

THE ANNUAL MAGAZINE  
DEPARTMENT OF MATHEMATICS  
BHARATI COLLEGE

TRENDS

STYLE

MODEL

INSPIRATION

ART

FASHION

# CONTINUUM

## 2.0



VOL

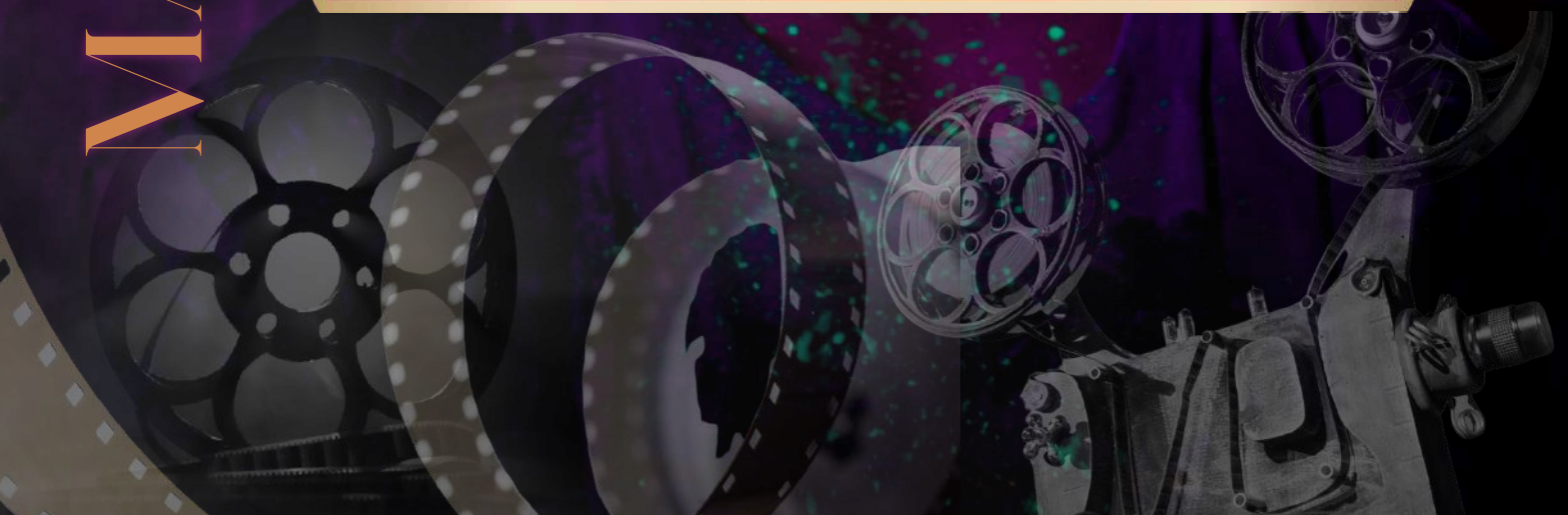
MATHS INTO  
FASHION AND  
CINEMA

MAGAZINE'S THEME

# Fashion



CINEMA



# From the desk of

## Principal

### Prof. Dr. Saloni Gupta

Dear Students and Faculty Members, It brings me great pleasure to congratulate you on the inaugural issue of our Mathematics department magazine. As we start on this exciting journey together, I am filled with optimism and enthusiasm for the boundless possibilities that lie ahead. I encourage each of you to embrace the challenge of diving deep into the world of numbers and equations. Let us approach mathematics not as a daunting task but as a captivating adventure, one that stimulates our brains and keeps them fertile with new ideas and insights. Mathematics is not just an academic pursuit; it is a mental workout that enhances cognitive abilities and fosters critical thinking skills.



As members of this esteemed department, we bear a special responsibility to not only hone our own quantitative aptitude but also to extend a helping hand to others in developing theirs. Let us embody the spirit of collaboration and mentorship, creating an environment where every student feels empowered to excel in mathematics. Whether through peer tutoring, study groups, or organized workshops, let us cultivate a culture of mutual support and encouragement. As we start on this journey together, I am confident that our dedication to the beauty of numbers will allow our minds to soar to new heights of understanding and creativity. Let us embrace this journey with open hearts and eager minds, knowing that the possibilities are limitless and the rewards immeasurable. I extend my heartfelt gratitude to all who have contributed to the creation of this magazine and look forward to witnessing the continued growth and success of our Mathematics department. Warm regards.

# From the desk of

## Teacher-in-Charge

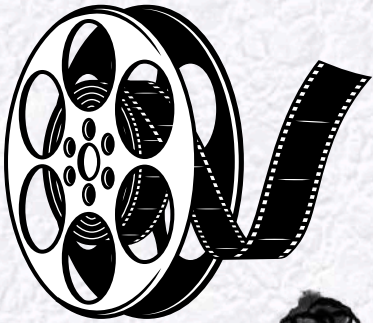
### Dr. Vinesh Kumar

It gives me immense pleasure to pen down a few words for the annual departmental magazine of The Exponents. A magazine is not just a collection of articles, but a reflection of the creativity, intellect, and teamwork of its contributors. It represents the spirit of our department and provides a platform for students to express their thoughts beyond the boundaries of classrooms.



I am proud to see our students balancing academics with such vibrant participation in writing, designing, and organizing this magazine. Their efforts mirror the same curiosity and discipline that Mathematics as a subject instills: clarity in thought, depth in understanding, and beauty in expression.

I extend my heartfelt appreciation to the entire editorial team, the contributors, and every student who has worked tirelessly to bring this edition to life. May this magazine continue to inspire, nurture creativity, and serve as a cherished archive of our department's journey.



FASHION



# TABLE OF CONTENTS

1. About Bharati college & the Exponents
2. Magazine Team
3. Our department
4. Growth of mathematics
5. Lottries and maths
6. Erdos Number
7. Benford's Law & Aperiodic Monotile Discovery
8. The secrets of ama (one)
9. Mathematical muses
10. Songs of Logic
11. Millennium prize problems
12. Mathematical theories that remain unsolved
13. New findings and additions to existing theorems/proofs -
14. Fashion is Math
15. Fractals in Fashion
16. Mathematics textile and fabrics
17. Sacred Symmetries:
18. Maths Marvels
19. The Movie
20. Film editing & scene composition
21. Contribution of women in mathematics
22. Riddle Time
23. Captured Moments
24. The Soul of Art
25. CTRL + LOL Our Best Meme Moments



# THE EXPONENTS



## Department of Mathematics Bharati College

In the constantly changing academic landscape of Bharati College, The Exponents is a strong symbol of passion, development, and mathematical curiosity.

Established in August 2017 by the Department of Mathematics, this society was born with a mission: to unveil students to the beautiful and rich world of mathematical sciences and to create a community where intellect and innovation go hand in hand.

Since its foundation, The Exponents has remained committed to the overall growth of students. Far more than an arena for scholastic enhancement, it cultivates leadership, confidence, and teamwork through a plethora of enriching activities. Right from arranging seminars and workshops to introducing niche initiatives such as Vedic Math classes and ASC (Aptitude Skill Coaching) for aspirants of government exams, the society makes sure that mathematics becomes not just comprehensible, but immensely empowering.

One of the highlights of the society is its annual event, named Xponentia this year—an intellectual celebration of talent and collaboration. Much more than the pages of textbooks, Xponentia provides students with a platform to venture into debates, games, creative competitions, and moments of togetherness that remain with them well after the event is over.

Through the years, The Exponents has become a center of learning, mentorship, and inspiration. It is not only a shaper of mathematical minds but also of well-rounded individuals who are ready to face the future with clarity and conviction.



# ABOUT BHARATI COLLEGE



## Empowering Women Leaders of the Future

Situated amidst the vibrant intellectual hub of Delhi University, Bharati College shines as a torchbearer of women's empowerment and excellence. It was founded in 1971 as Bharati Mahila College and has since grown into one of India's most respected women's institutions, dedicated not only to higher studies but to molding robust, independent thinkers and leaders.

With a heritage of more than half a century, Bharati College boasts a wide range of undergraduate and postgraduate courses in the arts, commerce, and science streams.

But Bharati College is so much more than an educational institution. It is a space for transformation where young women are encouraged to pursue excellence with courage and conviction. Here, not only is curriculum taught but life lessons too—determination, resilience, ambition, and purpose are imparted to the students. Every classroom, every corridor, and every campus activity resonates with a sense of purpose and sisterhood, creating a space where dreams are fostered and identities are forged.

From the classroom to the national-level conference, from cultural celebrations to outreach programs in the community, this college challenges its students to participate, to lead, and to rise. It is an institution where opportunity and aspiration converge and where women become graduates ready to change the world—not only as graduates, but as changemakers.

# MAGAZINE TEAM



**Anoushka Choudhary**  
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**Komal Payari**  
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**Namita Gurung**



**Nidhi Yadav**

# RESEARCH TEAM TEAM



## Thank you note

As we turn the pages of this edition, it's impossible not to pause and acknowledge the incredible team behind it. This magazine is not just a collection of articles and designs—it's the result of countless hours of brainstorming, editing, creating, and collaborating. To the writers, editors, designers, and coordinators—thank you. Your dedication, creativity, and attention to detail have brought this vision to life in the most beautiful way.

Each of you played a vital role, and together, we've created something truly special. Here's to the power of teamwork and the passion that drives us forward.

With heartfelt thanks

# OUR DEPARTMENT



Dr. Ankit Gupta



Dr. Meenakshi Gupta



Dr. Anubha Bhargava





**1ST  
YEAR  
SLAY**



*proof  
by  
style*



**NO MORE  
NUMBERS  
WONDERS**





**2ND  
YEAR  
SLAY**



*theorem  
of slay  
all day*



**FROM  
BOOKS TO  
BOOTS,  
WE  
CHOOSE  
TO SHINE**





**3RD  
YEAR  
SLAY**



*art of  
dressing*



**SERVING  
LOOKS,  
NOT  
ASSIGNMENT**



# GROWTH OF MATHEMATICS

Mathematics developed extensively due to puzzles and riddles and practical daily applications that fostered advanced logical thinking abilities as well as problem-solving capabilities. This piece examines the developments of math in these fields.

## In Puzzles and Riddles

Mathematical puzzles along with riddles served as fundamental tools for mathematics development throughout history. Some notable contributions include:

- Ancient civilizations particularly problems among its other contents.
- Archimedes and Euclid among other Greek intellectuals created difficult problems for studying mathematical concepts.

The Fibonacci's **Rabbit Problem** from the 13th century became the origin for both the Fibonacci sequence and its natural and financial and algorithm applications.

During the 19th and 20th centuries recreational mathematics gained popularity through its presence in recreational books and magazines.

Through his work Martin Gardner made recreational mathematics popular by introducing logic puzzles and combinational problems as well as cryptarithms to the public.

Today news paper as well as competitions including Olympiads and apps utilise math puzzles to improve mathematical skills among students and enthusiasts.

## In Daily Life

Various dimensions of modern society depend on mathematics for their essential functioning.

Budget management as well as interest computation and investments depend strongly on fundamental arithmetic alongside algebra and statistical techniques in both Economics and Finance parts.

Data science together with algorithms and cryptography need mathematical foundations to function properly in technology and computer science.

The fields of artificial intelligence and machine learning together with cybersecurity continue to rise in importance while based on fundamental mathematical concepts.

Engineering together with Architecture makes use of mathematical principles of geometry and calculus to design structures that include bridges and buildings.

Mathematical models enabled by the field enable disease spread assessment (e.g. epidemiology) and optimize medical imaging techniques and drive drug development advancement.

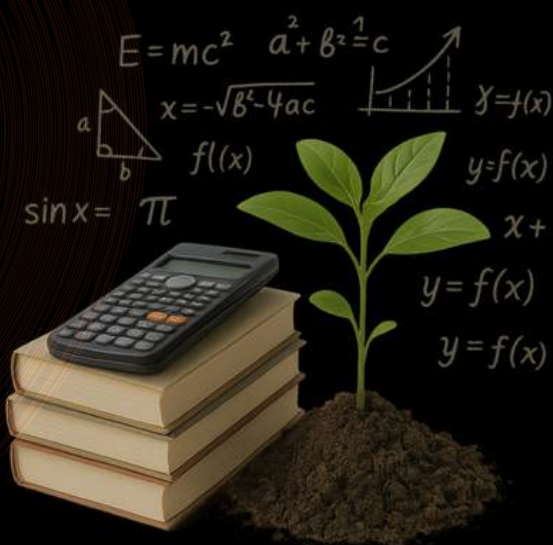
Every day people use mathematical calculations to decide about discounts as well as measure travel duration and determine cooking measurements.

The fields of games along with entertainment boost their applications

through probability along with combinatorics principles for game theory and sports strategies as well as video game construction.

### Conclusion

The development of mathematical knowledge streams from intellectual investigations of puzzles and riddles and practical uses in daily activities. Modern science along with technology and problem-solving areas discover continuous innovative uses for mathematical principles





# Lotteries and Maths



Mathematics, particularly probability theory and statistics, plays a crucial role in lotteries, betting, and horse racing. These fields rely on mathematical principles to determine odds, expected values, and winning probabilities. Let's break it down:

## 1. Mathematics in Lotteries

Lotteries are based purely on chance, and probability helps determine the likelihood of winning.

### Basic Probability in Lotteries:

- If a lottery requires selecting 6 numbers from 49 (as in a standard 6/49 lottery), the total number of possible combinations is calculated using combinations:

$$\begin{aligned} \blacksquare {}_{49}C_6 &= \frac{49!}{6!(49-6)!} \\ \blacksquare {}_{49}C_6 &= \frac{49!}{6!43!} \\ \blacksquare {}_{49}C_6 &= \frac{49 \times 48 \times 47 \times 46 \times 45 \times 44}{6 \times 5 \times 4 \times 3 \times 2 \times 1} \\ \blacksquare {}_{49}C_6 &= 13,983,816 \end{aligned}$$

- This means the probability of winning the jackpot is 1 in 13,983,816—very low!

### Expected Value (EV) Calculation:

- The expected value helps determine whether playing the lottery is profitable. If a ticket costs \$2 and the jackpot is \$10 million, but after taxes and prize splitting the average payout per ticket is only \$1.50, the expected value is negative, meaning it's a bad bet in the long run.

### Mathematical Strategies:

- While **no strategy guarantees a win**, players sometimes use number selection strategies like avoiding common numbers (birthdays, for example) to minimize sharing winnings with others.

## 2. Mathematics in Betting (Casino, Sports, and Horse Racing)

Betting markets, including horse racing and sports betting, use probability, statistics, and odds calculations to determine payouts.

### Probability in Sports Betting

- Bookmakers set odds based on probabilities of outcomes.
- Example: If a football team has a 50% chance of winning, its fair odds should be:

$$\text{Odds} = \frac{1}{\text{Probability}} = \frac{1}{0.50} = 2.00 \text{ (decimal odds)}$$

- However, bookmakers adjust odds to include a profit margin (the "house edge").

### Horse Racing and Odds Calculation

- Horse racing uses pari-mutuel betting, where all bets go into a pool, and payouts depend on how many people bet on each horse.

Handicapping (using past performance, track conditions, and jockey experience) relies on mathematical models to predict outcomes.

### The Kelly Criterion (Used in Betting Strategies)

- A formula that helps bettors decide how much to wager based on their advantage:

Where:

- o  $f^*$  = Fraction of bankroll to bet
- o  $b$  = Net odds (e.g., 2-to-1 odds  $\rightarrow b=2$ )
- o  $p$  = Probability of winning
- o  $q$  = Probability of losing ( $1-p$ )

- This helps maximize long-term profits while minimizing risks.

### 3. Casino Games and Probability

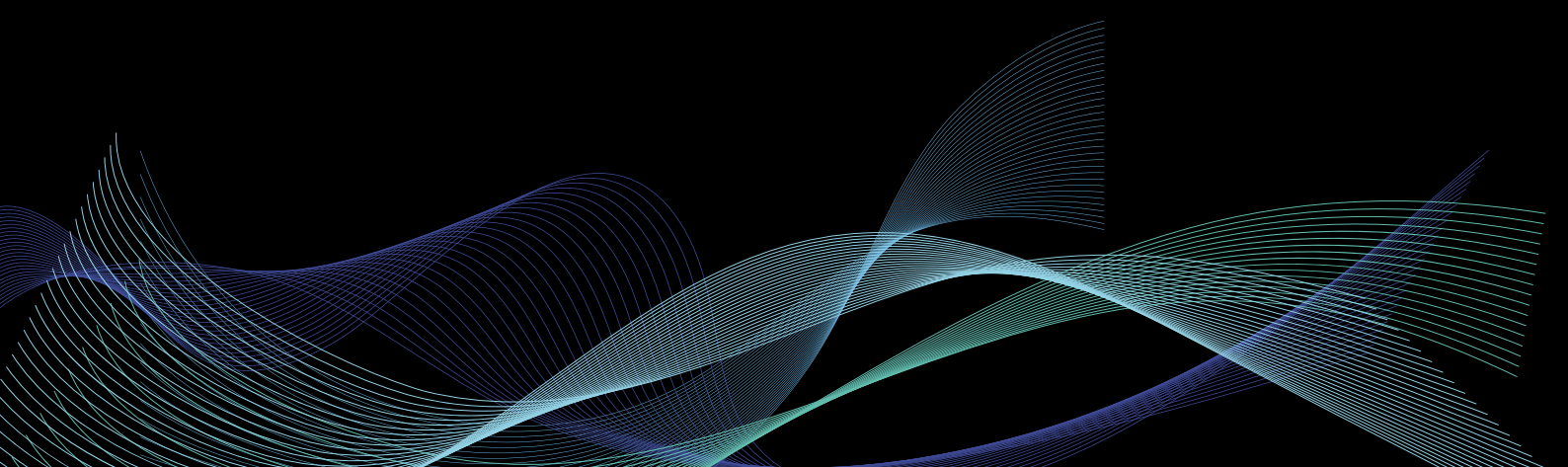
- Games like **roulette**, **blackjack**, **poker**, and **slot machines** have well-defined probabilities.
- **Roulette Example** (European wheel):  
37 slots (numbers 1-36 + a single 0)  
Probability of betting on a single number and winning:

$$\frac{1}{37} \approx 0.027 = 2.7\%$$

- The house edge ensures that casinos always profit over time.

### Conclusion

Mathematics plays a fundamental role in gambling, from lotteries to sports betting and casinos. Understanding probability, expected value, and strategies like the Kelly Criterion can help gamblers make informed decisions. However, since most games are designed to favor the house, longterm profitability is rare unless an edge (e.g., statistical modeling in sports betting) can be found.



# BENFORD'S LAW & APERIODIC MONOTILE DISCOVERY

Benford's Law is one of the most fascinating yet counterintuitive principles in mathematics. It states that in many naturally occurring numerical datasets, the first digit is more likely to be small than large. That means in numbers like city populations, stock prices, and lengths of rivers, the digit '1' appears far more often as the first digit than '9'. But why?

Benford's Law arises due to the way numbers are distributed logarithmically. It is widely used in fraud detection, accountants and forensic analysts check financial statements for violations of this pattern. If fabricated numbers don't follow Benford's expected distribution, fraud is suspected!

Now, onto another groundbreaking discovery in math—the aperiodic monotile, or the 'Einstein tile'. This recently found geometric shape is the first known single tile that can cover an infinite plane without forming a repeating pattern. Previously, aperiodic tiling required at least two different tiles, but this discovery has changed the game in tiling theory.

The Einstein tile is crucial for fields like crystallography and material science, where understanding non-repeating structures helps in designing materials with unique properties. Its discovery also links to Penrose tiling and quasicrystals fields that have implications in physics and engineering.

Whether it's spotting fraud or discovering revolutionary tiling concepts, Benford's Law and the Einstein tile show how mathematics continues to unveil surprising patterns in our world!

# ERDŐS NUMBER: THE COOLEST MATH BADGE

Imagine a game where you measure your closeness to a mathematical legend. That's essentially what the Erdős Number is! Named after the prolific Hungarian mathematician Paul Erdős, this number measures collaboration distance between researchers based on co-authored papers.

Erdős, who published over 1,500 papers, had an Erdős number of 0. If you wrote a paper with Erdős, your Erdős number is 1. If you co-authored a paper with someone who worked with Erdős, your number is 2, and so on. The lower your Erdős number, the closer you are to this mathematical giant!

Why does this matter? The Erdős Number is a fun way to visualize academic collaboration. It has inspired similar concepts in other fields, like the Bacon Number in Hollywood (linking actors to Kevin Bacon) and even the Erdős-Bacon number, which connects both academia and entertainment.

Beyond the fun, the Erdős Number highlights the interconnectedness of the academic world. It demonstrates how research is a collaborative effort, bridging different disciplines and countries.

Studies on academic networks show that mathematicians and scientists work within a vast, interwoven web of knowledge, where even an undergraduate researcher could theoretically link back to Erdős!

So, if you're considering a research career, don't just aim for publication check your Erdős Number! You might already be part of a mathematical legacy without realizing it!



# THE SECRETS OF AMA(ONE)

An excerpt from "The Untold Meaning of Sanamahi  
Symbol" by Dr. Raghu Ningthoujam

*"First make a small curve, now extend it on the other side and then give it a small tail... And that's how you write 'AMA', one in Manipuri, ☐*

These were the words of my school teacher when she taught the whole classroom how to write the number "one" in Manipuri when I was in kindergarten. Nothing special, just learning how to write numbers in my native script and never really gave much thought on the neither on the numbers nor the script. Just boring numbers, complicated script and additional stress on my young mind. To be honest, writing in Meitei Mayek, the Manipuri script was not much of a piece of cake for me. It was kind of like a very tough nut to crack, nothing like a sweet delectable piece of cake. I even went as far as to write numbers in roman letters in my Manipuri exam although my teachers warned me not too. That was how much I thought of a hassle it was. But until recently, everything changed. My thoughts, my perception and my view on my native script changed and that too in a way I never thought it would.

Just a few weeks back, my friend sent me an article titled "The Untold Meaning of Sanamahi Symbol" by Dr. Raghu Ningthoujam who is a scientist currently serving at Indian space Research Organisation. And reading that article changed my perception of my mother script because it was not just a simple script. It is the symbol of God and the very embodiment of many mathematical ideas. I also hope to provide some information to my readers about this very Sanamahi symbol.

Well to begin with, Sanamahi is the main deity for Meitei people. He is the supreme creator according to Sanamahism. The Sanamahi symbol mentioned here is "one" in Manipuri. The reason it is called as God's symbol is evident from Puya, the ancient Manipuri text. Several quotations from Puya show how AMA is the representation of Lainingthou Sanamahi. It is safe to say that this symbol is not a simple one as it not only represents god but is in relation with amny mathematical ideas.

In his article, Dr. Raghu brings forth the relation with AMA and the relation with mathematical ideas and theories, particularly Golden Ratio, Fibonacci Numbers, Golden Spiral, Fibonacci Spiral and Binet's Formula.

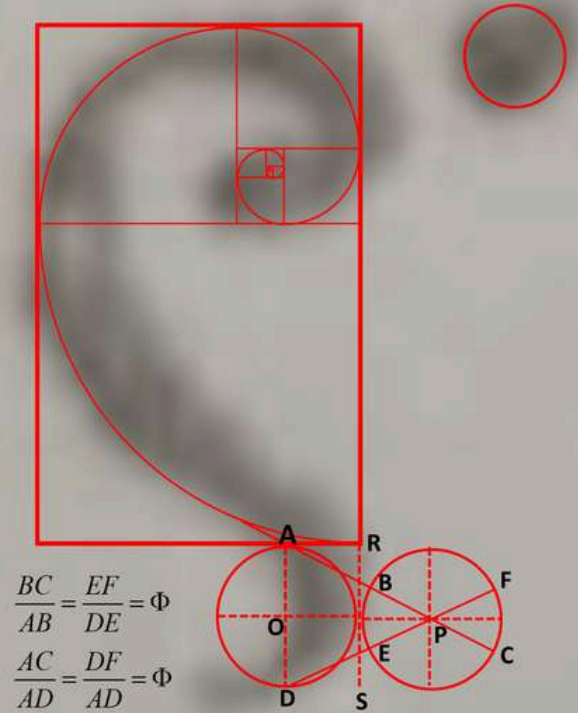


Mathematically, the holy symbol of Sanamahi Ama – representing 0 and 1 can be correlated to the first two Fibonacci numbers from which an infinite Fibonacci series is created and thus the holy figure Ama symbolizes the enormous power of generation acting on 0 and 1. Also, the Fibonacci number intricately contains an amazing number called the golden ratio Phi in it.

We have seen that in the history of mankind, Golden Ratio Phi is a single mysterious number which had pondered great thinkers of all disciplines like Mathematicians, Scientists, Artists, Historians, Architects, Musicians, Psychologists, Mystics and Theologians, over centuries over its ubiquity and appeal. Golden ratio is considered to be divine and God-like because of its ubiquity property that it is found almost everywhere, in art, architecture, plants, human beings, animals, science, mathematics, DNA, solar system and cosmos and what not, like a God who is omnipresent. Also, the Golden ratio is regarded to be the most exquisite extant and is called 'Tool of God' used to design/create the universe. Among numbers, it is the most irrational number having an infinite number of decimals but not repeating like God is infinite. Also, interestingly, Golden ratio is the only number which can be exclusively expressed in terms of infinite 1's as continued fraction

*Also, curiously enough, we have seen that the holy symbol of Sanamahi Ama has hidden golden spiral and golden ratio signatures in all respects in it. It exactly stands in the form of a golden spiral with embedded golden ratio proportions in the tail part as well.*

### Ama (the One) - Holy Symbol of Sanamahi



©Raghu Ningthoujam, 2021-22

*In essence, the symbol "Ama, □" transcends its role as a mere numeral in Manipuri script, revealing a deep connection between spirituality, mathematics, and the cosmos. Dr. Raghu Ningthoujam's insights uncover its hidden relationship with the Golden Ratio, Fibonacci sequence, and fundamental forces of creation. More than just a symbol, it reflects the divine essence of Lainingthou Sanamahi and the intricate patterns that shape the universe. This fusion of ancient wisdom and mathematical precision highlights the timeless significance of "Ama" as a bridge between the mystical and the scientific.*

In whispered curves and  
silent lines,  
Where reason sleeps and  
art entwines,  
The muses hum in  
numbers' grace,  
A secret song in time and  
space.

The poet dreams in  
algebra,  
Where X and Y define the  
stars,  
Equations dance beneath  
the moon,  
And symmetry becomes a  
tune.

A circle sings of endless round,  
Infinity in curves unbound,  
While angles craft the perfect prose,  
In every triangle that knows.

The golden ratio gently weaves  
Through petals, shells, and autumn leaves,  
A quiet hymn, a spiral's flight,  
From nature's hand to math's delight.

The prime waves beat, a hidden song,  
A code that pulses deep and strong,  
In patterns pure, the muses hide,  
Their riddles wrapped in numbers' pride.

In fractals' arms, the muses spin,  
A mirrored world, both out and in,  
Where chaos births a patterned stream,  
A paradox, a painter's dream.

The calculus of falling rain,  
Derives the joy, subtracts the pain,  
Each integral and sharp divide  
Reveals where truth and dreams collide.

So let the muses softly speak,  
In vectors bold and functions sleek,  
For math, beneath its steely art,  
Is poetry within the heart.

*By- Anisha Agarwal*

# MATHEMATICAL MUSES



Oh, dear math, why so tough?  
You make my brain scream,  
"Enough!" With numbers,  
angles, X and Y, Sometimes I  
just want to cry!

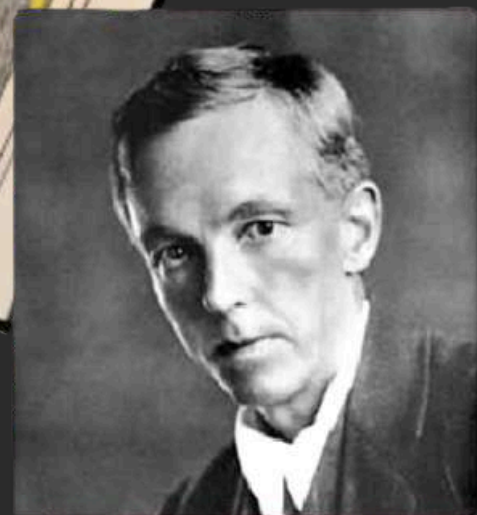
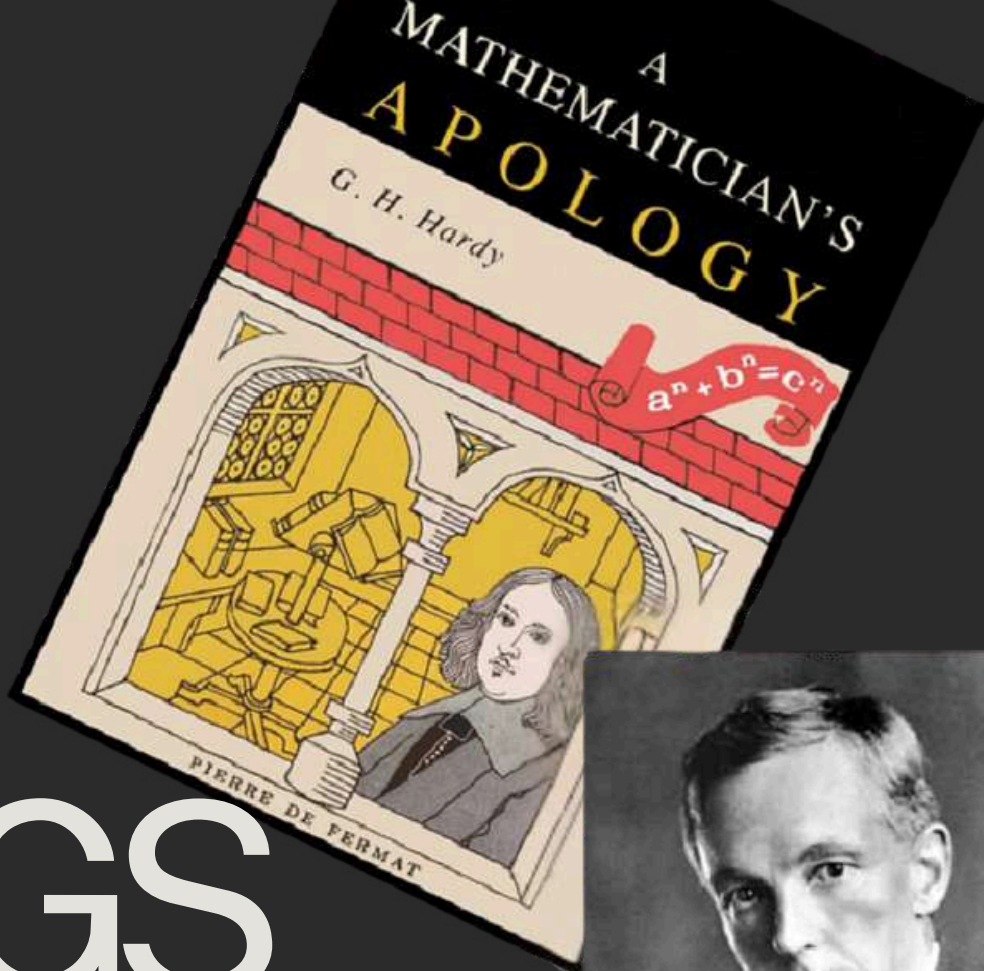
Equations dance inside my  
head, Fractions fill my heart  
with dread.  
Algebra feels like a tricky maze,  
And calculus? A foggy haze!

But wait—there's beauty deep  
inside,  
In every shape and curve so  
wide.

The golden ratio, circles grand,  
Math builds wonders across the  
land!

So, though you make my head  
go boom, I'll solve your riddles,  
give you room.  
For every problem, big or  
small,  
There's logic, reason—math  
loves all!

*By- Prachi Kumari*  
*From Keshav Mahavidyalaya,*  
*University of Delhi*

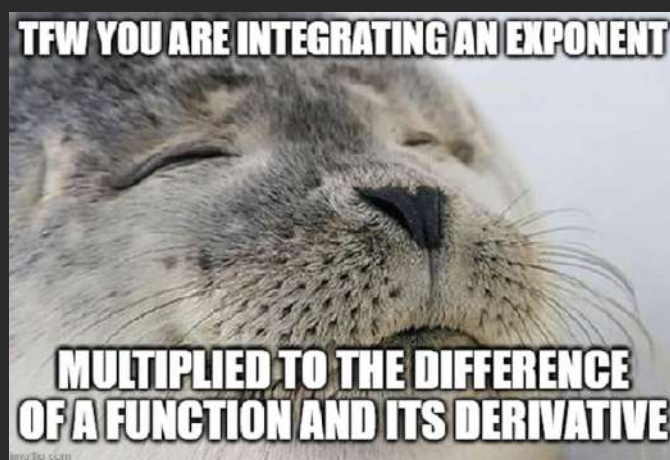


# SONGS OF LOGIC

*"A mathematician, like a painter or poet, is a maker of patterns. If his patterns are more permanent than theirs, it is because they are made with ideas."*

— *A Mathematician's Apology* by G. H. Hardy

Mathematics, often seen as rigid and unforgiving, has a more profound language that governs everything around us. Yet, it remains an insurmountable challenge for many. Why is math so "tough", and how can it be made more accessible?



*I discovered I liked math when I encountered geometry in the 'Triangles' unit of 9th grade. But it truly clicked when I discovered how to integrate an exponent multiplied by a function and its derivative's difference, because simplifying is just so elegant in its form.*

# MATH FOR A NOVICE

Math is typically taught as rigid rules rather than a discovery adventure. School children and engineers alike fail when they are not allowed to see the 'why' behind the equations. Learning math in the context of real-world applications, like how the acceleration of a car is connected to derivatives, makes math make sense. Visual learning, interactive problem-solving, and storytelling can transform math from a chore into an engaging puzzle.



*I once watched "Only Yesterday", where the protagonist said those who understand rational fractions in school tend to have their life set in adulthood. I failed a small ratios and fractions unit test with 3/10 marks but later scored 99/100 in my 10th-grade math board exams. I enjoy math now, but my life isn't exactly "set." While this is ironic to the title but can be applicable probabilistically, it's stuck in my brain as a very creative observation.*

# MATH AND LOGIC: THE ROYAL COUPLE

Gauss called mathematics the "queen of sciences" and logic its king. Without logic, no theorem stands; without mathematics, no logic can be quantified. Programming, for example, relies on Boolean algebra and probability. Even philosophy draws on logical structures founded on mathematics. The precision of mathematics makes sure that scientific hypotheses hold good when put to test.

Mathematics is also highly philosophical. According to Zeno's paradox, Achilles will never overtake a tortoise due to infinite divisions. However, calculus debunks this by demonstrating that a sum that is infinite can also be finite. The idea of something being infinitely huge and yet infinitesimally tiny is surreal but absolutely vital in quantum mechanics and cosmology. Cantor's theory of different sizes of infinity adds to this complexity, showing that infinity is not one but an enormous set of mathematical possibilities.



*The  $\xi$  (xi) symbol haunting me now is an understatement. It's in my engineering syllabus, in the most backlog-prone subject: Antennas and Propagation. I thought it would be simple, full of derivations. What I didn't expect was the sheer number of formulas to memorize just to derive those equations, making it my biggest ick of the year.*

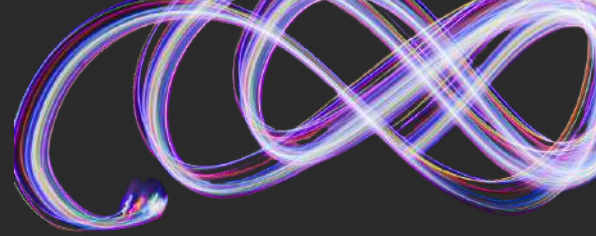
# MATH IN EVERYTHING

Harmonies in music are controlled by mathematical proportions, programming by algorithms, and space travel by Newton's laws and Einstein's equations. Biology too is subject to mathematical patterns, from the Fibonacci spiral of nature to fractals in the blood vessels. In economics, mathematical models predict trends in the market, and in medicine, statistics help in new cures.

Even art is not exempt—perspective drawing and the golden ratio dictate everything from Renaissance paintings to modern architecture. Snowflake symmetry, the structure of DNA, and even the locomotion of animals all follow mathematical rules, demonstrating that mathematics is not abstract but is deeply woven into existence.



*What I love about math is the sense-building involved. The more you solve, the more you feel it, that's what makes it so magical. This gave me an edge in programming; while my peers struggled, I found the underlying logic intuitive. The same applied to engineering graphics, where the methodical nature felt natural to me. And in music, what made me excel in swara kalpana was recognizing the patterns in rhythms and notes.*



# AN INFINITE BEAUTY

What's a good solution to overcoming this fear? They are just puzzles. A strong foundation in logic doesn't just help in mathematics but also in daily life. Decision-making, programming, and even creative fields like music composition rely on logical progression. If logic-building is approached with curiosity rather than memorization, it can shape a person's ability to analyze, predict, and innovate. Logic and the arts together create a balance, one that makes life intellectually rich and emotionally fulfilling.

Mathematics is not merely numbers — it's the universe's language. With interest and applicability, it can be as captivating as music or as thrilling as travel to space. Understanding its patterns reveals the beauty of everything in our surroundings, from the atomic interactions to the universe itself. Perhaps, by embracing mathematics entirely, we learn more about reality itself.

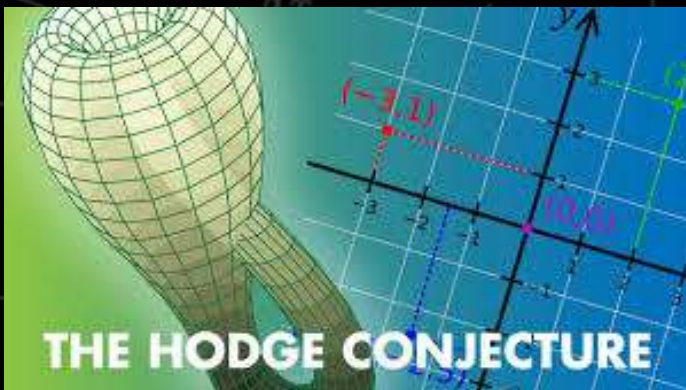
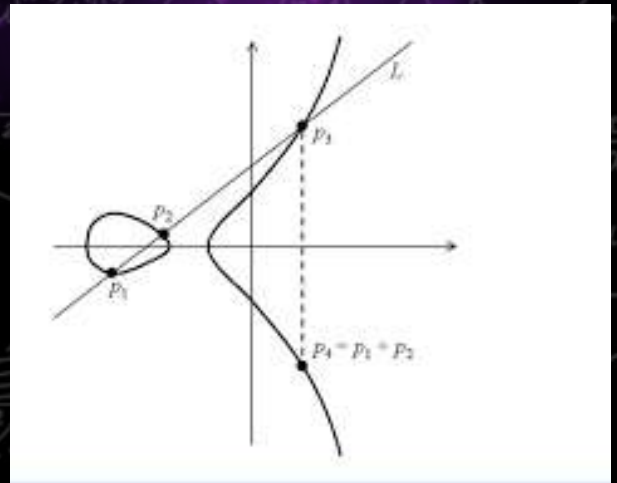
*By- Anusha*

# MILLENNIUM PRIZE PROBLEMS

Ever heard of expensive math problems? The Millennium Prize Problems are seven well-known complex mathematical problems selected by the Clay Mathematics Institute in 2000. Each question is worth a US \$1 million prize for the first correct solution, which is roughly 8,69,46,919 Indian Rupee. Now let's dive in to know what the problems are:

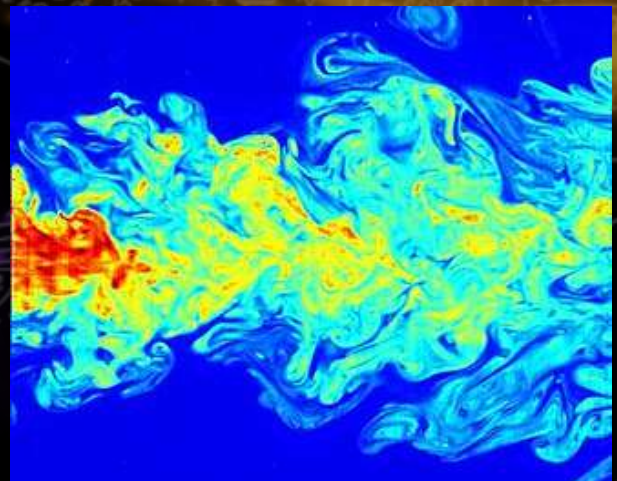
## 1. Birch and Swinnerton-Dyer Conjecture

- Deals with: Elliptic curves, which are a type of algebraic curve with important applications in cryptography and number theory.
- The conjecture: Predicts the number of rational points on an elliptic curve based on its associated L-function.
- Why it's important: A proof would provide a deeper understanding of elliptic curves and their relationship to other areas of mathematics.



## 2. Hodge Conjecture

- Deals with: Complex algebraic varieties, which are geometric objects defined by polynomial equations.
- The conjecture: Relates the algebraic topology of a complex algebraic variety to its De Rham cohomology.
- Why it's important: A proof would provide a deeper understanding of the relationship between algebraic geometry and topology.

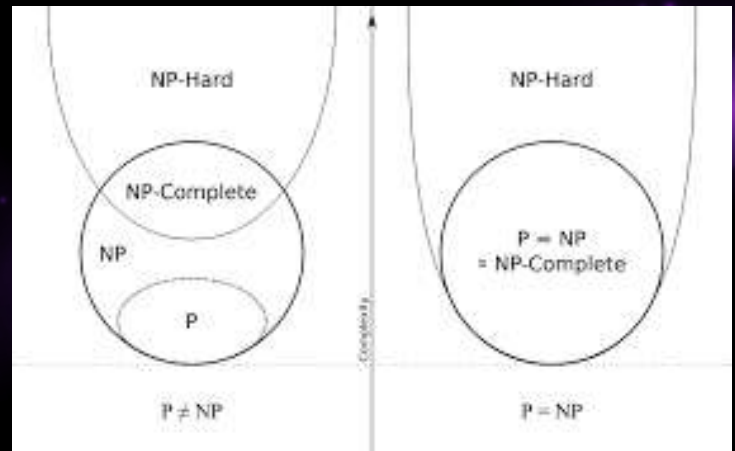


## 3. Navier-Stokes Existence and Smoothness

- Deals with: The Navier-Stokes equations, which describe the motion of fluids.
- The problem: Whether smooth, physically reasonable solutions to the Navier-Stokes equations exist for all time.
- Why it's important: A proof would have implications for our understanding of fluid dynamics and turbulence.

#### 4. P versus NP

- Deals with: Computational complexity theory, which studies the resources required to solve computational problems.
- The problem: Whether problems whose solutions can be quickly verified can also be quickly solved.
- Why it's important: A proof would have major implications for computer science and cryptography.

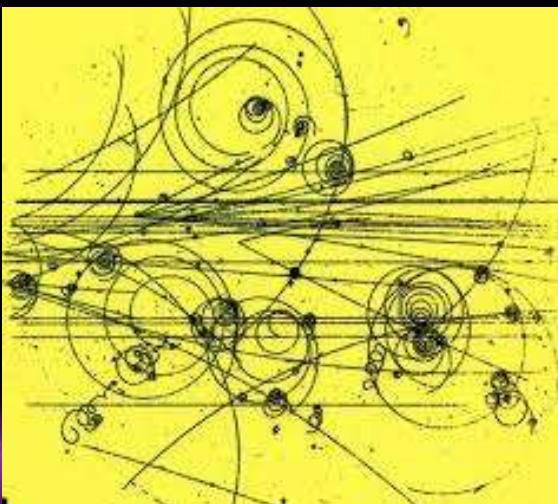
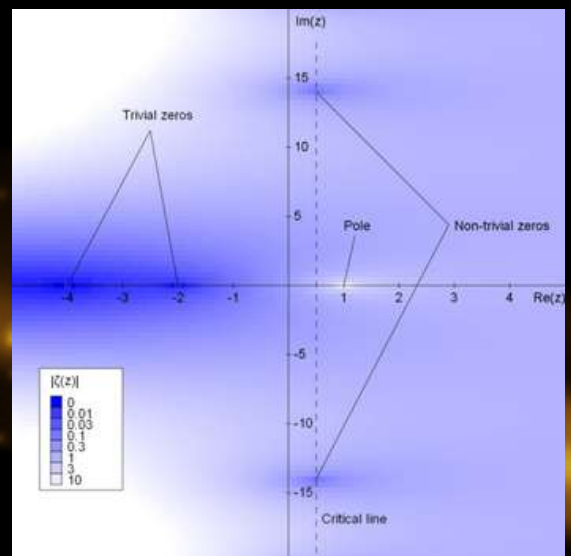


#### 5. Poincaré Conjecture

- Deals with: The shape of three-dimensional spaces.
- The conjecture: That every simply connected, closed 3-manifold is homeomorphic to the 3-sphere.
- Why it's important: It provides a fundamental understanding of the topology of three-dimensional space.

#### 6. Riemann Hypothesis

- Deals with: The distribution of zeros of the Riemann zeta function.
- The conjecture: That all non-trivial zeros of the Riemann zeta function lie on the critical line.
- Why it's important: A proof would have major implications for number theory, especially the distribution of prime numbers.



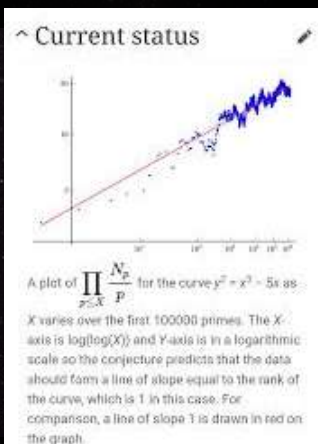
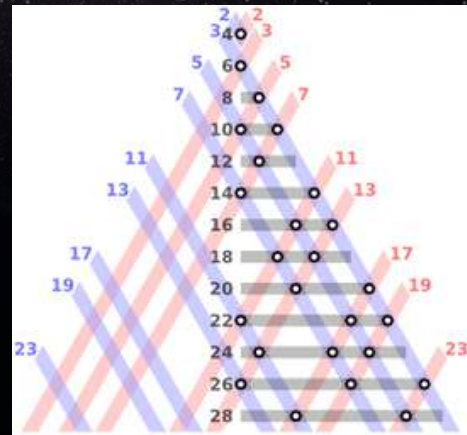
#### 7. Yang-Mills Existence and Mass Gap

- Deals with: Quantum Yang-Mills theory, which is a fundamental theory in particle physics.
- The problem: To prove that Yang-Mills theory exists and that it has a mass gap.
- Why it's important: A proof would provide a deeper understanding of the fundamental forces of nature.



# Mathematical Theories that remain unsolved

1. Goldbach Conjecture: This famous conjecture says that every even integer greater than two can be expressed as the sum of two prime numbers. However even after extensive numerical evidence supporting it, the proof remains unsolved till date.



2. Birch and Swinnerton-Dyer Conjecture: This conjecture relates to elliptic curves and it suggests a deep connection between the number of rational points on an elliptic curve and the behavior of its associated L-function. This inspired many people to do deep research across many fields, leading to new theories, techniques, and connections between different areas of mathematics. It can be said that this Conjecture led rise to many new discoveries in mathematics.

3. Existence of Odd Perfect Numbers: It remains unknown whether any odd perfect numbers exist, despite extensive research into their properties.

4. Hadamard Matrix Conjecture - The Hadamard matrix conjecture proposes that a Hadamard matrix of order  $4k$  exists for every positive integer  $k$ . A Hadamard matrix is a square matrix with entries of  $+1$  or  $-1$ , whose rows are mutually orthogonal. Hadamard matrices can be used to create error-correcting codes and are used in balanced repeated replication for statistical variance estimation.

5. Collatz Conjecture - The Collatz conjecture is a famous unsolved problem in mathematics that proposes a simple process which will eventually transform every positive integer into 1.

The process says that -

1. Start with any positive integer,  $n$
  2. If  $n$  is even, divide it by 2.
  3. If  $n$  is odd, multiply it by 3 and add 1.
- Repeat the process with the resulting number.

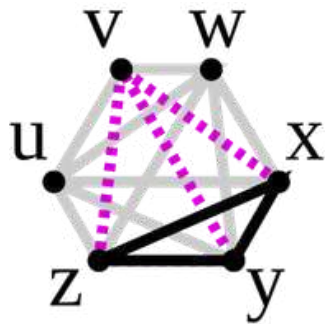
The conjecture states that regardless of the starting number, this process will always eventually reach 1. The conjecture has been tested for all positive integers up to  $2.95 \times 10^{20}$ , but no general proof has been found on this till date.

# NEW FINDINGS AND ADDITIONS TO EXISTING THEOREMS/PROOFS -

## 1 Advancement in Ramsey Numbers -

Definition - The Ramsey number is a fundamental concept in combinatorial mathematics and graph theory. It represents the minimum number of vertices required in a complete graph to guarantee that a certain structure, such as a monochromatic clique, exists regardless of how the edges are colored.

New Upper Bound - The upper bound for Ramsey numbers has been tightened from  $4(\text{power } n)$  to approximately  $3.993(\text{power } n)$ .



## 2. Climate Change Predictions -

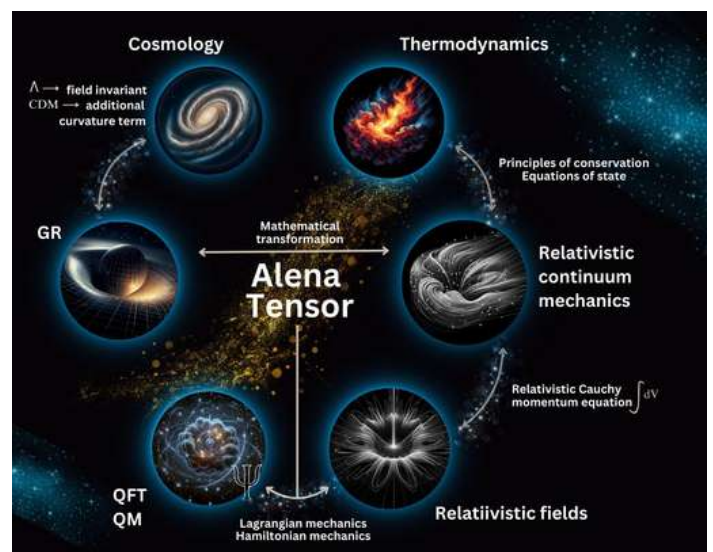
From the past few years researchers have started using mathematical models to show how movements in sea ice enhances heat transfer, which may help in improving climate change predictions.

## 3. Mathematical Properties of 2025:

The year 2025 has unique mathematical properties, including being a perfect square ( $45 * 45$ ) and can be represented in various ways using mathematical operations. It can be expressed as the sum of cubes of all single-digit numbers and as the square of the sum of all single-digit numbers.

## 4. Unifying Physics with the Alena Tensor:

A new mathematical object called the Alena Tensor may bridge general relativity, quantum mechanics, and electrodynamics. It transforms curved space-time into a flat model, revealing that charged particles inherently possess spin.



# FASHION IS MATH

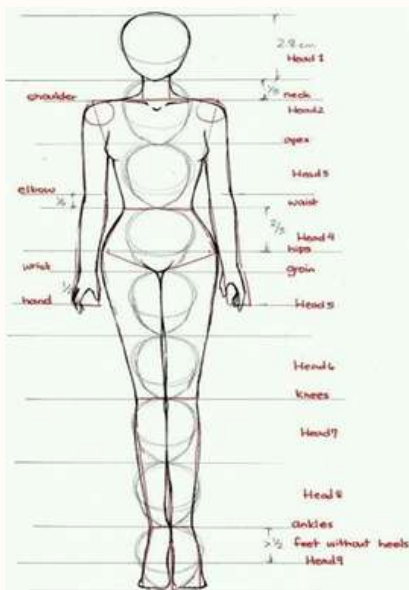
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Fashion is more than just creativity and aesthetics—it is deeply rooted in mathematics.

Behind every perfectly tailored outfit lies a precise system of proportions, measurements, and scaling that ensures a flawless fit. Mathematics over the years, has been playing a crucial role in the field of fashion, particularly in tailoring, through the art of proportions and measurements. From the golden ratio influencing garment design to pattern drafting based on mathematical scaling, tailoring is an art which is mainly guided by numbers.

There are many ways how Mathematics plays a key important role in the field of Mathematics. Let's see how the beauty of mathematics has impact on the beauty of garments:

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## **1. PROPORTION IN DESIGN:**

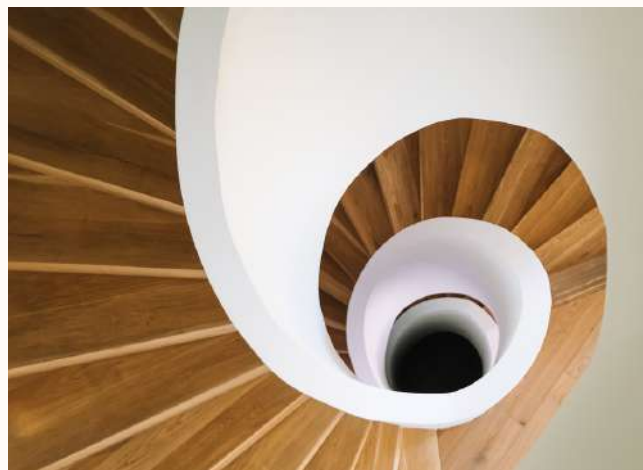
Fashion designers use proportions to create pleasing garments. This involves understanding the relationships between different parts of a garment to achieve balance and elegance. Fashion designers keep various proportions and measurements in mind while preparing garments.

## **2. RATIO AND SYMMETRY:**

Tailors rely on various mathematical principles such as ratios and symmetry to ensure that garments complement the exact human form. Measurements like chest-to-waist ratio, sleeve-to-shoulder length, and the balance between garment sections follow specific proportions to create aesthetically pleasing and well-fitted clothing.

## **USE OF THE GOLDEN RATIO:**

The golden ratio (approximately 1.618) is often used in design to create visually appealing silhouettes, ensuring harmony in clothing proportions. There are certain specific algebraic calculations which help in scaling these outstanding patterns that make each garment unique in its own way. These calculations mainly determine what the output of the specific will turn out to be.



## **MANIPURI DRESS**

### **REFERENCE:**

The Meitei phanek mapan naiba, which is the traditional dress for women and the “Khamen chatpa” pattern which is usually used for ceremonial male clothing is related with the golden ratio.

The patterns there are believed to be the golden ratio drawing.

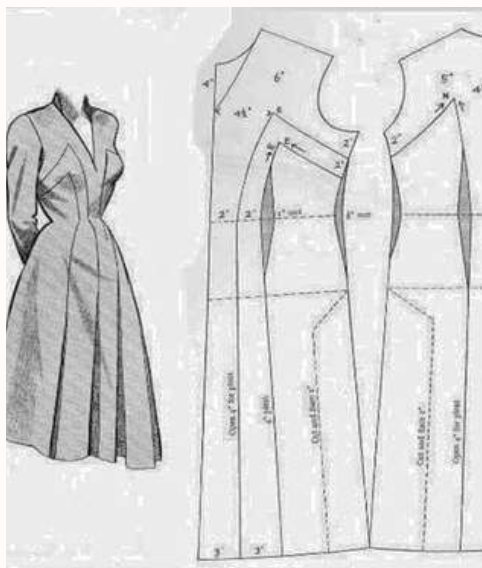


**Khamen Chatpa Pattern**  
**Phanek Mapan Naiba**



## **GEOMETRY**

The use of Geometry while Sewing is also used as a primary tool/method to determine symmetry and various other structural elements in garments, ensuring precision in sewing. This process of sewing is very delicate as the use of every measurement is to be specifically elemented in each garment which would otherwise lead to not enhancing the look of the garment to the fullest.



**Shakha Pola** bangles are a significant part of Bengali cultural heritage. They symbolize purity and passion. They consist of white conch shell (Shakha) and red coral (Pola) bangles, worn by married women as a mark of their marital status.

But do you know how these bangles have their remarkable mathematical contribution? Yes, you heard it right, these bangles use the symmetry and geometric to inspire designs and it reflects balance and harmony.



## **MATHEMATICAL MODELING**

Mathematics is also used in digital manufacturing and virtual try-on.

Technologies like these are used to optimize production processes and reduce waste. This use of technology reduces time, effort and money. This technique emerges as a game changer in the fashion industry.

## **PATTERN MAKING:**

Precision in Design while Pattern making is a fundamental aspect of fashion that relies heavily on mathematics.

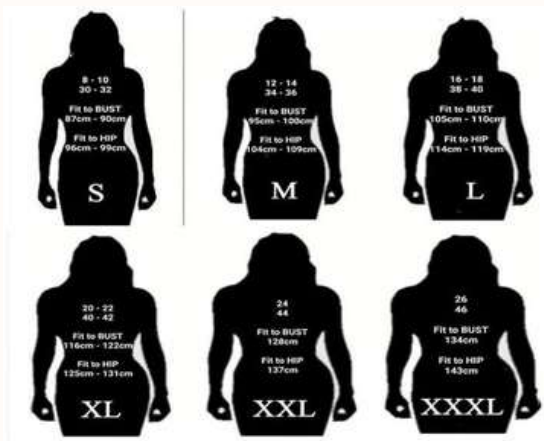
Each pattern piece must be drafted with very accurate angles, lines, and curves, ensuring a seamless assembling of fabric.

The use of geometric principles, such as perpendicular and parallel lines, helps in creating darts, pleats, and seams that enhance the garment's fit.

Mathematical formulas help adjust patterns for different sizes while maintaining the original design's integrity.

## SCALING DESIGNS WITH RATIOS: ADAPTING FASHION FOR ALL SIZES

Fashion isn't one-size-fits-all. Scaling designs to fit different body sizes requires the use of ratios and grading techniques. By applying a systematic increase or decrease in measurements, designers create size variations without distorting the original design. This process, known as pattern grading, ensures that a dress in size S maintains the same proportions when scaled to size XL. Each measurement is adjusted proportionally using algebraic calculations, allowing garments to fit diverse body types while maintaining balance and symmetry. These elements are a must for enhancing the fit and structure of garments. Each pattern piece must be drafted with precise angles, lines, and curves to ensure that the fabric assembles seamlessly. This requires a deep understanding of geometry and spatial reasoning.



Mathematics and fashion go hand in hand, ensuring precision in tailoring, symmetry in design, and adaptability in sizes. Whether it's the golden ratio shaping silhouettes, geometric patterns forming structures, or scaling formulas adjusting sizes, mathematics is the invisible force behind every well-fitted outfit. Fashion may be an art, but mathematics makes it wearable. Mathematics is like an integral to fashion, particularly in pattern making and scaling designs. It ensures precision, consistency, and appealing looks across various garment sizes and styles. Isn't it fascinating how we all love those fashionable garments where precision and accuracy is paid attention to the fullest. But do we ever realize how Mathematics and its tools which all have been studying for years now play that significant role which is required in enhancing each garment. Whether it's geometry of measurements or the art of sewing. These tools are the ones which help in ensuring that each outfit is finished with style.



# FRACTALS IN FASHION:

## MATHEMATICS MEETS AESTHETICS

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Fractals, which are self-repeating patterns found in nature and mathematics, have made a significant impact on fashion design. These intricate geometric shapes create stunning visual effects and influence both textile patterns and structural designs.

### 1. What Are Fractals?

The mathematical structure known as a fractal contains characteristics where patterns persist across different magnitudes. Some well-known fractals include:

The Mandelbrot Set (complex and infinite in detail)  
Koch Snowflake (recursive triangular patterns)  
Sierpiński Triangle (repeating triangular gaps)  
The algorithm L-Systems helps developers create realistic plant growth patterns.

Fashion industries implement fractals through three dimensional clothing structures in addition to their application for creating patterns and fabric designs.

### 2. How Fractals Influence Fashion?

#### A. Textile & Print Designs

Manufacturers apply fractal designs through printing and embroidery to create mesmerizing complex patterns that convey futuristic appearances.

Digital printing algorithms apply fractal mathematics to develop complicated natural designs which emulate tree branches and snowflakes and galaxy formations.

Designer combinations of Alexander McQueen and Iris van Herpen included fractal elements in their fashion show productions.





### B. 3D-Structured Clothing

Fractals enable fashion designers to generate pleats and fold designs that create flowing patterns which resemble natural elements.

Fractal-based patterns in laser cutting operations allow designers to create geometric lace elements and structural fabric components.

The application of recursive fractal folding patterns in origami fashion results in elastic clothing made through modular construction.

### C. Sustainable & Functional Fashion

Through biomimicry designers created adaptive clothing with fractal designs which demonstrate natural patterns to produce heat-responsive garments and movement-adjusted garments.

The development of clothing using fractal-based fabric structures leads to flexible breathable materials which drive forward advancements in sportswear and avant-garde fashion.

## 3. The Future of Fractals in Fashion

The industry utilizes AI-generated fractal design to make algorithms print and produce 3D patterns.

Advanced fabrics which use fractal antennae play an essential role in wearable technological applications. Fractals serve as inspiration for self-growing sustainable materials that help diminish industrial waste.

### Conclusion

Fractals create a mathematical pathway between mathematical theory and artistic expression to allow fusion between natural and mathematical design elements in the fashion world. The advancement of technology will lead fractals toward transforming textile innovation and sustainable design as well as 3D-printed clothing production.



# MATHEMATICS TEXTILE AND FABRICS

Mathematics and fashion might seem worlds apart, but they are deeply intertwined, quite literally! The patterns, weaves, and structures of textiles are all governed by mathematical principles, making math an essential part of the fabric industry. From traditional handloom designs to cutting-edge smart textiles, math plays a crucial role in shaping what we wear.

One of the most fundamental mathematical concepts in textiles is symmetry and tessellations. The intricate patterns seen in fabrics, such as houndstooth, paisley, and tartan, often follow mathematical symmetry groups. Tessellations, like those inspired by Escher's artwork, are used in textile design to create visually captivating and mathematically precise patterns.

Knitting and weaving also rely on math, specifically in topology and combinatorics. The loops in knitting follow structured, repeating sequences that can be represented as mathematical graphs. Similarly, weaving uses numerical patterns to create intricate designs, with binary sequences guiding the interlacing of warp and weft threads.



Beyond aesthetics, geometry and computational mathematics are driving innovations in fabric technology. With 3D knitting and computational pattern-making, designers use algorithms to create seamless, customized garments. Engineers are also utilizing topology in materials science to design smart textiles that respond to temperature, light, or even biometrics. For instance, phase-changing materials adapt to body heat, and moisture-wicking fabrics use microstructures designed with fractal mathematics.

Even fashion forecasting relies on mathematics! Data analytics and predictive modeling are used to analyze market trends, consumer preferences, and purchasing behaviors, helping designers and retailers stay ahead of the curve.

*SO, NEXT TIME YOU WRAP YOURSELF IN A COZY SWEATER OR ADMIRE A STYLISH GEOMETRIC PRINT, REMEMBER- MATH IS QUITE LITERALLY WOVEN INTO EVERY THREAD!*



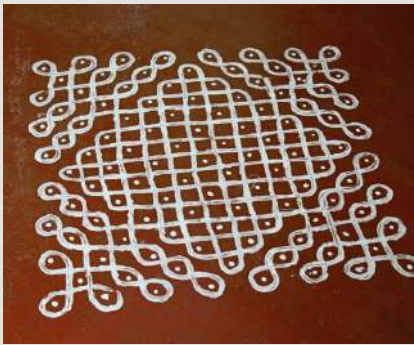
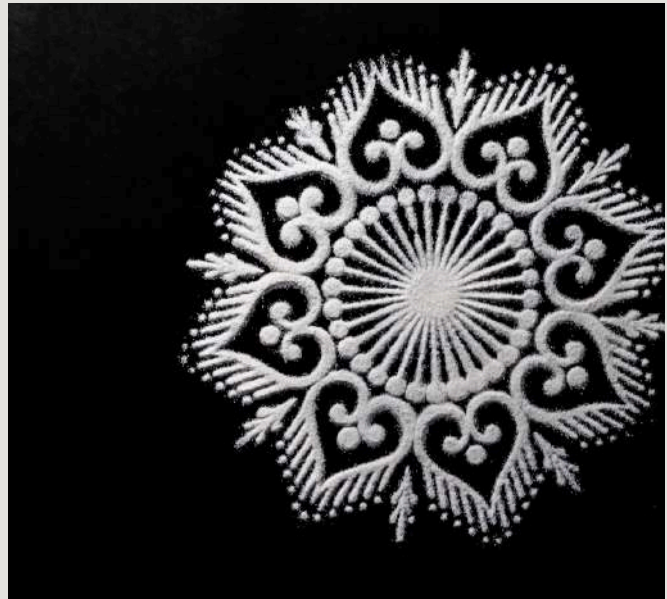
# SACRED SYMMETRIES:

## The Mathematical Heart of Indian Art

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### COSMIC CALCULATIONS: INDIAN ART'S MATHEMATICAL SOUL

In Indian tradition, math and art are harmoniously blended. A fundamental symbiosis between artistic expression and mathematical precision is reflected in the deep and intricate relationship between art and mathematics in Indian civilization. Revolutionary developments in algebra, geometry, and number theory were brought about by pioneers like Aryabhata, Brahmagupta, and Bhaskara II, who in turn improved India's artistic traditions.



### RANGOLI AND KOLAM: GEOMETRY'S AESTHETIC ORDER

Rangoli and Kolam, two traditional Indian floor designs, are excellent illustrations of how mathematical ideas can be used in art. Rangoli, with its complex geometric designs, uses the principles of symmetry, tessellation, and fractal repetition, demonstrating an intuitive sense of spatial order. Kolam, made of systematically linked points, exhibits recursive patterning and algorithmic principles of design — not just as a visual art form, but also as a mental drill in mathematical ordering.



### ARCHITECTURAL ACCURACY AND PROPORTIONAL BEAUTY

Indian architecture is a case study in the mathematical foundations of structural harmony.

The Taj Mahal, a synonym for axial symmetry and golden ratio proportions, exemplifies mathematical exactness in architecture.

The Brihadeeswara Temple, built based on principles from Vastu Shastra and Silpa Shastra, combines geometric patterns that promote both structural stability and aesthetic consistency.

The scrupulous use of mathematical proportions in temple design is a testimony to the high level of knowledge about spatial dynamics and harmonic balance.



## SACRED GEOMETRY AND METAPHYSICAL SYMBOLISM

Mathematics in traditional Indian culture is not only restricted to structural applications but also extends into metaphysical representation.

The Sri Yantra, a compound geometric diagram with interlocking triangles, is a prime example of combining mathematical precision with philosophical profundity.

The careful angular proportions in the Sri Yantra align with basic geometric theory, representing cosmic unity and balance between dualistic forces.

Sacred geometric formations like these reflect an evolved level of mathematical abstraction with spiritual ideology embedded within.



## MATHEMATICAL BEAUTY IN TEXTILES AND CRAFTS

The beautiful motifs of Kanjeevaram sarees and other Indian textile arts evidence advanced mathematical craftsmanship.

These woven textiles frequently exhibit symmetry, recursion, and tessellation – principles that are at the root of present-day computational design.

The attention to detail involved in rendering these mathematical concepts into textiles is evidence of an empirical expression of geometric principles into material culture.

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## CONTEMPORARY ARTISTIC EXPRESSION

The mathematical-artistic legacy of India still inspires contemporary artists, who integrate topology, symmetry, and non-Euclidean geometry into their work.

Abstract works build fresh paradigms for art using the mathematical roots set by early intellectuals.

This ongoing communication between art and mathematics helps to justify the relevance of such multidisciplinary connections.



## CONCLUSION

The historical and modern synthesis of mathematics and art in India portrays a continuum of intellectual and aesthetic endeavor.

This interwoven heritage not only shows the mathematical acumen of Indian civilization but also its capability to translate abstract numerical principles into enduring artistic forms, connecting the empirical with the transcendental.



# MATHS MARVEL



From the sweet “Your friendly neighborhood Spider-Man”, the resistant “I can do this all day”, the haughty “I am iron man”, the proud “Wakanda Forever” and who can forget the iconic “Avengers, Assemble!”, the Marvel Cinematic Universe has always played a huge role in our cinema experience with movies that left us on the edge of our seats, made us cry and inspired us. The MCU has woven together a sprawling, interconnected narrative where heroes soar, villain scheme and every battle rewrites destiny.

The MCU has revolutionized the use of visual effects (VFX) in cinema, establishing a new standard for spectacle and immersion. VFX, in Marvel’s hands is less a tool and more a painter’s brush, swirling vibrant hues of magic and technology onto to the canvas of the silver screen. And do you know math and physics are used for VFX? Now let’s dive into how the MCU utilizes VFX to create some of our favorite movies with some examples:

# DOCTOR STRANGE

Mirror Dimension: The Mirror Dimension, where reality is twisted and reshaped, are heavily based on fractal geometry.



Portals: Portals are made using particle systems that simulate fire-like motion. Fractal mathematics & turbulence equations generate the swirling pattern.



# SPIDER-MAN

Spider-Man's acrobatic movements require precise calculations of kinematics, the study of motion.

Spider-Man's swinging follows pendulum motion equations.

# BLACK PANTHER

Wakanda: The architecture of Wakanda, including the intricate tribal designs and futuristic cityscape, was influenced by fractals and procedural geometry. Mathematical algorithms like L-systems and Voronoi diagrams were used to generate complex textures and patterns.



Vibranium Suit: The Vibranium suit worn by Black Panther (T'Challa) had nano-technology effects that involved particle systems and fluid simulations based on Navier-Stokes equations.



# GUARDIANS OF THE GALAXY

Characters: Many characters of this beloved series such as Our beloved Groot, the savage Rocket Raccoon, the telekinetic space dog, Cosmo are created using VFX by utilizing the principles of Geometry, Trigonometry, Linear Algebra, Kinematics and Calculus.

Spaceship Movement:

The complex maneuvers of the Guardians' spaceship, the Milano, and other spacecraft in the MCU, require accurate simulations of motion and physics. Effects like the energy trails of spaceships or the creation of celestial phenomena often utilize particle systems.



# AVENGERS

the MCU employs VFX to create the desired effects and deliver an ethereal experience to its fans. Some examples are:

**Endgame: Crowd Simulation:** The massive battle scenes in "Avengers: Endgame" required complex crowd simulations to depict the movement of thousands of characters. Mathematical algorithms are used to control the behavior of these virtual crowds, ensuring that they move realistically and interact with each other in a believable way.



**The Blip and its Reversal (The Decimation and the Snap):** The disintegration of characters during the Blip and their subsequent re-materialization required extremely complex particle system simulations.



# THANOS

Thanos' face was modeled using 3D coordinate geometry. Vector transformations & matrices helped rotate and move different parts of his face and body realistically. Bezier curves & NURBS (Non-Uniform Rational B-Splines) were used to create smooth surfaces for his facial expressions. Inverse kinematics (IK) helped animate Thanos' hands and legs realistically.

# THOR



**Thor's flight, Mjolnir and Stormbreaker:** Thor's powers and flight require accurate physics simulations which rely heavily on mathematical equations. Mjolnir reflects light based on ray tracing algorithms. Refraction index calculations determine how light bends around it.

# IRON MAN

**Iron Man's Flight:**

Iron Man's flight path follows real projectile motion equations. Aerodynamics simulations ensure his movement is smooth and realistic.

**Iron Man's suit reflection:**

The metallic surface of the suit uses Phong reflection models for realistic shine.





THE

MOVIE

To all the haters of Mathematics saying its boring, difficult and complicated, ever wondered if you would find math, if not the whole perhaps some elements, interesting? If no, then maybe this article can help you. I'm sure almost everyone likes movies...And well for the section who *don't like movies*, mate! You gotta wait for Continuum 3.0. Ok back to the topic, Movies: those flickering portals to other worlds, where popcorn is currency (overrated in my opinion, oops) and suspension of disbelief is the toll. They're the ultimate escape hatch and proof that sometimes, the best stories are the ones we watch together (even if we secretly judge the characters' terrible choices). Among the millions of movies, there are some which revolves around or some include mathematical elements in their storyline. Such two movies and the mathematical idea contained in them will be discussed in this article. Who knows you might find those concepts interesting!

This Oscar winning, Robin William and Matt Damon starrer follows Will Hunting, a young janitor at MIT, who's a mathematics genius but struggles with personal demons and emotional barriers.

In this movie, there's a mathematical concept involved called the Hamiltonian Path.

**Hamiltonian Path:** A **Hamiltonian path** is a path in a graph that visits each vertex exactly once. If a Hamiltonian path exists in a graph and the path forms a cycle (i.e., the first and last vertex are connected), it is called a **Hamiltonian cycle**.

**Key Points:**

1. **Vertices** are the places.
2. **Edges** are the roads that connect the places.
3. A Hamiltonian Path visits each vertex exactly once, but doesn't have to return to the starting point.
4. If the path **does** return to the starting point, it forms a **Hamiltonian Cycle**.

**Simple Example:**

Let's say we have a city with just **3 places (vertices)**:

- Place A
- Place B
- Place C

The roads (edges) connect them like this:

- $A \rightarrow B$
- $A \rightarrow C$
- $B \rightarrow C$

Now, the Hamiltonian paths that visit each place exactly once are:

- $A \rightarrow B \rightarrow C$
- $B \rightarrow C \rightarrow A$
- $A \rightarrow C \rightarrow B$
- $C \rightarrow A \rightarrow B$
- $B \rightarrow A \rightarrow C$
- $C \rightarrow B \rightarrow A$

So, there are 6 possible ways (paths) to visit all 3 places without revisiting any of them. This is  $3!$  (3 factorial), which is  $3 \times 2 \times 1 = 6$ .

In General: For n places (vertices), the number of possible ways to arrange them in a Hamiltonian Path is  $n!$  (n factorial).

For example:

- If there are 4 places, the number of possible paths is  $4! = 4 \times 3 \times 2 \times 1 = 24$ .



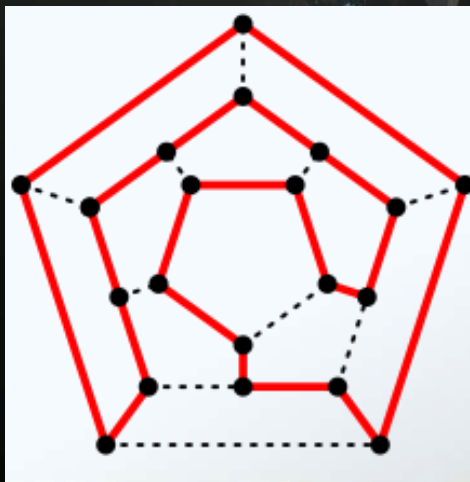
# GOOD WILL HUNTING 1997

running time: 126MINS

directed by GUS VAN SANT

produced by LAWRENCE BENDER

starring: MATT DAMON, BEN AFFLECK, ROBIN WILLIAMS, MINNIE DRIVER





# THE MAN WHO KNEW INFINITE

2015

running time 108m

directed by Matthew Brown

produced by Edward R. Pressman Jim Young

starring Dev Patel Jeremy Irons Devika Bhise

This Jeremy Irons and Dev Patel starrer is a biographical movie which narrates the story Srinivasa Ramanujan, the self-taught Indian mathematic genius, who despite lacking formal education, makes ground-breaking contributions to the mathematical world. One of the most memorable and mathematically significant aspects of *The Man Who Knew Infinity* is the **Ramanujan-Hardy number (1729)**.

## The 1729 Story: "The Hardy-Ramanujan Number"

In the movie, there's a scene where **G.H. Hardy** tells **Srinivasa Ramanujan** that he had arrived at the hospital in a taxi with the number **1729**. Hardy remarks that it seems like a dull number, but Ramanujan immediately responds with an incredible insight about its mathematical properties.

Ramanujan says that **1729** is actually a very **special number**: it is the **smallest number** that can be expressed as the sum of two cubes in two different ways.

In other words:

$$1729 = 1^3 + 12^3 = 9^3 + 10^3$$

This means that **1729** can be written as the sum of cubes of two different sets of numbers:

- $1^3 + 12^3 = 1 + 1728 = 1729$
- $9^3 + 10^3 = 729 + 1000 = 1729$

Mathematical Explanation:

1.

$$1^3 = 1$$

$$12^3 = 1728$$

$$1^3 + 12^3 = 1 + 1728 = 1729$$

2.

$$9^3 = 729$$

$$10^3 = 1000$$

$$9^3 + 10^3 = 729 + 1000 = 1729$$

## Why Is This Important?

This property of **1729** became known as the **Hardy-Ramanujan** number because of the famous anecdote, and it is a classic example of Ramanujan's ability to find hidden properties in numbers. This small number turned out to be much more interesting than it initially appeared!

## A Deeper Dive: The Taxicab Number

The number **1729** is the first **taxicab number** (denoted  $\text{Taxicab}(2)$ ), which means it is the smallest number that can be expressed as the sum of two cubes in two different ways.

In general, the **taxicab number**  $\text{Taxicab}(n)$  is the smallest number that can be expressed as the sum of two positive cube numbers in  $n$  distinct ways. So:

- $\text{Taxicab}(1) = 2$ , which is the sum of cubes  $1^3 + 1^3$ .
- $\text{Taxicab}(2) = 1729$ , as we've discussed.
- $\text{Taxicab}(3) = 4104$ , which can be written as  $2^3 + 16^3 = 9^3 + 15^3 = 4104$ .

This inspirational film tells the untold story of three African-American women mathematicians—Katherine Johnson, Dorothy Vaughan, and Mary Jackson—who played vital roles at NASA during the space race. One of the mathematical concepts used in the movie is parabolic trajectories, crucial for spacecraft re-entry and landing.



In this movie, the math concept highlighted is: Parabolic Motion and Orbital Mechanics

**Parabolic Motion:**

Objects that are projected into the air follow a curved path called a parabola, due to gravity. This is a foundational concept in projectile motion and physics.

**Key Points:**

1. NASA had to calculate the exact path a space capsule would follow when re-entering Earth's atmosphere.
2. Katherine Johnson applied complex geometry and Newtonian physics to find accurate landing coordinates.
3. Her calculations helped John Glenn become the first American to orbit the Earth.

**Simple Example:**

Throwing a ball:

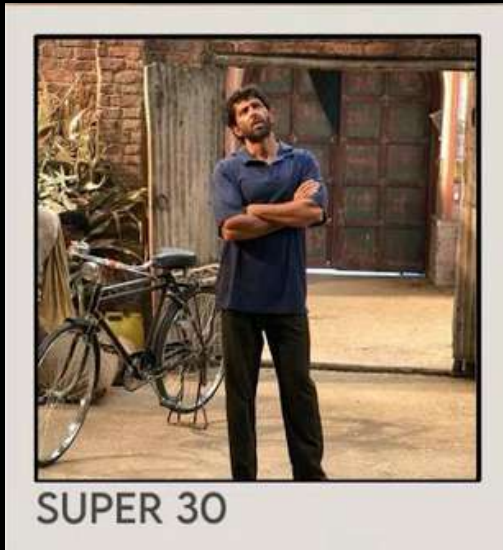
It rises, slows down, then falls—this curved path is a parabola.

The formula to describe it is:

$y = ax^2 + bx + c$ , where  $x$  is horizontal distance and  $y$  is height.

**Real-Life Use in NASA:**

Calculating time of flight, angle of re-entry, and speed to ensure safe landings. Even small errors in trajectory could be catastrophic.



**Key Highlights:**

1. Instead of focusing on formulas, he encourages students to understand the “why” behind each step.
2. His classes often involve storytelling, local examples, and visual thinking—like explaining permutations through seating arrangements at a wedding or geometry through farming plots.
3. This method fosters critical thinking, confidence, and problem-solving abilities.

**Simple Example:**

To teach the concept of probability, Anand might say:

“You have 5 laddoos in a box—2 are sweet, 3 are spicy. What’s the chance you’ll pick a sweet one with your eyes closed?” This makes probability = favorable outcomes / total outcomes =  $2/5$ , instantly clear.

**Real-Life Use:**

By linking mathematical principles with day-to-day experiences, Anand enables students to not just pass an exam, but to truly own the subject.

This 2019 biographical film follows the life of Anand Kumar, a mathematician from Bihar, portrayed by Hrithik Roshan. Anand rises from poverty and personal tragedy to establish the Super 30 program—free coaching for underprivileged students aiming to crack the prestigious Indian Institute of Technology (IIT) entrance exam. The film highlights how his commitment, innovation, and courage empower students against all odds.

In this movie, one of the key mathematical concepts is: Problem-Solving through Real-Life Applications

**Real-Life Mathematical Reasoning:** Anand Kumar's approach to teaching mathematics emphasizes logical thinking and conceptual clarity rather than rote memorization. He uses relatable, real-world analogies to help his students grasp complex topics.



# 1. The Golden Ratio in Film

## Composition:



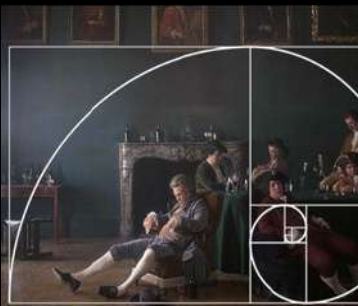
The Golden Ratio (about 1.618) is a special number used in art and architecture for centuries to create beautiful and balanced designs. In movies, filmmakers use this ratio to arrange objects and characters in a way that looks naturally pleasing to the eye. By dividing the screen using the Golden Ratio, important elements are placed at key points, making the scene look well-balanced and visually appealing. This technique helps guide the viewer's focus to the most important parts of the frame. In Alfonso Cuarón's film *Roma*, the composition of certain scenes aligns with the Golden Ratio, guiding the audience's focus to the central action while maintaining a balanced background.

# Film editing & scene composition

## 2. Perspective and Projections in

## Cinematography - How math shapes camera

### angles :



Perspective in cinematography is how objects appear in a scene based on the camera's position. Filmmakers use it to create depth, show size differences, and shape how the audience sees a scene. One notable application is the use of one-point perspective, where all lines converge toward a single point on the horizon



[www.reallygreatsite.com](http://www.reallygreatsite.com)

# Maths in cinema

## Computer Graphics & Animation

**How Mathematics Powers CGI in Films:** Mathematics, especially **linear algebra**, **calculus**, and **geometry**, is the backbone of CGI in films. It enables realistic movements, lighting, textures, and physics simulations.

❖ **The Role of Linear Algebra in 3D Animation:** Linear algebra is the math that helps computers create and move things in 3D animation. It allows characters, objects, and cameras to be positioned, rotated, and resized in a realistic way.

- **Vectors and Points:** Represent positions, directions, and movements in space.
- **Matrices:** Used for transformations like rotation, scaling, and translation.
- **Homogeneous Coordinates:** Extend 3D transformations into a 4D space for easier computations.
- **Cross Product & Dot Product:** Help with lighting calculations and surface normals.
- **Eigenvalues and Eigenvectors:** Used in motion capture and character animation.

## Lighting and Shading

Vector operations like the dot product are used in the Phong Reflection Model to determine light intensity on surfaces.

$$I = k_a I_a + k_d (N \cdot L) I_d + k_s (R \cdot V) I_s$$

where:

$N \cdot L$  brightness based on angle.  $R \cdot V$  controls specular highlights.



## Key Applications in CGI :

Objects in CGI are manipulated using transformation matrices:

- **Translation** (Moving an object)
- **Scaling** (Resizing an object)
- **Rotation** (Turning an object around an axis)



## Bezier Curves and Splines in Animation:

- For smooth character movement and animation paths, **Bezier curves** and **B-splines** are used.

**The Bezier curve equation:**

$$B(t) = (1-t)^3 P_0 + 3(1-t)^2 t P_1 + 3(1-t) t^2 P_2 + t^3 P_3$$

where  $P_0, P_1, P_2, P_3$  are control points.



# CONTRIBUTION WOMEN IN MATHEMATICS

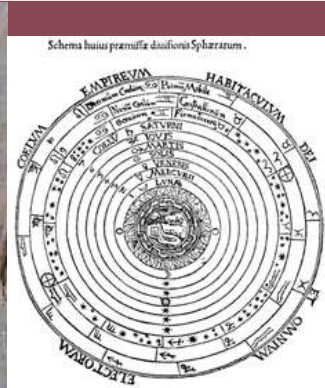
Mathematics is a language of the universe, a tool for understanding the fundamental principles that govern the world. And women are eloquent speakers of this language, yet are not much talked about and often overlooked. This selection seeks to bring these “Hidden Figures” into the light, celebrating their achievements and reclaiming their place in the history of Mathematics.

Nature and women often share a profound and perhaps a poetic and intricate relation. Just like nature, women throughout history have embodied a spirit of giving. This inherent quality of women manifests in countless ways, from the nurturing embrace of a mother to the tireless contribution women make to their families, communities and the world at large. But often times, women are overlooked and cast away that their contribution find it hard to make its way to the limelight. This is true for women in every field, every discipline ... everywhere one can imagine.



# HYPATIA OF ALEXANDRIA:

From Roman Egypt, she was one of the earliest known mathematicians and was known for her work on conic sections and her commentary on Diophantus' Arithmetica. Hypatia was known to have edited at least Book III of Ptolemy's Amalgast which supported the geocentric model of the universe.



# MARIE-SOPHIE GERMAIN:

She was a French mathematician, physicist and philosopher. She was a pioneer not only in Mathematics but also in Physics too. She is known for Elasticity Theory, Number Theory, Mean Curvature, Sophie Germain Prime, Sophie-Germain's Theorem and Germain-Lagrange plate equation. The Academy of Sciences established the 'Sophie Germain Prize' in her honour.



# EMMY NOETHER:

She was a German mathematician who made many important contributions to abstract algebra. She also proved Noether's first and second theorems, which are fundamental in mathematical physics. Her work on differential invariants in the calculus of variations, Noether's theorem has been called "one of the most important mathematical theorems ever proved in guiding the development of mathematical physics". She is often described as the most important woman in the history of mathematics.



# KATHERINE JOHNSON:

She was an American mathematician whose calculations of orbital mechanics as a NASA employee were critical to the success of the first and subsequent U.S. crewed spaceflights. NASA noted her for her “historical role as one of the first African-American women to work as a NASA scientist. She was presented the Presidential Medal of Freedom by the then U.S. President Barack Obama in 2015. She was also portrayed in the Hollywood movie “Hidden Figures”.



# MARYAM MIRZAKHANI:

An Iranian mathematician and the first woman and the first Iranian to win the Fields Medal, the most prestigious award in mathematics. She was considered a leading force in the fields of hyperbolic geometry, topology and dynamics. She was famous for her work in “the dynamics and geometry of Reimann surfaces and their moduli spaces”.



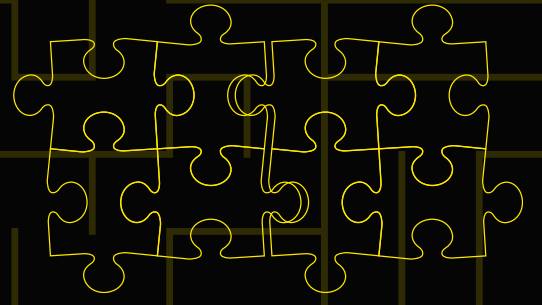
# NEENA GUPTA:

She is an Indian Mathematician and is a professor at the statistics and mathematics Unit of the Indian Statistical Institute (ISI), Kolkata. She is famous for providing a counter-example over a field of positive characteristic to the special Zerinski Cancellation problem.

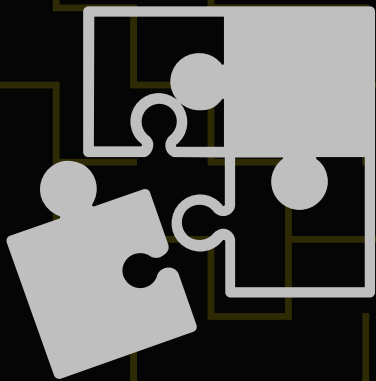


*The contributions of women to Mathematics are undeniable. From the pioneering work of Hypatia to the Fields Award winner, women have consistently shown brilliance in this field. Historical and societal barriers have often hindered their achievements, for the sole reason that they're not men, for the very sole reason that they're WOMEN. But it is also true that the impact women have on Mathematics, in fact in every discipline, is profound and cannot be suppressed. Recognizing and celebrating these achievements is a crucial step in fostering a more inclusive community. By acknowledging the past and supporting the present, we can unlock the full potential of the genius of human mind and take more progressive steps towards the future.*

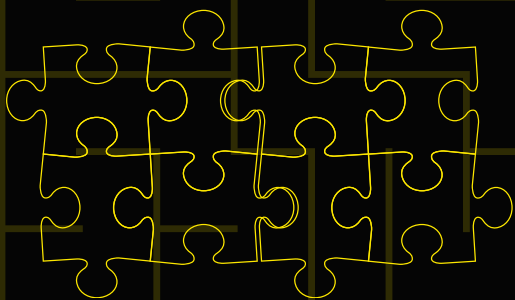




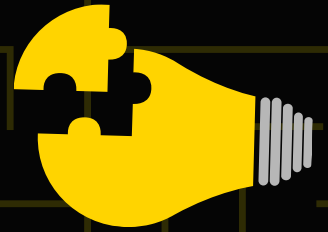
# RIDDLE



**TIME** 

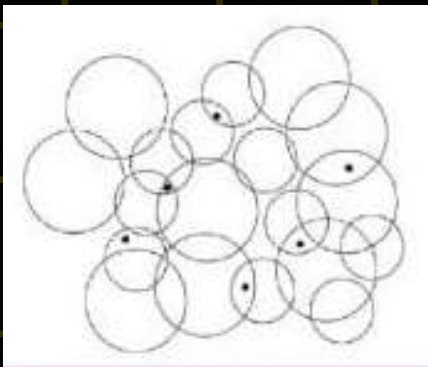
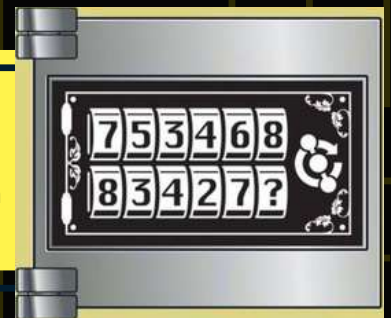


# Let's dive in!!



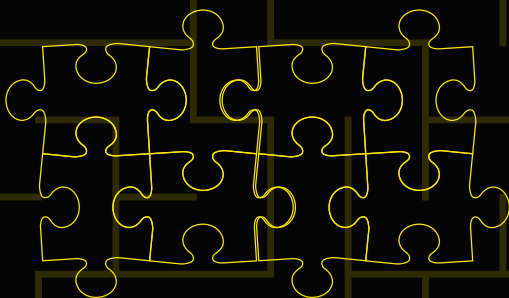
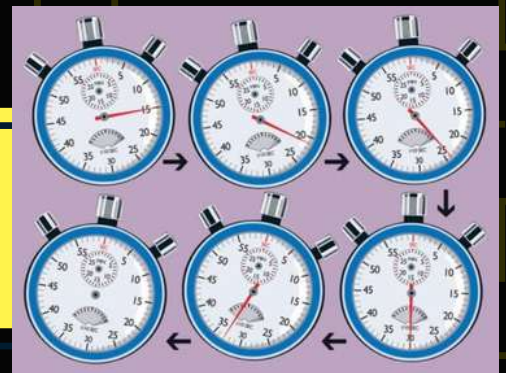
Which number should replace the question mark to form accurate equations, knowing that three numbers are shown per row (i.e., two of the numbers form a two-digit number)?

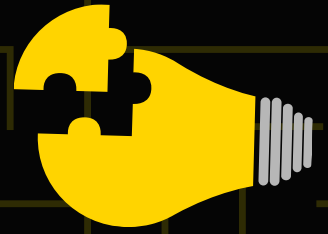
To open this safe, you have to replace the question mark with the correct figure. You can find this figure by determining the logical method behind the numbers shown. These methods can include calculation, inversion, repetition, chronological succession or forming ascending and descending series.



HOW MANY CIRCLES CONTAIN THE BLACK DOT?

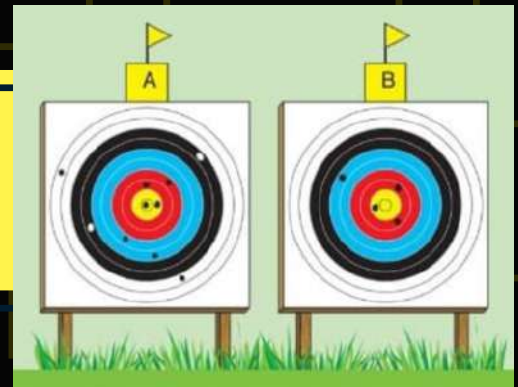
The winner has run the distance in 15 seconds, the second in 21 seconds, etc. How many seconds will the sixth athlete take to cross the line?





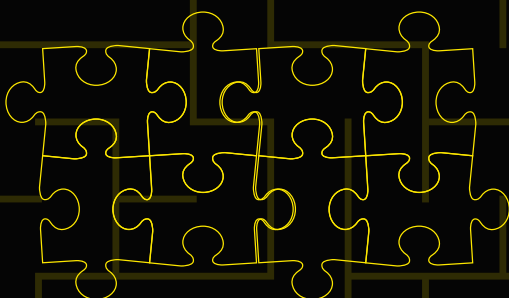
Which year does not belong on the chalkboard?

How many points does Archer B scores knowing that the total score of Archer A is 55 and that different points are earned in the ten zones in ascending toward the center??



Which number is missing on the bottom credit card ?

Which pin must be knocked over to score exactly 100?



1. 6
2. 6
3. 12
4. 39
5. 1967
6. 30
7. 8
8. 13, 39 and 48

# CAPTURED MOMENTS



**NISHIKA 3RD YEAR**

**MANASVI 3RD YEAR**



**VARSHA 2<sup>ND</sup> YEAR**



# THE ART OF OBSERVATION



**SAMARTH**



**TANNU 2<sup>ND</sup> YEAR**



OUR WINNERS OF PHITOGRAPHY:  
THE PHOTOGRAPHY  
COMPETITION



**RAJ**



**PRIYANSH MALIK**

**DHAVAL SHAH**



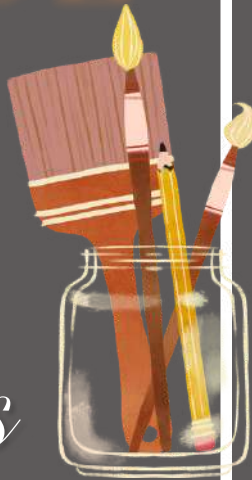
**PARTH KUMAR**

**RUCHIT SHAH**



# THE SOUL OF ART

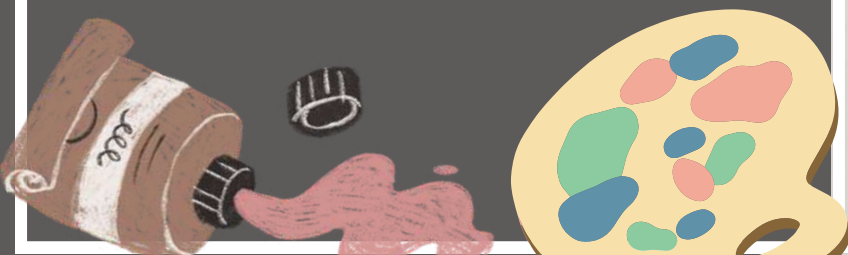
*Crafted by  
Our Students*



GHANIYA 2<sup>ND</sup> YEAR



VARSHA 2<sup>ND</sup> YEAR



When teacher asks you something you had studied in the previous semester...

Me to the question:



### School Maths...

I will learn to solve one question, and then do the rest and get full marks!



### College Maths...

Prove theorem, show that, prove theorem, show that, prove theorem, show that, prove theorem...



RESULT: Not in syllabus.

When you want to remind your professor to give you attendance for the seminar you attended, but can't be direct...

Le students just after the seminar:



BY

Anoushka

3RD YEAR

BSC HONS. MATHEMATICS

# CTRL + LOL

Our Best Meme Moments

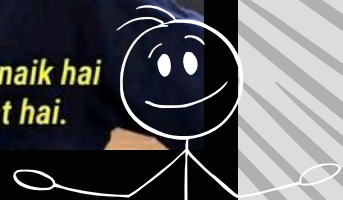


\*Me thinking I can pass semester exams by studying 1 night before the exam only

\*Also me (lowkey knowing Imma fail 🤔):



Pov: Professors when we try to prove a theorem the way a random teacher at youtube has taught to do so



BY

Jannu Priya

2ND YEAR

BSC HONS. MATHEMATICS

# 2024-2025 REPORT



22ND  
DEC  
2024

## NATIONAL MATHEMATICS DAY

On the occasion of **National Mathematics Day**, the Department of Mathematics organized a special seminar and competitions like **Quiz** and **Sudoku** competition. The event commenced with a Saraswati Vandana, followed by a short play presented by students depicting the struggles, talent, and contributions of Srinivasa Ramanujan. Subsequently, the keynote speaker, **Dr. Rekha Gupta** (Assistant Professor, Miranda House, University of Delhi), delivered a lecture on the topic "The Man Who Knew Infinity." She emphasized that mathematics is not merely a game of equations and numbers but a blend of logic, structure, and imagination.

## SCREENING OF THE FILM HIDDEN FIGURES

The primary objective of the movie screening was to highlight the contributions of women in the field of mathematics and science and to inspire students. The film **Hidden Figures** presents the inspirational story of three African-American women mathematicians working at NASA, whose intelligence and dedication significantly contributed to space research. Through this event, students had the opportunity to understand and become aware of aspects related to science, mathematics, and gender equality.

14TH  
FEB  
2025



## SEMINAR ON QUANTITATIVE APTITUDE FOR MBA ENTRANCE EXAMS

20TH  
FEB  
2025

The workshop was held on 20th February 2025 in the seminar room at 12:30 PM. The session was conducted by Mr. Abhishek Kaul and Mr. Navneet Anand, experts in MBA entrance exam preparation. The program commenced with a welcome address by Dr. Meenakshi Gupta, Assistant Professor, Department of Mathematics. Following the welcome, Mr. Abhishek Kaul elaborated on the importance of Quantitative Aptitude in MBA entrance exams, the exam pattern, and effective strategies. He provided insights into rapid calculation tricks, time management skills, and frequently asked questions (FAQs). He also emphasized how mock tests and regular practice can significantly improve scores. At the end of the session, a Q&A segment was conducted, allowing students to clarify their doubts and receive personalized guidance from the experts.





## CAREER COUNSELING SEMINAR

The Department of Mathematics of Bharati College, University of Delhi, organized a "Career Counseling Session" on February 18, 2025, under the aegis of IQAC (Internal Quality Assurance Cell). The session was held in the Seminar Room, with Dr. Sunil Tripathi (Career Counselor) as the keynote speaker, who provided guidance to students. The event commenced with Dr. Vinesh Kumar, Teacher in Charge of Department of Mathematics, welcoming and honoring the chief guest, Dr. Sunil Tripathi. Following this, Dr. Tripathi delivered a lecture discussing various career opportunities available in the field of mathematics. He elaborated on roles in research, teaching, data science, banking, statistics, civil services, and the private sector.

Additionally, he provided guidance on IIT JAM, CSIR-NET, GATE, UPSC, SSC, banking exams, and placement opportunities in private companies. Throughout the session, students were encouraged to identify their interests, skills, and potential career paths. Dr. Tripathi also shared effective study techniques, time management strategies, and tips on selecting the right resources. Moreover, he emphasized the importance of internships, online courses (NPTEL, Coursera, edX), and industry-based training programs. Towards the end of the session, a Q&A session was conducted, where students asked career-related questions, and Dr. Tripathi addressed their queries. The students found the session highly informative and inspiring.

18TH  
FEB  
2025



## SEMINAR ON CERTIFICATE PROGRAMME (ADVANCE EXCEL AND SOFT SKILL TRAINING)

28TH  
MAR  
2025

The session was conducted on 28th March 2025 in room G3 from 11:00 AM to 1:00 PM. Mr. Naresh, Senior IT Trainer, facilitated the workshop. He provided insights on the importance of comprehensive and hands-on training of Advanced Excel, covering data analysis, automation, formulas, functions, and tools like charts and pivot tables. The session also focused on the necessity of developing essential soft skills such as effective communication, teamwork, leadership, and professional ethics.



Riddle solutions

1. 6

2. 6

3. 12

4. 39

5. 1967

6. 30

7. 8

8. 13, 39 and 48

"FASHION IN FRAME, GEOMETRY IN MOTION"



**The Exponents: Full of Power**