It is one thing to be a part of the dynamic mathematical culture, its another to make the mathematical culture dynamic

Dear Readers,

While studying Statistics, I happened to learn about Friedrich Bessel's illustrative achievements as a German astronomer, mathematician, physicist and geodesist. This made me realise the true scope of learning and discovering, which is infinite.

Delving into the realm of mathematics, and drawing inter-disciplinary connections is perhaps the first step towards this intellectual journey.

It was this newsletter that ignited my curiosity and the desire to seek solutions to the infinite problems we face in our day to day life.

From checking out S. L. Loney's book in the library to writing proposals, making score sheets, developing the criteria and designing the certificates for the recent Lit-Mit, we did it all.

Conforming to the unconventional approach, the articles in this newsletter are not restricted to one theme but offer variety to the readers. This newsletter uncovers mathematical elements of not only the sunflower but also the City of Love, Paris. The natural and creative ideas run from the very essence of Dyscalculia to a Math Whiz.

Mathematics is a subject of deep analysis and application. It lights up the darkness of ignorance and propels the ideas of innovation. Being the universal language of precision, it shapes understanding and reality. The purpose of this newsletter is to involve various minds in the hunt to seek answers. As a team, we aim to induce curiosity within learners, in order to motivate them to think rationally.

My deepest gratitude to my invaluable team, you have constantly made time for this publication, to my teachers for kindling the flames of curiosity within me, to my friends who have been the running motivation behind the scenes, and for my mother, who has been my biggest supporter.

I'm sure after this issue, on a random evening, I will catch myself saying "Oh I have to take a Pi-Rate meeting tonight," only to mid-sentence realise that the last time passed away, just how the first arrived last fall.

Editor-in-Chief
Vaishnavi Agarwal

CONTENTS

INDIAN PROBABILITY LEAGUE

Do you also bet that Chennai Super Kings would hit a six on the last ball and win against Gujarat Titans in the mega final match of TATA IPL 2023?

Every aspect of sports betting, as well as gambling in general, revolves around the odds. If you're new to the game, the odds essentially represent the likelihood of a certain result. Game theory too holds relevance with the statistics and probability applications that make up the mathematics of betting. If any one risks money on any of the two sides playing a sporting event or any other event (regardless of time and place), then it's called **betting**.

Mathematics and statistics are frequently ignored in the field of sports betting, where millions of enthusiasts try their luck. However, the results of bets, and bettors' reasoning of decision-making can be considerably influenced by an intricate framework of computations, probabilities, and data analysis. As you watch a match at the TV screen, you can't help but notice the intense focus displaying odds and statistics. It's a world where knowledge truly is power and the tool of probability theory holds the key to unlocking the secrets of success. Probability theory is crucial for evaluating the possible outcomes of a bet in the betting context and for helping players make wise choices. Statistics also plays a crucial role in analyzing historical data to identify patterns, trends, and outliers. A bettor can gain insights into the strengths and weaknesses of teams and players by reviewing previous performances and can predict future outcomes by using statistical models.

Expected Value is a method of probability that helps assess the potential value of a bet by considering both the probability of winning and the potential pay out. Let's assume you have estimated the probability of CSK winning to be 0.6, and the bettor offers decimal odds of 2.50 for CSK.
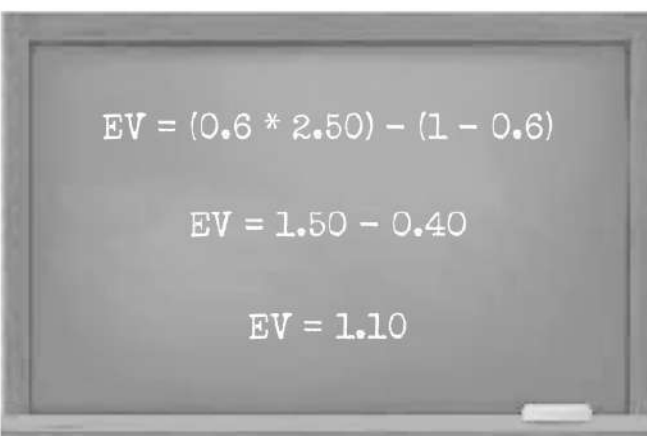
$$EV = (P * W) - (1 - P)$$

P- Probability of CSK winning
W- Decimal odds for Team A

$$EV = (0.6 * 2.50) - (1 - 0.6)$$

$$EV = 1.50 - 0.40$$

$$EV = 1.10$$

A positive EV of 1.10 indicates that the bet on CSK has a positive expected value and could be profitable in the long run. By using such formulae as Kelly Criterion and Expected Value, successful bettors analyse and make impulse decisions to make the best of it from their wages.

By striking a balance between mathematical analysis and clever decision-making, individuals can maximize their enjoyment of the betting and gambling experience while increasing their chances of achieving positive results. In conclusion, betting is a complex pursuit that intertwines elements of chance, strategy, and analysis.

-Nimrat Kaur Mehram
Pre SCs

Paris, fondly called "The City of Love," boasts about 35 million tourists every year. Overlooking its romantic charm, Paris would not be Paris without a little 'mathe-magic'.

Did you know that Paris has numerous streets named after renowned mathematicians? Even the iconic Eiffel Tower, the everlasting symbol for love and romance, proudly bears the names of 24 mathematicians, etched on its trusses.

Paris boasts a grid-like street layout with right-angled intersections, facilitating efficient navigation and fostering unity among its diverse inhabitants, shaping both its physical and social landscape.

The world-famous Louvre Museum, known for its art treasures, also exhibits mathematical beauty. Leonardo da Vinci's eternal, "Mona Lisa," incorporates the golden ratio. Moreover, the museum's architecture resembles a colossal pyramid, depicting the elegant union of math and art.

Paris, a cultural capital, hosts concerts, performances, and dance events contributing to its artistic atmosphere. These beloved, rhythmic arts rely on fundamental mathematical concepts of timing, beats, and patterns. While one may not utter Paris and Math in the same breath, it subtly influences the city's architecture, music, and culture, enhancing the enchantment that defines Paris. In this splendid city, love and math harmoniously coexist, creating a unique and captivating atmosphere.

The City of
LOVE, PARIS
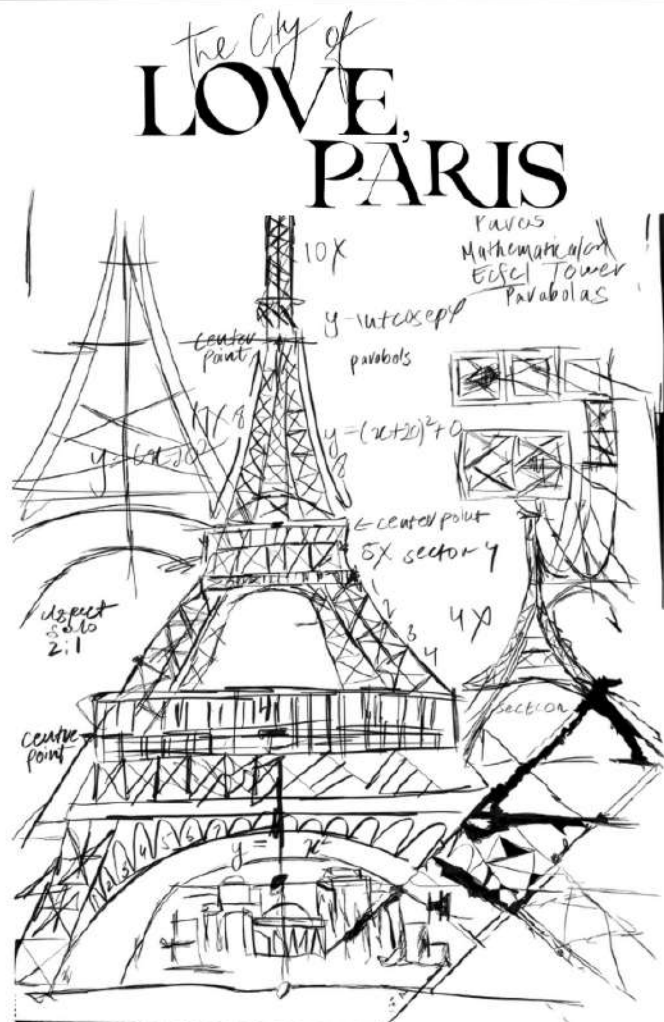
-Arumai Jain and Manini Mahipal
AIIIs

HAT'trick

A 60-year-old geometry conundrum has been answered by David Smith's recent discovery of "The Hat," a unique 13-sided shape. This finding promises to open up new possibilities for geometric exploration. Today, the discovery of AlphaTensor's AI system development, which has brought ground-breaking algorithms for rapid matrix multiplication, dwarfs the mathematicians' famed "hattrick" accomplishment.

Imagine a form in geometry that gently spans a plane with no overlaps, gaps, or repeated themes. The moniker "Einstein" for this rare form, a real pioneer, was inspired by the German term "ein stein," which means "one stone." In the intense hunt for the elusive Einstein form, co-author Chaim Goodman-Strauss wittily observed, "We're searching for the one in a million, filtering out the mundane from the extraordinary, something truly peculiar." This adventure depends on human intelligence. A proof that resonates with human comprehension cannot be produced by machines. The cryptic forms are revealed by the complex interaction between AlphaTensor's algorithms and human understanding, demonstrating the co-operation between man and machine in search for mathematical truths.

The name "The Hat" is derived from a subtle allusion to its shape, which is similar of the iconic fedora worn by males in American society. The debonair Ryan Gosling's portrayal of this characteristic shape in the Barbie filmography perfectly combines the iconic hat with the stereotypically patriarchal cowboy garb. Since the 1940s, a long journey has been taken in search of this enigma, traversing the pages of history. We take great delight in announcing that the intriguing name has finally been decoded as the climax of our tireless search.

-Aashvi Sanjay Gupta
AIIIs

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The Titanic's design and navigation during her tragic maiden voyage in 1912 were altogether reliant on mathematics. The ship's precise location was determined by carefully calculating celestial observations using trigonometry and geometry. These computations helped in course selection and guaranteed precise navigation. The proportions and stability of the ship were also determined by trigonometry and geometry, which had an impact on its structural construction. The ship's buoyancy was controlled by the Archimedes Principle, a mathematical and physical idea, and it helped keep it afloat. In difficult circumstances, mathematical models were essential to preserving the stability of the Titanic. As a result, mathematics, with its accuracy and discipline, was deeply intertwined into the tale of the Titanic and played a significant part in its fate.

Data about the passengers and the crew of 'Titanic' provided a wealth of information for demographic and statistical study. Researchers examined characteristics including survival rates using cutting-edge statistical methods, segmenting the data by passenger class, age, gender, and other criteria. These statistical investigations gave important insights into how the tragedy differed for various groups.

Meanwhile, mathematical simulations and computations were of utmost significance in ensuring the structural soundness, stability, and weight distribution of the ship. These mathematical foundations served as an example of the exact application of mathematical concepts in marine engineering and were painstakingly designed to resist the immense pressures imposed on the ship by the merciless ocean.

The engineering mathematical calculations were extensively used in the design and construction of a ship as huge as the 'Titanic'. The design of the ship, using principles of mathematics, physics and various other subjects made it "virtually unsinkable" and therefore, the primary causes of it sinking were navigational errors, inadequate safety measures, and the collision with the iceberg rather than mathematical miscalculations.

Mathematicians have been trying to improve the models to be able to better analyze and collect data on the design and making of ships.
Today, the biggest ship; 'The Royal Caribbean', is five times larger in size as compared to the 'Titanic'.

—Riana Naresh Thumar
AIIIs

The only Series not on NETFLIX

Have you ever questioned a sunflower's perfect symmetry and the intricate spirals that seem to emerge effortlessly from its centre? The answer lies within these vibrant blooms that conceal a mathematical code. Helianthus, a genus of the sunflower family exhibits a fascinating pattern of integers, known as the Fibonacci sequence which has been an unsolved mystery among mathematicians for centuries. Sunflowers depict precise numerical arrangements that underlie their growth and distribution of seeds. The seeds of sunflower form two spirals known as parastichies, one emerging from the centre in a clockwise direction and other in anti- clockwise direction. For instance, you will notice 21 spirals curving clockwise and 34 anti-clockwise, thus corresponding to the consecutive Fibonacci numbers. The Fibonacci series is a sequence of numbers, where every number is the sum of the preceding one, such that the first two are 0 and 1. Hence a Fibonacci series can be given as 0, 1, 1, 2, 3, 5, 8, 13, 21... and so on.

The golden ratio emerges when you divide any two consecutive Fibonacci numbers, which determines the angle at which leaves and seeds grow around the stem of the sunflower. Typically, adjacent leaves or seeds are spaced approximately 137.5 degrees apart, which is very close to the golden angle of about 137.5077 degrees. The amount of turning from one leaf to the next is a fraction of one complete rotation of the stem. It's the nature's style of allowing as much light to reach each leaf as possible, yet the subsequent rotation is always a Fibonacci fraction: 1/2, 2/3, 3/5, 5/8, and so on.
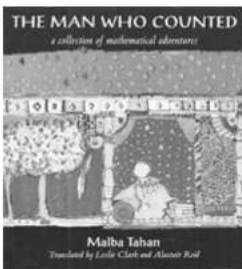
Following the alignment, leaves don't overlap and overshadow one another, and seeds, flowers, and other parts efficiently fill the available space. This optimizes seed packing, aids in effective pollination, and provides structural stability, all of which enhance their chances of survival and reproduction.
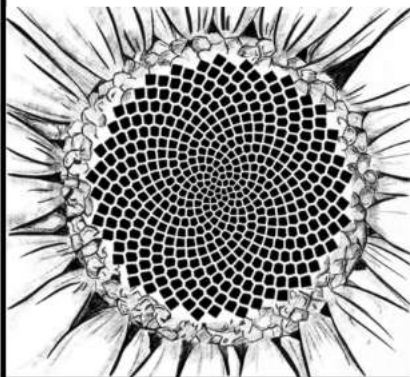
Next time you see a sunflower take a moment to admire the mathematical elegance buried inside its petals and seeds, a living example of the synchrony of the natural world and mathematics. A sunflower reveals the blueprint for perfection through the Fibonacci sequence and the golden ratio, from the radiant spirals of its seeds to the exact angles at which its leaves and seeds unfold. Our attention is drawn to the mathematical beauty of the sunflower, which serves as a reminder of the wonderful harmony found in nature. It celebrates the age-old relationship between mathematics and art that never ceases to amaze and inspire us all, serving as a reminder that the secrets of the universe can be discovered even in the most unlikely locations.

-Aarushi Jain and Palak Arora
PreSCs

BOOK RECOMMENDATIONS

THE MAN WHO COUNTED
a collection of mathematical adventures

Malba Tahan
Translated by Leslie Clark and Alastair Reid

It is a celebration of mathematics' beauty and universality, told through captivating adventures of Beremiz Samir, a wise Persian where he encounters various mathematical puzzles and challenges that entice readers to recognize the magic of numbers and the rich beauty of human history.

Measurement
PAUL LOCKHART

This book offers a permanent solution to math phobia by presenting mathematics as an artistic method of thinking and living. Through a series of essays and reflections we see that math is an art form and a language, a dynamic, living, and endlessly fascinating realm of human knowledge

-The EB
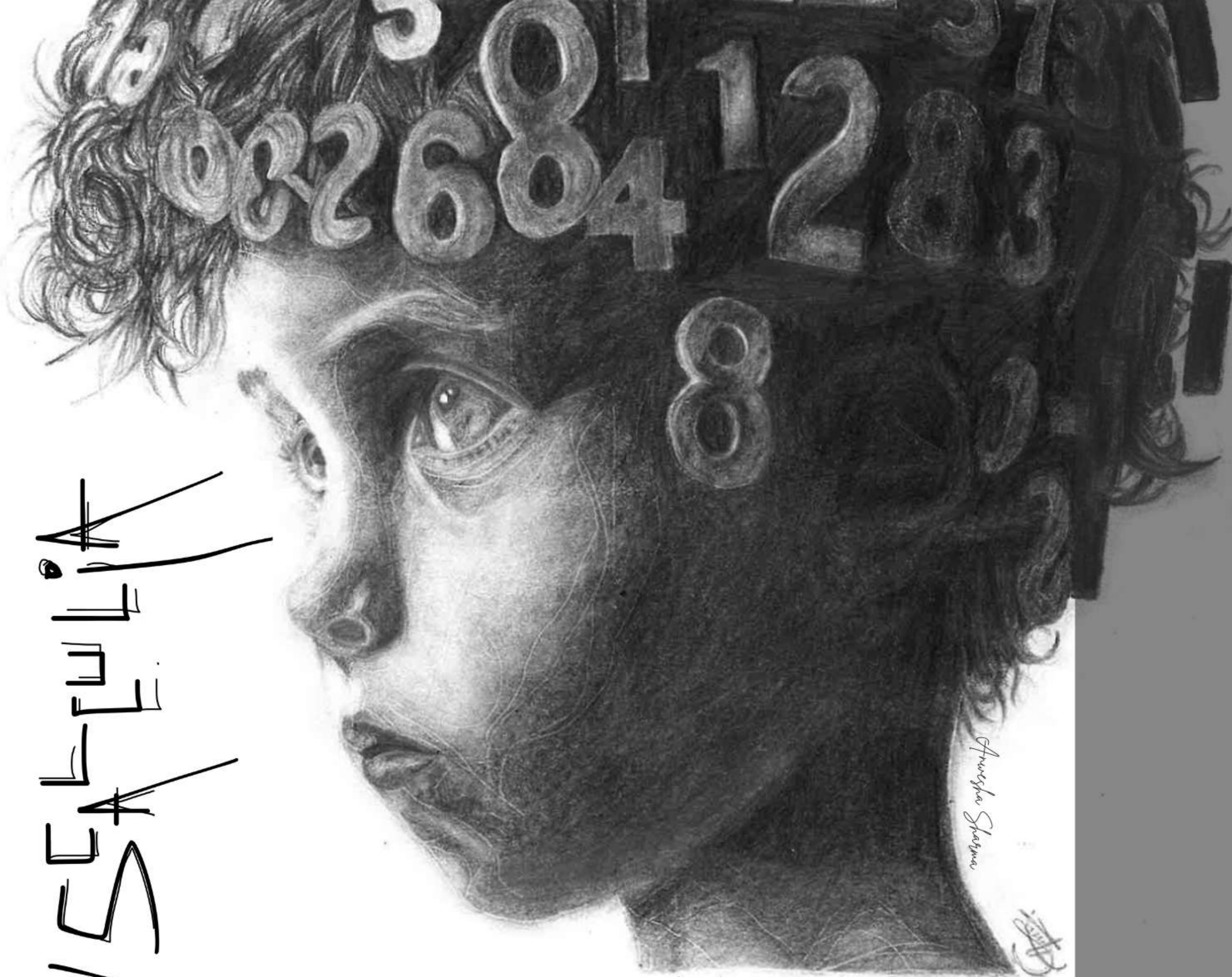
DYSCALCULIA

There are several varieties of minds in the artwork of human thinking, and each one inculcates a distinct thread to the fabric of the experience shared by the human population. Dyscalculia is frequently seen as a mathematical challenge, and not as a special mathematical journey. The individuals who have dyscalculia perceive numbers and mathematical ideas in a different way. It is not a lack of thought, instead a different way of thinking that enhances our collective mental environment. Dyscalculics often demonstrate difficulties in problem-solving, using unusual ways to arrive at mathematical solutions. Their unique viewpoint encourages creative thinking and can support a variety of problem-solving techniques. We may promote an inclusive and appreciative culture if we acknowledge dyscalculia as a distinctive feature of the human brain spectrum. We should learn to appreciate differences rather than stigmatize them. Giving dyscalculics individualised assistance and accommodations helps them to study and interact with mathematics in ways that speak to their particular minds. Dyscalculia is not a sickness to be concealed in this magnificent tapestry of ideas, but rather a distinctive quality that deepens our idea of the mathematical area as a whole. It is an invitation to reframe how we see things and to create an atmosphere where everyone can excel in their individual mathematical adventures.

-Priyanjali Sharma
AIIs

CoNspiRaciEs eXposEd

GRIMES

Conspiracy theories, ranging from moon landing hoaxes and Illuminati secrets to the mysteries of Subhas Chandra Bose's death and the disappearance of MH370, have always held our fascination. But the question is, to what extent are they true? Dr. Grimes devised a mathematical model to shed light on the odds of such conspiracies remaining concealed.

Picture a conspiracy involving two people. The odds of one person exposing the secret is 50%. If anyone breaks the silence, the entire conspiracy comes crashing down. The table alongside explains the breakdown:

In this scenario, there is a 75% chance of the conspiracy being exposed. Now, let's increase the complexity by adding a third conspirator. There's only one way for the conspiracy to survive- all three must remain silent. This raises the likelihood of being exposed to 87.5%. Thus, it becomes evident that as the number of participants increases, the chances of the truth emerging also escalates. Dr. Grimes also considered the factor of time, revealing that as time passes, the likelihood of a conspiracy being exposed increases.

Applying this to the moon landing hoax, involving a reported 411,000 people, Grimes' calculations indicate that in such a colossal conspiracy, the odds were slim, with an estimated unraveling in just 3.68 years. This underscores the improbability of large-scale conspiracy theories, as they would necessitate an enormous number of people to remain silent, a highly unlikely scenario.

Here's advice, if you ever contemplate a conspiracy, keep the participant count under 125. Why? The math shows that involvement of fewer people, extends the duration before the secret's exposure. With 125 individuals, your secret can stay buried for a century. It's a strategy to keep your conspiracy a hidden mystery that may never see the light of day.

Possibilities	Outcome
A stayas quiet, B stays quiet	Conspiracy remains hidden
A stays quiet, B reveals secret	Conspiracy exposed
A reveals secret, B stays quiet	Conspiracy exposed
A reveals secret, B reveals secret	Conspiracy exposed

RAMSEY

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I S W H O C O M I N G T O L A Y H I M D O W N C A
O U T S E T Q U E E Q U E G I N S I S T E D T H A
I S F I E R Y L A N C E I N M I G H T I E R S T R
N D W H E N H E W A S G O I N G T O C O M E O N B
I N G A N D N O T T O B E K I L L E D B Y T H E M
Y E T H E R E A R E W H A L E S H E R E A B O U T
E S O P O T A M I A N F A M I L Y T H E S E W H A
I L L S T U B B C A U T I O U S L Y W H I S P E R
N T A N D C O U R A G E O U S E N O U G H I N O F
T H E I N T E N S I F Y I N G A G E N T I N T H I
P R E P A R E F O R D E A T H A N D I N D E E D T
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Martin Luther King was was fatally shot
in Tennessee on April 4, 1968

Conspiracy theories captivate the living world to such an extent that we try to implement its logistics into our manifestations . The Moby Dick conspiracy is one that has fascinated most minds through the course of time. Researchers have found that when the complete text of Herman Melville's "Moby-Dick" is meticulously arranged into a rectangular shape, it contains predictions for, or references to historical events, including the assassination of Martin Luther King and the tragic death of Princess Diana. It seems peculiar, doesn't it?

Well, this is because we humans have a tendency to find order in chaos and patterns in every randomization. Our minds are wired to create it, whether we're spotting words in a messy jumble of letters or finding familiar shapes among the stars in the night sky. From solving a Rubik's cube to completing a sudoku, we seek utmost rationality. Interestingly, math can explain it all through Ramsey's Theorem which guarantees the emergence of interesting patterns from set structures.

On examining a gathering of at least six people, one is guaranteed to find a trio with either all know each other or, conversely, having never crossed paths before. The individuals are represented as points and their connections as lines between them .The Ramsey theory asserts that, in a group of six people with edges colored in a certain way, you will always find a monochromatic triangle. However, when considering a group of five individuals, the same outcome cannot easily be determined due to the vast number of possible combinations. This is the party problem that was proposed by Dr logician Frank Ramsey in 1930.

Dear readers, as much as we wish to believe in the existence of conspiracy theories, math suggests their improbability. So next time you stumble upon a tantalizing conspiracy, consider the numbers – they're often the most revealing storytellers.

-Aaruni Garg and Vedika Poddar
PreSCs

Technology and mathematics have become inseparable partners in today's quickly expanding world, revolutionizing the ways in which we live, work, and communicate. The intersection of technology and mathematics has paved the way for a promising tech-driven future, from the remarkable developments in artificial intelligence to the complicated algorithms driving our everyday digital interactions.

Mathematics is the fundamental language for science and engineering, enabling us to model, analyse, and forecast phenomena that drive technological advancements. It is the backbone of modern technology, supporting algorithm design, machine learning, cryptography, and more. Equations, calculus, linear algebra, statistics, and probability theory are essential branches shaping the digital world.

The field of computational mathematics has transformed our understanding of complex systems and events. Virtual experiments are possible, saving time and resources while revealing ground-breaking findings. Risks are reduced by using mathematical models to improve financial, medical, and aerospace solutions.

The Internet of Things (IoT) has ushered in a period of connected devices, which has great promise for enhancing many facets of our lives. Within IoT networks, mathematics is essential for enabling effective data transfer and resource management. To ensure that IoT devices run effortlessly, effectively exchange data, and respond to real-time events while preserving energy and bandwidth, optimisation methodologies are used.

The rise of big data and the field of data science exemplify the convergence of technology and mathematics. To extract useful insights from the huge amounts of data that are generated daily, complex algorithms and statistical techniques are required. The foundation of data science is built on mathematical ideas like probability theory, regression evaluation, and data visualisation. Data scientists can find trends, anticipate the future, and help people decide what to do in a variety of fields, including marketing, finance, and healthcare.

Technology and mathematics go hand in hand and shape the modern world in amazing ways. Advances in computing power and mathematical algorithms have pushed the boundaries of what is possible, transformed industries, and revolutionized problem-solving skills. Whether optimizing complex systems, predicting outcomes, or protecting information, mathematics provides the intellectual framework for technology to thrive. The synergies between technology and mathematics will continue to pave the way for further innovation, ushering in a future in which the frontiers of knowledge and performance are continually pushed forward.

-Udisha Agrawal
AIs

GAME OF NIM

Nim is a combinatorial game, where two players alternately take turns in taking objects from several heaps. The only rule is that each player must take at least one object on their turn, but they may take more than one object in a single turn, as long as they all come from the same heap.

Nim is the most well-known example of an impartial game, where both players have the same moves all the time, and thus the only distinguishing feature is that one player goes first. It is also completely solved, in the sense that the exact strategy has been found for any starting configuration.

The basic Nim begins with two players and several heaps, each containing several objects. Occasionally, heaps are also called piles, and the objects are called stones.

Each player, in turn, must take at least one stone, but they may take more than one stone as long as they all come from the same pile. It's allowed to make a pile empty, effectively removing the pile out of the game. When a player is unable to move, the game ends. Naturally, as long as there is a stone, either player can take that stone, and thus can move. So the ending condition can be rephrased, where the game ends if there is no stone left.

In normal Nim, the loser is the player unable to move. It is called normal condition by convention from combinatorial game theory, where a normal game gives the win to the last player making a move. In misère Nim, the player unable to move wins instead; this is equivalent to the player taking the last stone losing.

THE PSYCHIC MATH WHIZ

The 1089 Technique

This is a tried-and-true number guessing method that always yields an intriguing outcome.

Step 1: Pick a three-digit number, such as 684, where the first and last numbers differ by at least two

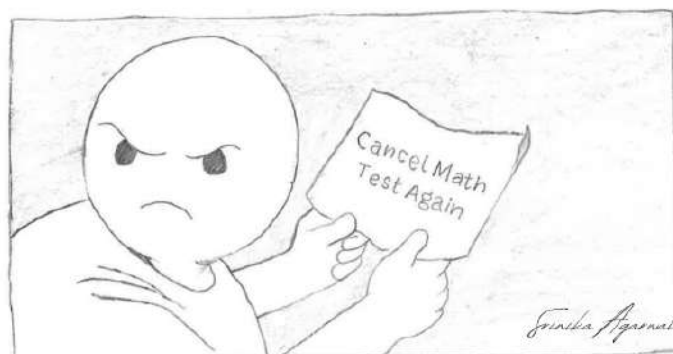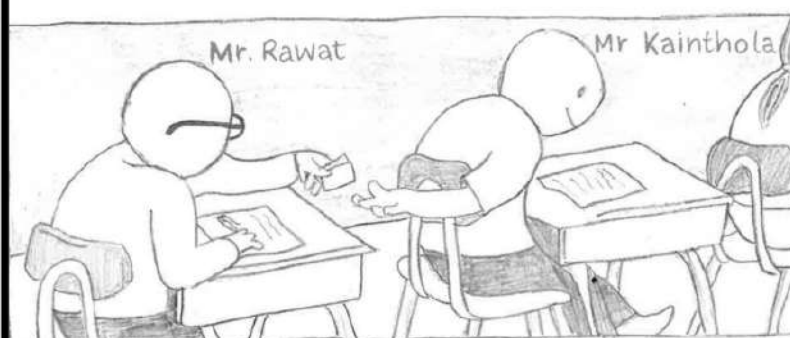**Step 2**: Reverse the digits to produce a new number, 486

Step 3: Subtract the lower amount (684 - 486 = 198) by the bigger number.

Step 4: Reverse the result (198 becomes 891)

Step 5: Combine the results from steps 3 and 4 (198 + 891 = 1089).

Answer: No matter what three-digit number they started with, the outcome is always 1089.

-Priyanjali Sharma
-AIIs

George Boole, a self-taught English mathematician and logician, is widely regarded as the father of Boolean logic. Born on November 2, 1815, in Lincoln, England, Boole's work laid the foundation for modern computer science and information technology. His innovative ideas on mathematical logic have had a profound impact on computer programming, electronics, and even artificial intelligence.

Boole's early life was marked by financial hardship, but he was a highly motivated and curious individual. He began his self-guided exploration of mathematics, and eventually gained recognition for his work in algebra. His most significant contribution to the world of mathematics and logic came with the publication of "An Investigation of the Laws of Thought" in 1854. In this groundbreaking work, Boole introduced a symbolic algebraic system that could express logical statements and operations, now known as Boolean algebra.

Boolean algebra is based on a binary system, where values can only be true or false, and logical operations like AND, OR, and NOT are used to manipulate these values. Boole's system provided a formal way to represent and manipulate logical statements, making it a pivotal tool in the development of modern computing. In 1850 Boole met his future wife, Mary Everest, at Cork when she was visiting her uncle, John Ryall who was professor of Greek and Vice-President at the College. They were married in 1855 and had five daughters, of whom Alicia made important contributions to four-dimensional geometry. Unfortunately, George Boole's life was cut short when he died of pneumonia at the age of 49 in 1864. However, his legacy lives on. The field of Boolean logic, named in his honor, remains a fundamental part of computer science, and his ideas have been crucial in the advancement of technology and the digital age.

In conclusion, George Boole was a visionary mathematician and logician who revolutionized the world of computing and information technology and his creation of Boolean algebra left an indelible mark on the development of modern computers and digital systems. Boole's work exemplifies how a single individual's innovative ideas can shape the course of human progress, as his discovery continues to influence the digital world we live in today.

Mary Everest Boole was a remarkable British mathematician and educator known for her pioneering work in the fields of mathematics and education. She was born in England and was the daughter of George Everest, a prominent geographer and surveyor general of India.

Mary's most notable contribution to mathematics was her development of 'Boole's Method of Linear and Differential Equations,' a novel approach to solving linear differential equations. Her work had a profound impact in the field, and she was recognized as a significant figure of 19th-century mathematics.

In addition to her mathematical accomplishments, Mary Everest Boole was a dedicated educator. She preferred a child-centered, intuitive approach to teaching and learning, which was quite progressive for her time. Her educational philosophy was influenced by her interest in psychology and her own experiences as a mother. She authored several books on education, the most famous of which is The Philosophy and Fun of Algebra, in which she introduced algebraic concepts through storytelling and play, making it accessible to and engaging for young learners.

Mary's work and ideas laid the foundation for the development of modern mathematical education, particularly in the teaching of algebra. Her legacy continues to inspire educators and mathematicians, and her commitment to both mathematics and innovative teaching methods has left an indelible mark on the world of education and mathematical thought. Her emphasis on making abstract mathematical concepts accessible and enjoyable for learners remains a guiding principle for educators worldwide. Mary's contributions to mathematics and pedagogy reflect her pioneering spirit in advancing both the fields .

MATH-A-GENIUS

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Teacher's Note

Dear Readers,

At the conclusion of this issue of Pi-rate, I extend my deepest appreciation to our talented student contributors and dedicated editorial team. Their unwavering commitment to creativity and excellence has brought this magazine to life. Your readership is the cornerstone of our success, and we are grateful for your continued support.

I encourage all students to consider sharing their ideas and stories in the next edition. Writing for our magazine is a great opportunity to express your thoughts and showcase your skills. Your voices matter, and your words can inspire, inform, and entertain.

Mathematics is the universal language that unveils the hidden patterns in our world, from the intricacies of nature to the complexities of technology. With every equation you solve, you gain the confidence to conquer new challenges and shape a brighter future. Remember, in the language of numbers, your possibilities are limitless, and your brilliance knows no bounds.

Thank you for your commitment to the world of numbers, and I eagerly anticipate your future contributions.

With enthusiasm,
Vishal Rawat