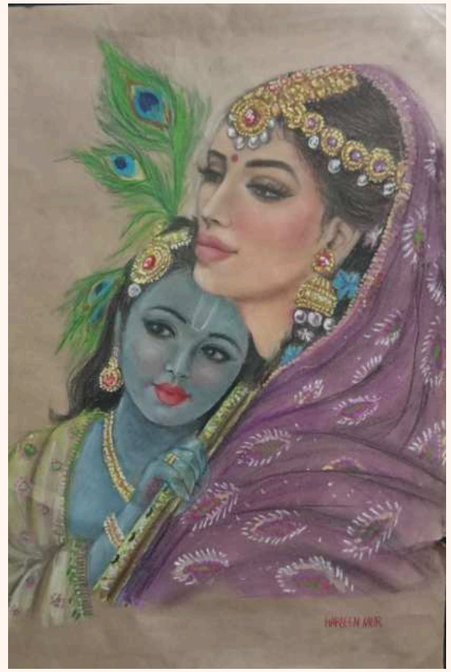
A. 31 B. 61 C. 91 D. 71

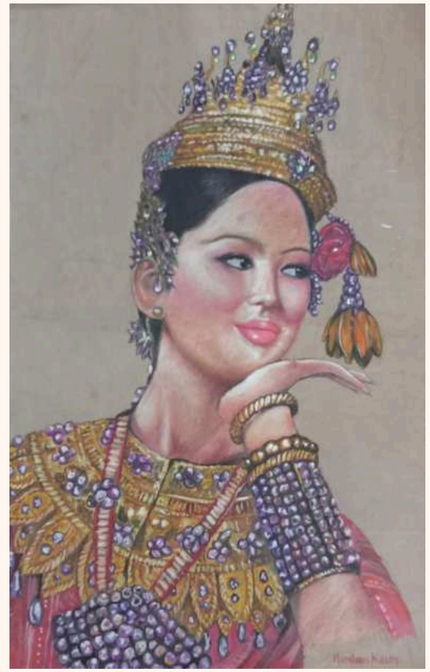
Fun Fact: Primes are the sacred stones of number theory. Euler believed they hold the secrets of the universe!

HARLEEN KAUR

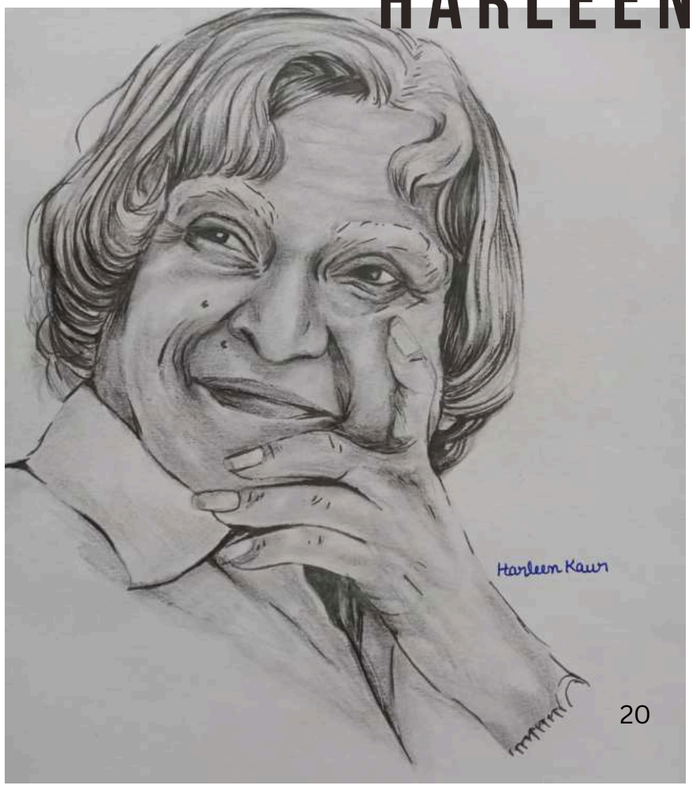
HARLEEN KAUR

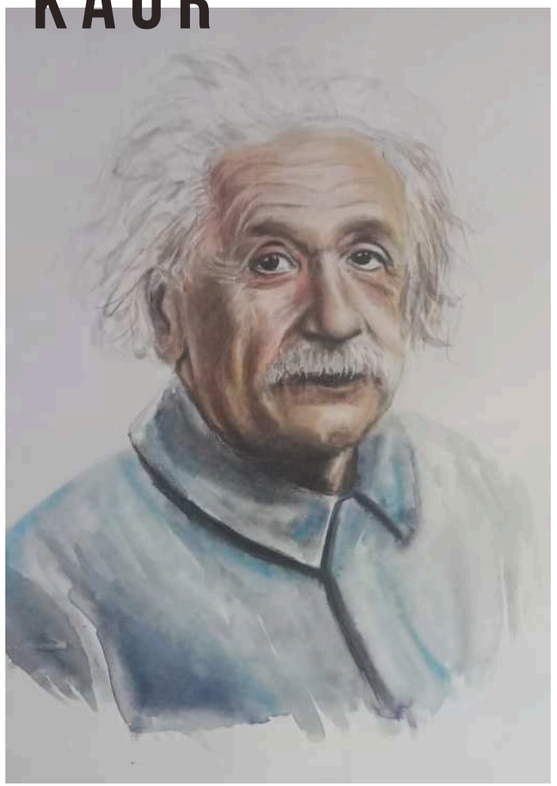
B.Sc. (Hons.) Mathematics, III yr.





HARLEEN KAUR





SONIYA BHARTI

B.Sc. (Hons.) Mathematics, II yr.

SONIYA BHARTI

3

LITERARY CONTRIBUTIONS

Scroll VIII: Pi's Portal

Step through the first digits of pi. What comes after 3.14?

A. 15 B. 16 C. 92 D. 59

Fun Fact: Pi is the number that never ends — and never repeats. Some memorize 1000+ digits. Brave souls!

ROLE OF MATHEMATICS IN TECHNOLOGY AND INNOVATION

by **DIPANSH CHAUDHARY**, B.Sc. (Hons.) Mathematics, 3rd year

IN THE constantly evolving world of technology and innovation, there is just one thing that remains constant i.e, the indispensable role of mathematics. Unknown to most people, Mathematics is the backbone of technological advancements. It is considered as the language of science and technology. It is a way of describing and understanding various natural phenomena, even those which are related to day-to-day life. It enables the development of appropriate and adequate solutions to complex real-world problems and aids in decision making. This article talks about the significant role that mathematics has played in the technological field and innovations, discussing how mathematical concepts and theories paved the way for progress in various fields.

Mathematics is an inseparable part of modern technology. It is used in various fields such as engineering, finance, and business. By understanding mathematical relationships, and concepts, engineers can create models that help them design and test products. Additionally, mathematicians are able to solve problems quickly and easily, which helps them develop innovative solutions. Before we discuss the specific areas of technology and innovation, it is important to recognize that mathe-matics is the bedrock upon which innovation stands. Whether it is coding algorithms, optimizing supply chains, or designing intricate machinery, mathematics plays an irreplaceable role.

Mathematics in Technology & Innovation

Data Science and Technology

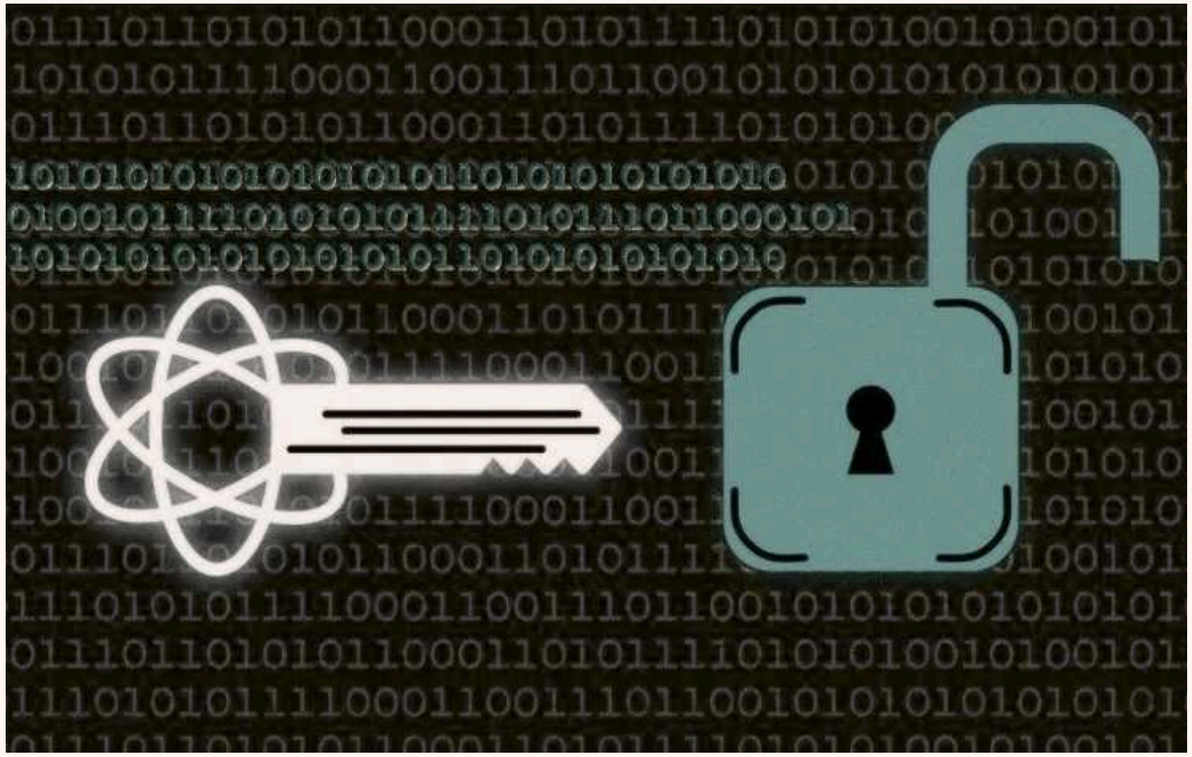
Modern technologies are based on different foundational principles and algorithms derived from the different branches of mathematics. Algorithms are the driving force behind everything from search engines to recommendation systems and

autonomous vehicles. They are a direct application of mathematical logic and optimization. Computer science uses various mathematical logics and number theory to develop data structures and computer algorithms. Advanced computer algorithms, such as finding and sorting variables, are built from mathematical concepts such as graph and recursion theory. Advanced technologies are mainly a result of ongoing innovations and research in math. These advancements have transformed industries such as healthcare, finance, and e-commerce, making processes more efficient and data-driven.

Artificial Intelligence and Machine Learning

Artificial Intelligence and Machine Learning technologies use powerful algorithms and data to learn and upgrade their machine intelligence. Mathematics is used in the development of algorithms that enable machines to learn and make decisions. Machine learning and data analysis are the leaders in modern technological advancements. These technologies drive innovations across all industries. Machine learning relies mainly on mathematical models to make predictions, classify data, and recognize patterns. Linear algebra also underpins machine learning principles, which power data analysis and artificial intelligence. Math plays a crucial role in machine learning and data analysis through:

- Probability theory helps users understand randomness and uncertainty within data sets.
- Statistical methods and models help statisticians summarize, interpret, and make inferences from unstructured data.
- Regression analysis models use mathematical equations to establish how different variables relate. This is perfect for trend analysis and predictions.
- Optimization techniques, which rely on calculus, help fine-tune ML models, and reduce errors during training.



Mathematical Modeling, Optimization and Simulation

Mathematical modeling involves using mathematical equations to simulate real-world phenomena. Whether it's predicting the spread of infectious diseases, optimising traffic flow, or designing efficient energy systems, mathematical models enable us to understand complex systems, make informed decisions, & innovate for a sustainable future. Optimisation & simulation help various industries boost their decision-making, efficiency, and problem solving abilities. Mathematical techniques employed allow professionals to find solutions from endless available options.

Financial Technology and Quantitative Analysis

Financial technology and quantitative analysis also heavily relies on mathematics. Below are a few ways mathematics helps these fields:

- Quantitative Analysis: The use of mathematical models and numerical methods to analyze financial data. Statisticians use these models to identify trends and patterns.
- Financial technology: FinTech uses mathematical models for credit scoring, fraud detection, and risk assessment.
- Risk management: Value at Risk and stress testing are important tools that help calculate financial risks.

Conclusion

The importance of mathematics in technology and innovation is undeniable. As we continue to do more and more research in any field, mathematics will remain a driving force behind progress. The foundation principles and models behind modern innovations are derived from mathematical concepts. For those with a passion for mathematics, the path to a career at the forefront of technological advancement is wide open. It is highly advisable that you embrace the power of math to succeed in the current tech driven world.

ROLE OF HIGHER MATHS — SCOPE BEYOND THE THEORY

by SHRISH KUMAR SINHA, B.A. (Hons.) Business Economics, 2nd year

IN TODAY'S world of growing job competitiveness, it is common to find teenagers with the misbelief that Mathematics doesn't have a place that could assist them with their professional careers. But in fact, it lays a foundation for various skill sets required in the market.

The essence it has in the Coding world is immense. An interesting career choice, Actuarial Science, which focuses on assessing financial risks using mathematical and statistical methods, also requires a strong foundation in advanced mathematics.

With the help of this aspiring field, we can understand why Higher-level mathematics cannot be ignored for the value it adds.

The Power of Stochastic Processes

One of the key areas in Actuarial Science is Stochastic Processes, which model randomly evolving systems over time.

These are mathematical models used to predict and analyze systems that evolve over time with inherent randomness, such as stock prices or insurance claims. A simple yet fundamental stochastic process is the Brownian Motion, often described by

$$dX_t = \mu dt + \sigma dW_t$$

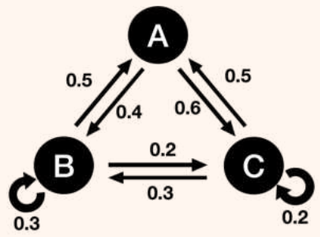
where t represents the stochastic variable, μ is the drift term, σ is the volatility, and W_t is the Wiener process. Understanding such models helps actuaries develop financial products that mitigate risks and ensure long-term sustainability.

Markov Chains and Usage of Differential Equations

Markov chains describe systems where the next state depends only on the present state, not past states. A discrete-time Markov process follows the relation:

$$P\left(X_{n+1} = j \,|\, X_n = i\right) = p_{ij}$$

where the transition probability depends only on the current state and not on past states. This property simplifies calculations and aids in predicting future financial outcomes.



Homogeneous and inhomogeneous Markov Jump Processes extend this concept by incorporating constant or variable transition rates over time with the help of Differential Equations, whose simplest form can be represented as:

$$\frac{dy}{dx} + p\left(t\right)y = q\left(t\right)$$

In the context of general and health insurance, both these concepts help in understanding probability transitions from one state to another. A few models which are based on these concepts are 'No Claims Discount' Model and 'Healthy-Sick-Dead' Model.

Probability Theorems and Their Impact on Risk Assessment

Probability theory forms the backbone of actuarial calculations. The Bayes' Theorem and various probability distributions play an integral role in estimating credibility premiums and financial risk assessments. Bayes' Theorem, which updates the probability of an event based on prior knowledge (distribution), is expressed as

$$P\left(A\,|B\right) = \frac{P\left(B\,|A\right) \times P\left(A\right)}{P\left(B\right)}.$$

Actuaries use prior and posterior distributions in credibility premium calculations to adjust claims data based on historical information, ensuring fair and efficient pricing of insurance policies.

Developing a Habit of Grind

Actuarial aspirants must develop a rigorous approach to learning, as mastering new concepts such as Stochastic Calculus and advanced probability requires persistence. The Ito's Lemma, a fundamental result in stochastic calculus, is frequently used in option pricing and risk modeling:

$$\begin{aligned} df\left(X_t, t\right) = \Bigg(& \frac{df}{dt} + \frac{df}{dX_t} \times \mu\left(X_t, t\right) \\ & + \frac{1}{2} \times \frac{d^2 f}{dX_t^2} \times \sigma^2\left(X_t, t\right) \Bigg) dt \\ & + \left(\sigma\left(X_t, t\right) \times \frac{df}{dX_t} \times dW_t \right) \end{aligned}$$

Having a solid grounding in such advanced mathematical techniques enables actuaries to apply sophisticated models for financial decision-making.

A Gateway to Analytical Thinking

Even though the theory doesn't directly come into practical applications in this field, the use of such concepts is undeniable. Higher mathematics cultivates analytical thinking and structured problem-solving approaches. The ability to think abstractly and apply mathematical principles across different domains enhances one's capability to navigate challenges in actuarial science and beyond.

With many of these concepts being emphasised even in colleges, students can utilise their college learnings directly in this field to great extent. This also connects with the beliefs of professors to not ignore the value one can gain if he/she thoroughly goes through the subjects offered by the University. For those who find mathematics fascinating but sometimes struggle with complex problems, do not let these challenges dampen your curiosity. As wisely said —

"Do not worry about your difficulties in mathematics; I assure you that mine are greater."

~ ALBERT EINSTEIN

PRIME NUMBERS AND CRYPTOGRAPHY — THE MATHEMATICS OF SECURE COMMUNICATION

by **KRISHNA SHARMA**, B.Sc. (Hons.) Mathematics, 2nd year

IN THE modern digital age, where online transactions, encrypted messages, and secure authentication play a vital role, cryptography ensures that sensitive information remains protected. A crucial element behind many encryption techniques is prime numbers. Their unique mathematical properties make them the foundation of public-key cryptography, which powers security mechanisms like RSA encryption and Elliptic Curve Cryptography (ECC).

The security of these encryption techniques depends on the difficulty of certain mathematical problems, such as integer factorization and the discrete logarithm problem. In this article, we will explore the deep mathematical concepts behind the use of prime numbers in cryptography and how they contribute to secure communication.

Prime Numbers: The Foundation of Cryptography

A prime number is an integer greater than 1 that has only two divisors: 1 and itself. Some examples of prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23, and so on.

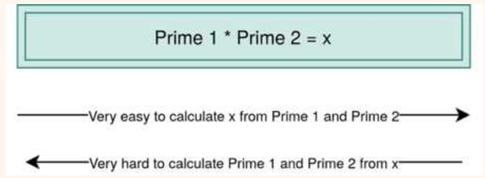
1. They are difficult to predict – there is no simple formula to generate large primes.
2. Multiplying them is easy, but factoring them is hard – given two large prime numbers and, computing their product is straightforward. However, given only the product, determining constituting numbers is computationally challenging.

   This difficulty forms the basis of many encryption schemes, especially RSA encryption.

The Special Property of Prime Numbers

Every number can be factorized into its prime factors. Generally, it's very hard to find the factors of a number. To find all the prime factors of a natural number n, one has to try and divide it by its possible factors upto $\sqrt{n}$.

It is very difficult to find the prime factors of a large number. On the other hand, it's very easy to calculate a number with already given primes:



Ideally, we use two big numbers which are primes. We then calculate the product of those two to encrypt a message. To decrypt it we need one of the primes because there's no easy way to calculate Prime 1 and Prime 2 from x alone. But before we go into the details of how we can use these numbers exactly, let's take a look at the different cryptographic systems.

Cryptography Systems

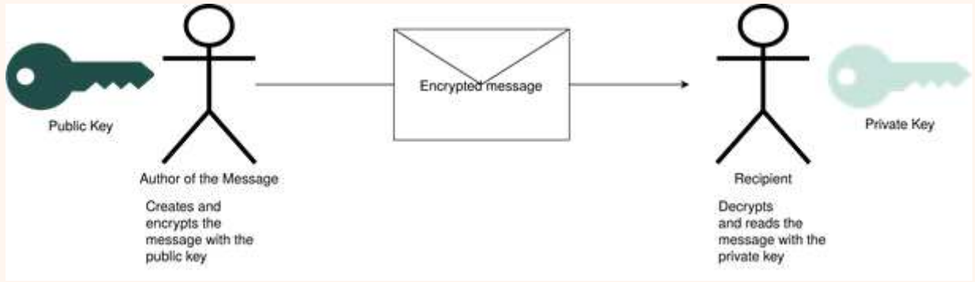
In cryptography, we have two important methods to encrypt messages: symmetric encryption and asymmetric encryption.

In the symmetric case, both parties share the same key. We use the same key to encrypt and decrypt a message. It's very safe as long as only the two people have the key and they have a way to share it with each other safely, for example in person.

Now we can imagine that this method is very hard to implement. If we want to write an encrypted E-Mail to someone we shouldn't first have to meet in person with him to exchange the secret keys.

That's why, in asymmetric encryption, we have two different keys, one for encrypting and one for decrypting.

One key is for the writer of the message. After writing his message he can encrypt it with the public key from the recipient. This key is, as the name suggests, public, and can be looked up i.e. in a key database. As it's only for encrypting it does no harm by being public. On the other hand, there's the private key. This key is only visible to one person, the recipient of the messages. He can use it to decrypt the messages he receives:



Using Prime Numbers for Encryption

Now that we have a clear understanding of the two different encryption systems, let's take a look at how we can create a public and a private key in the case of asymmetric encryption.

First, we should note that we can not encrypt the text directly, but have to transform it to a number first. This process is called padding and happens with a list that assigns a number to each symbol. Then we connect each number to create another number, let's call it, which we then encrypt. A very easy padding list is just assigning each letter to its position in the alphabet, for example, "A" to 1, "B" to 2, etc. While this list only allows very simple words it's sufficient to understand the theory behind RSA.

Creating a Key

As we have already mentioned in the second paragraph, it's very easy to calculate a large number from known primes. On the other hand, it's very hard to guess the factors of a known large number. We use this mechanism in the following process, to create two keys, a private and a public one:

1. Choose two random, stochastically independent prime numbers, and
2. Calculate the product of both
$$N = pq.$$
3. Calculate the Phi function of both:

4. Choose a natural number that's coprime to and smaller than
5. Calculate the multiplicative inverse of modulo , i.e.

$$\phi(n) = (p-1)(q-1).$$

N and e now build our public keys, we'll use them to encrypt the message. Our Inverse, which we use to decrypt the encrypted message, k on the other hand is our private key. To see this more clearly we have a look at the encryption and decryption process.

Encrypting and Decrypting a Message

We now encrypt our message by using the public key:

$$s \approx m^e \bmod N$$

and decrypt it with:

$$m \approx s^k \bmod N.$$

As we can see we can only invert our encryption if we have the multiplicative inverse of mod . These we can only get if we have either

- The private key, or
- The prime factors of N.

Since it's not possible to calculate the prime factors of a large in the foreseeable future, there's no way to decrypt the message without the private key. This makes the system very secure.

Conclusion

Prime numbers are a cornerstone of modern cryptography. Their unique properties, particularly the difficulty of factoring large numbers into their prime components, make them ideal for creating secure encryption systems. Public-key cryptography, which relies heavily on prime numbers, enables secure communication over insecure channels like the internet, protecting sensitive information from unauthorized access. The ongoing research in number theory and computational complexity continues to reinforce the importance of prime numbers in safeguarding digital information

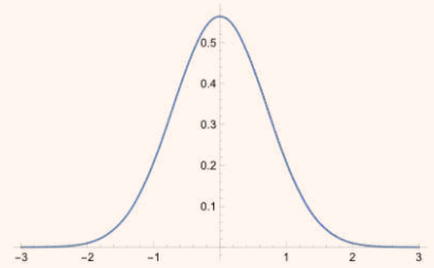
GAUSSIAN DISTRIBUTION

by **NAMAN TAGGAR**, B.Sc. (Hons.) Mathematics, 3rd year

IN PROBABILITY theory, a normal distribution or a Gaussian distribution is a type of continuous probability distribution for a real-valued random variable, such as age, height, marks, and so on. The general form of this distribution is given by

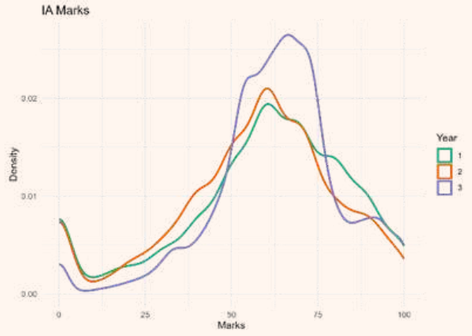
$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{(x-\mu)^2}{2\sigma^2}}$$

where μ is the mean or expectation of variable, σ^2 is the variation, and x is the random variable. When plotted, this looks like a symmetrical bell-shaped curve. For μ = 1 and σ^2 = 1/2, the distribution looks like this:



Here, the peak occurs at mean (in this case, 0), whereas the standard deviation dictates the width of the curve. While the normal distribution equation (1) may appear complex at first glance, it elegantly describes some of the simplest and most common natural phenomena, such as the distribution of heights in a population or more complicated events such as measurement errors in scientific experiments.

Case Study. On campus, one of the most interesting applications of this equation is in modelling of the distribution of marks in a large class, where scores tend to cluster around the average with fewer students scoring extremely high or low. This average mostly happens to appear at 60% or around that. For example, the figure below represents distribution of marks scored by students of Sri Guru Tegh Bahadur Khalsa College in internal assessments. The data was taken from college website.



A normal distribution can indeed be seen. In this case, we find that the average lies around 60 as expected, and marks corresponding to students of all three years follow a similar distribution.

CHAOS THEORY — UNDERSTANDING THE UNPREDICTABLE DYNAMICS OF COMPLEX SYSTEMS

by KUNWAR PARNEET SINGH B.Sc. (Hons.) Mathematics, 2nd year

CHAOS THEORY, derived from the Greek word "Khaos," delves into the behaviour of complex systems that initially appear orderly but exhibit unpredictable dynamics. At its core, chaos theory emphasizes the sensitivity of these systems to initial conditions. Even small changes can lead to vastly divergent outcomes over time, a concept famously illustrated by the "Butterfly Effect" introduced by Edward Lorenz in 1972. This effect highlights how seemingly insignificant variations can cascade into significant effects in chaotic systems.

Applications of chaos theory span various disciplines, including physics, engineering, economics, biology, and philosophy. It offers insights into diverse pheno- mena such as atmospheric behaviour, population dynamics, and neurological processes.

Despite appearing random, chaotic systems possess underlying order, challenging traditional notions of predictability.

One key characteristic of chaotic systems is their sensitivity to initial conditions. Slight deviations in starting parameters can lead to dramatically different outcomes, making long-term predictions infeasible. These systems exhibit non-periodic behaviour, are difficult to forecast, and often appear random in their motions.

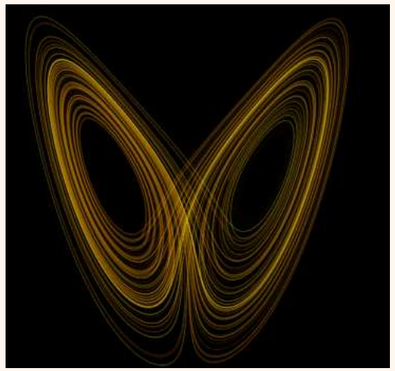
Fractals, intricate geometric shapes with self-similar patterns, serve as visual representations of chaos. They manifest in various natural phenomena, such as the branching patterns of trees and the intricate structures of clouds. Fractals offer a means to understand and visualize chaotic behaviour, showcasing the intricate interplay between order and randomness in nature.

Real-world applications of chaos theory further illustrate its significance

1. Weather Systems:
Minor changes in atmospheric conditions can lead to vastly different weather patterns, showcasing chaotic behaviour and making long-term weather prediction challenging.

2. Stock Market Dynamics:
Financial markets exhibit chaotic behaviour with unpredictable fluctuations in stock prices, influenced by various factors like investor behaviour and market volatility.

3. Traffic Flow:
Urban traffic systems demonstrate chaotic behaviour, where minor disturbances can lead to unpredictable congestion patterns and traffic jams.



4. Population Dynamics:
Animal populations show chaotic behaviour due to factors like food availability, predator-prey interactions, and environmental changes, resulting in significant fluctuations in population sizes.

5. Brain Activity:
Neural networks in the brain exhibit chaotic behaviour, with complex interactions between neurons leading to emergent patterns of activity, crucial for understanding cognitive processes and neurological disorders.

6. Epidemic Outbreaks:
The spread of infectious diseases can display chaotic behaviour influenced by factors like population density and social interactions, leading to unpredictable outbreak patterns.

7. Ecological Systems:
Ecosystems are complex systems where changes in one component can have cascading effects, resulting in unpredictable changes in biodiversity and ecosystem stability.

8. Heart Rate Variability:
The rhythm of the heart can exhibit chaotic behaviour influenced by factors like stress and physical activity, highlighting the complexity of cardiac physiology.

In essence, chaos theory provides a framework for understanding the inherent complexity and unpredictability of natural systems. By embracing chaos theory, researchers and practitioners gain a deeper understanding of the dynamics shaping the world around us, challenging traditional notions of determinism and offering insights into the intricate patterns that emerge from seemingly chaotic behaviour.

THE BEAUTY OF FIBONACCI: NATURE'S ELEGANT ARITHMETIC

by DEEPANITA B.Sc. (Hons.) Mathematics, 3rd year

Basic Definition

The Fibonacci Sequence is a set of numbers where the sum of 2 previous numbers gives the next number. For example, let's consider a set 4, 8, 12, 20, 32, 52. We can see that, 4+8=12, 12+20=32, 20+32=52. So, this is a Fibonacci sequence

Origin

This sequence is named after the Italian Mathematician, Leonardo Pisalo Bigollo,whose nickname is Fibonacci. He was not the discoverer of this sequence but played a great role in spreading the idea through his book "Book of Calculation". The f irst record of the Fibonacci sequence was explained in 200 BC by Acharya Pingala, an Indian mathematician, and poet. He identified possible patterns of Sanskrit poetry formed from syllables of two lengths

Mathematical Definition

The Fibonacci numbers may be defined by the recurrence relation:

$$F_0 = 0, F_1 = 1,$$

and

$$F_n = F_n + 1 + F_n - 2, for\ n > 1.$$

Under some older definitions the value $F_0 = 0$ is omitted, so that the sequence starts with $F_1 = F_2 = 1$, and the recurrence $F_n = F_{n-1} + F_{n-2}$ is valid for $n > 2$.

Matrix Form

A 2-dimensional system of linear difference equations that describes the Fibonacci sequence is

$$\begin{pmatrix} F_{k+2} \\ F_{k+1} \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} F_{k+1} \\ F_k \end{pmatrix}$$

alternatively denoted as

$$\vec{F}_{k+1} = A^n \vec{F}_k \implies \vec{F}_n = A^n \vec{F}_n$$

Golden Ratio

The special thing about this is that any number in the Fibonacci sequence (ignoring the first few numbers) divided by the previous number is always 1.6. Example, let us consider the Fibonacci sequence 4, 8, 12, 20, 32, 52 ignoring the first two terms, $\frac{20}{12} = 1.67$, $\frac{32}{20} = 1.6$ and $\frac{52}{32} = 1.625$. This means that each number is 1.6 times higher than the previous number. As the series goes on, the ratio seems to be exactly 1.618 but actually never reaches it. This number, 1.618 is called the Golden Ratio or phi. Greeks used this ratio to form golden rectangle which is significant in architecture, the most notable ones being, the Pantheon and the Great Pyramid at Giza.

Significance of The Golden Ratio in Nature

The Fibonacci sequence appears abundantly in nature, showcasing its in trinsic connection to biological phenomena:

Phyllotaxis:

The arrangement of leaves, seeds, and petals in plants often follows Fibonacci patterns. The spirals in sunflowers, pinecones, and pineapples reflect the Fibonacci sequence, optimizing space and maximizing efficiency in natural growth patterns

Animal Anatomy:

The Fibonacci sequence is observed in the proportions of animal bodies, including the arrangement of scales in pineapples, the branching patterns of trees, and the spirals of shells and horns.

DNA Molecules:

The structure of DNA molecules exhibits proportions that align with Fi bonacci sequences, reflecting the inherent mathematical principles gov erning biological systems.If you divide the length and breadth of DNA molecule, which is 34 and 21 angstroms, it approximates to phi.

Population of animals:

The golden ratio pops up in animals too. If you divide the number of females in a colony by the number of males, the answer is mostly 1.618. And in the bee family tree, the number of male's parents and grandparents is 2, 3, 5, 8. This applies to the females too but the number is 2, 3, 5, 8, 13.

•

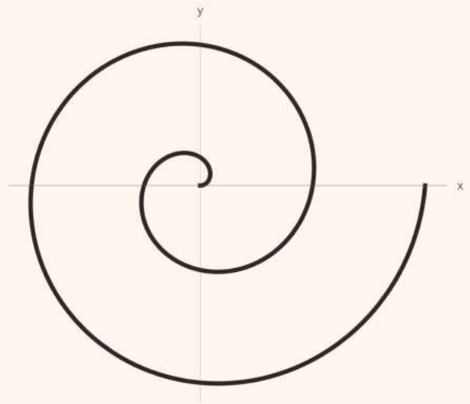
In humans, if you measure the section of each finger, it's approximately 1.6 times bigger than the previous section.

Spiral Galaxies:

The arms of spiral galaxies, such as the Milky Way, often follow Fibonacci spiral patterns. These spirals emerge due to gravitational interactions and rotational forces within the galaxies, showcasing the natural occurrence of Fibonacci sequences in astronomical phenomena.

Conclusion

The arms of spiral galaxies, such as the Milky Way, often follow Fibonacci spiral patterns. These spirals emerge due to gravitational interactions and rotational forces within the galaxies, showcasing the natural occurrence of Fibonacci sequences in astronomical phenomena.



NAVIGATING CHANGE: MATHEMATICS AND ADAPTING TO NEW NORMS

by **DIVYA SHARMA**, B.Sc. (Hons.) Mathematics, 3rd year

IN an ever-evolving world, adapting to new norms is a constant challenge. From technological advancements to global shifts in socio-economic dynamics, the changing landscape demands innovative solutions Mathematics plays a pivotal role in helping individuals, industries, and societies cope with these transformations and navigate the complexities of the modern era.

The changing world is increasingly reliant on data to inform decisions. Mathematics, particularly statistics and data analysis, empowers individuals and organizations to extract meaningful insights from vast amounts of information. This data-driven approach is instrumental in adapting strategies, anticipating trends, and making infor-med decisions in various fields, from business to healthcare.

Mathematical modeling and simulation techniques allow us to simulate and understand complex systems. From predicting the spread of diseases to optimizing logistical processes, these mathematical tools enable proactive planning and preparation for a wide range of scenarios, helping societies cope with unforeseen challenges.

In a world that increasingly values remote work and global collaboration, mathematics facilitates seamless connectivity. Mathematical algorithms govern communication networks, ensuring efficient data transfer and connectivity. From video conferencing algorithms to encryption methods, mathematics plays a crucial role in creating and maintaining the digital infrastructure that supports modern communication.

As the world grapples with environmental challenges, mathematics contributes to the development of sustainable solutions. Mathematical modeling aids in understanding ecological systems, optimizing resource management, and designing eco-friendly technologies. This mathematical approach supports efforts to create a more sustainable and resilient future.

In essence, mathematics is not merely a subject confined to textbooks; it is a dynamic and integral part of the evolving world. Its role in data analysis, technological advancements, risk management, and education positions mathematics as a cornerstone for coping with new norms. By embracing mathematical principles, individuals and societies can navigate change, adapt to uncertainties, and forge a path toward a more resilient and innovative future.

4 POEMS

ODE TO MATHEMATICS

by **GURNIHAL SINGH**, B.Sc. (Hons.) Mathematics, 3rd year

If there is any form of human knowledge,
That one ultimately proclaims,
Full of rigour from school to college,
after then the student exclaims,
No other discipline can boast,
Pure truth that it offers the most,

Mathematics is this poetry,
that is written for centuries anew,
which inspires one to be,
to read its verses and further pursue,
the boon of the language of the God,
and the mathematicians worthy of applaud

From this very tree of wisdom,
various awesome branches arise,
the magnificient algebraic systems,
and data that statistics analyse,
the annals of analysis of the reals,
and the succinct plots of economic deals

From Archimedes, Thales, Euclid and Hero,
to the Brahmagupta and Arybhata who birthed Zero,
and so the Greek Giants and Inventive Indics thrived,
and the pioneers of Babylon and Arabia who later arrived,
Not to forget the Clever Chinese and Elegant Egyptians,
and later on the Eminent Europeans who need no description.

Scroll IX: Gauss's Flash

Add the first 50 numbers faster than lightning!

A. 1225 B. 1275 C. 1325 D. 1375

Fun Fact: At age 7, Gauss stunned everyone with a formula that still powers modern computation. Child prodigy vibes!

5

Events @ Shoonya

Scroll X: The Reversal Riddle

I'm a number. Flip my digits and subtract — you'll get 27. My tens digit is double the units. Who am I?

A. 42 B. 63 C. 84 D. 21

Fun Fact: Reverse puzzles are number palindromes in disguise — and perfect for number sleuths.

Teachers' Day Celebration

A Memorable Tribute to our Mentors

05 September, 2024

This year, as well as usual, Shoonya organised a heartfelt celebration filled with joy, gratitude, and unforgettable moments.

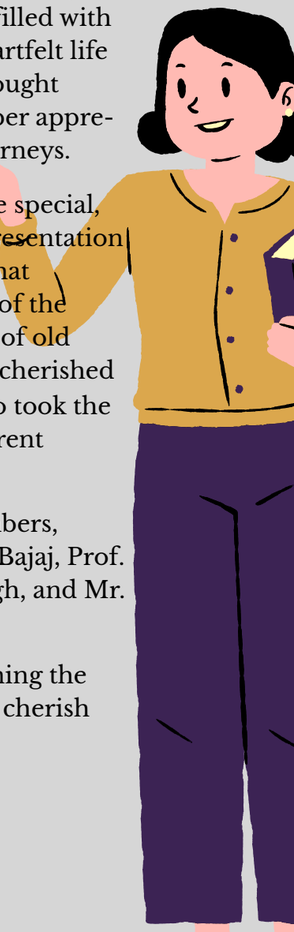
The event began with a cake-cutting ceremony where our esteemed teachers gathered to mark the occasion. One of the most exciting segments of the event was a unique balloon game designed exclusively for our teachers. Each teacher had to select one out of numerous balloons which contained hidden chits containing fun questions to answer, such as "If not a teacher, what else would you have liked to become?" or "What is the best part of your job?" and so on.

The answers shared were not only entertaining but were also filled with personal anecdotes and heartfelt life experiences. The game brought smiles, laughter, and a deeper appreciation for the teachers' journeys.

To make the day even more special, we had prepared a video presentation dedicated to our teachers that featured nostalgic pictures of the department. The inclusion of old photographs brought back cherished memories, evoking emotions of gratitude and admiration. Students also took the stage to share their experiences and express their appreciation for different teachers.

We were delighted to have the presence of several beloved faculty members, including Dr. Ruchi Kaur, Prof. Dharmendra Kumar, Mr. Daljeet Singh Bajaj, Prof. Charanpreet Kaur, Ms. Amarpreet Kaur Sabherwal, Ms. Daljeet I. P. Singh, and Mr. Nitin Kumar.

This Teacher's Day celebration was truly a remarkable event, strengthening the bond between teachers and students while leaving us with memories to cherish forever.



Freshers' Party

An Observation on the Freshers' Evening

It was on a perfectly ordinary day that a most spirited gathering took place within the modest bounds of a classroom—not a grand hall, mind you, but a space made lively by the company it contained. The event in question was the Freshers' Party, that curious and time-honoured affair in which new students are welcomed by their seniors with merriment, mischief, and cake.

The occasion was formally set in motion by an introductory speech, delivered by Mr. Shubham Jain, a senior whose tone struck the right balance between friendly guidance and quiet encouragement. With spirits thus lifted, the ramp walk followed—an informal parade of freshers, each taking to the floor with a glimmer of boldness and self-expression. Though brief, the walk revealed much: a sense of humour here, a touch of grace there, and everywhere, the subtle signs of students beginning to find their place. What followed was a pleasant descent into all manner of revelry. Games were played, of both the amusing and mildly competitive kind. Music drifted through the air, some of it from speakers, some from voices too eager to remain quiet. There was dancing, there was singing, and all around, the sort of easy laughter that fills the corners of a room and makes it feel larger than it truly is.

At a fitting juncture, refreshments were served, and most notably, a cake was shared, as is custom. It was neither grand in size nor ostentatious in design, but it bore the hallmark of all good cakes: it disappeared quickly.

And thus the celebration came to a close—not with fireworks or fanfare, but with smiles, photographs, and the quiet joy of shared moments. It was, in all its simplicity, a successful affair—and as every good observer knows, it is not the setting that makes an evening memorable, but the people in it.

Wronskian '25

A Ritual of the Society

As part of Lashkara, the annual cultural fest of Sri Guru Tegh Bahadur Khalsa College, Shoonya — the society of the Department of Mathematics — proudly hosted Wronskian '25, its much-anticipated annual event. Celebrating the spirit of mathematics, strategy, and quick thinking, Wronskian '25 brought together a vibrant array of activities that energized the fest. From thrilling one-minute challenges (Quickie Quests) to the grand intellectual showdown BidWiser: The IPL Auction, the event witnessed enthusiastic participation from students across the University of Delhi and esteemed institutes such as DTU. With a perfect blend of fun and fierce competition, Wronskian '25 left a lasting mark on Lashkara, making it a memorable highlight of the celebrations.

The event included the following events:

Whisper Challenge was one of the most engaging and fun-filled games. In this game, participants were divided into teams. One player wore noise-canceling headphones with loud music, while another teammate whispered a phrase or word. The player with the headphones had to guess what was being said by lip-reading. The objective was to correctly guess as many phrases as possible within a time limit.

Whisper Challenge was one of the most engaging and fun-filled games. In this game, participants were divided into teams. One player wore noise-canceling headphones with loud music, while another teammate whispered a phrase or word. The player with the headphones had to guess what was being said by lip-reading. The objective was to correctly guess as many phrases as possible within a time limit.

In "**Lucky Roll Showdown**," the thrilling game of chance, players placed bets on a number between 1 and 6 before rolling a dice. If the number they bet on appeared, they won an exciting cash prize. The simple rules made it accessible to everyone, while the suspense of the rolling dice kept the crowd on edge with excitement. Participants enjoyed multiple rounds, with many walking away with cheerful winnings.

Half Meter Dash was about measuring half a meter without using the measuring take, by pure guess. Participants were asked to measure different lengths such as 35 cm, 40 cm, and of course half a meter. It was the simplest challenge yet the most engaging, recording greatest participation during the event!

BidWiser, the IPL Auction is the flagship event in Wronskian '25, where the top teams, selected through an online quiz, competed in an exciting player auction. Each team, given an imaginary purse of ₹120 crore, bid strategically for over 200 players to form a squad of 20. The event was filled with intense bidding wars, smart picks, and lively competition, showcasing the teams' planning and cricketing knowledge. BidWiser recorded over 150 registrations from various colleges of University of Delhi and was a grand success. Saksham Azad, Yuvraj Sawhney and Naman Taggar must be deservingly mentioned for their dedication towards managing the operations on the date of event to ensure a smooth conduct.

Above: Editorial Board with President and Vice-President.
(Left to Right) Rudravisek Sahu, Naman Taggar, Gursheen Kaur, Divya Sharma, Krishna Sharma, Shrish Kumar Sinha, Gurnihal Singh (Not in frame).

Above *(Left to Right)*: Naman Taggar, Gurnihal Singh, Amrinder Kaur Raien, Kripleen Kaur, Sagar Sachdeva (ex-treasurer), Gursheen Kaur, Divya Sharma, Tushar Chakraverty, Kunwar Parneet Singh, Muskan Gupta, Soniya Bharti.

First in History

THE DEPARTMENT OF MATHEMATICS ORGANISES

International Conference on Mathematical Sciences & its Applications

The Department of Mathematics, Sri Guru Tegh Bahadur Khalsa College, University of Delhi hosted the 'International Conference on Mathematical Sciences and its Applications' (ICMSA 2024) during October 15–17, 2024. The conference provided a dynamic platform to industry experts, faculty members, academicians, post-doctoral fellows, research scholars, under-/post-graduate students for discussion on diverse topics in mathematical sciences and related fields, as well as potential collaboration on future research problems. Around **140 delegates** joined the conference from various universities and institutions across India and abroad, which included around 30 guests for delivering invited and plenary talks, and around 100 attendees or paper presenters. The conference received funding from NBHM, DST SERB, CSIR and DRDO.

Inauguration

At the first day of the conference, Inaugural Ceremony started in Master Tara Singh Auditorium with Shabad recitation to invoke divine blessing. The ceremony was graced with the presence of respected dignitaries such as Chief Guest **Prof. Balaram Pani,** Dean of Colleges, University of Delhi; Guests of Honour **Prof. Eberhard Malkowsky** from State University of Novi Pazar, Serbia and **Prof. Yasunori Kimura** from Toho University, Japan; and **Padma Bhushan S. Tarlochan Singh,** Chairman, Governing Body. Principal **Prof. Gurmohinder Singh** and Vice-Principal **Prof. Harbans Singh** greeted the guests. **Dr. Ruchi Kaur,** Convener, ICMSA 2024 welcomed the delegates to the conference giving them an overview of the upcoming 3 days.

Sessions

All 3 days of the conference began with 2 plenary talks followed by a series of invited talks by eminent mathematicians from institutions such as DRDO, ISI, North-Eastern Hill University, VIT-Bhopal, Jamia Millia Islamia University, and many others in addition to University of Delhi. On each day after plenary and invited talks, papers were presented by research scholars and faculty members from various universities from across the country including NIT Sikkim, SRM University Sonepat, Pondicherry University, Rajasthan Technical University, Netaji Subas University of Technology, Delhi, DRDO, and many more. Dedicated batches were made for paper presentations by under-/post-graduate students, so as to promote research endeavors amongst young scientists. A few presentations were delivered in online mode, for which arrangements were made on day 2 & 3 of the conference.

Valediction

Under the able leadership of faculty members of the Department of Mathematics including Prof. Satish Verma, Dr. Virendra Kumar Mehra, Dr. Sunderjeet Kaur Bhatia, Dr. Jasvinder Bhalla, Prof. Dharmendra Kumar, Prof. Charanpreet Kaur, Mrs. Amarpreet Kaur Sabherwal, Dr. Ruchi Kaur, Mr. Daljeet Singh Bajaj, and Ms. Sheetal, the conference concluded with the valedictory ceremony, wherein Prof. Gurpreet Singh Tuteja, Controller of Examinations, DU was the chief guest.

Prof. Gurpreet Singh Tuteja addressed the audience about the importance of college, and high quality education. He also emphasised on the need for self-contemplation, and a need to develop new skills. He quoted Guru Granth Sahib's "Vidya Vichari Tan Paropkari" — implying "True learning induces in the mind, service to mankind." He shared one of his own instances of his own student life making the interaction more interesting for the audience.

He also believed that experiences of professor Eberhard Malkowsky, and Yasunori Kimura would come very handy to the students involved in the Conference. His speech provided a great sense of motivation to the attendees. The conference report was read by **Dr. Ruchi Kaur,** Convener, and following that, a few participants also shared their feedback adding a cherry to the event. After certificate distribution to the paper presenters, the conference ended with a vote of thanks by **Prof. Dharmendra Kumar**, Co-Convener, ICMSA 2024.

To sum up, the first ever international conference organised by the department was a huge success, evident from the positive feedback received from all the esteemed guests and delegates.

PHOTO GALLERY

ICMSA 2024


Artwork by HARLEEN KAUR
Batch of 2025
CARL FRIEDRICH GAUSS
(1777–1855)
German mathematician, astronomer, geodesist, and physicist