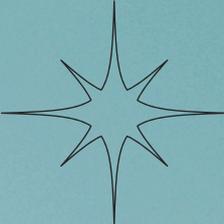# ALGORITHM

Mathematics Unconventionally

Harmonizing Chaos

Welcome to the 11th edition of Algorithm: The Mathematics Newsletter, where we proudly present this edition on the theme **Mathematics Unconventionally!** In a world where numbers often feel confined to blackboards and calculators, we explore how math extends beyond traditional boundaries, leaving its mark on unexpected fields. From shaping Geography to revolutionizing Pharmacology, from enhancing Economics to influencing Political Science, Psychology, and Philosophy. Discover math's role as a universal problem-solver.

This edition challenges conventional views of mathematics, proving that **"Mathematics is the language of the universe".** Beyond textbooks, math influences countless daily practices & practical applications, often unnoticed. It's the subject that adds value to everything, multiplies opportunities, and never subtracts the fun! After the articles, explore sections that will guide you to more opportunities in mathematics. That is why there is an array of career opportunities and courses for individuals that are not identified as what we may call "math people" such as Data science and Analytics, Finance and Investment, Artificial Intelligence, etc. In such roles employers often look for certifications and practical experience rather than formal qualifications. Draw inspiration from today's mathematicians, stay updated on the latest developments, and discover potential career paths. Who knows, **maybe one day we'll be reading about your achievements in the world of math too!!**

Math is often seen as a domain reserved for those pursuing specialized degrees in the subject. But the reality is far more inclusive. What is increasingly becoming essential across various fields are mathematical skills rather than the degree. The sections will provide you with knowledge of various platforms and websites where people from all streams can find math related internships, certified courses, etc. They also include information regarding various researchers, engineers and government officers with a mathematical background. We also have talked about new research breakthroughs in math. Thus we see that Mathematics is the language of the universe. It's a melody woven into the fabric of our lives.

From the rhythm of music to the spirals of galaxies, math is both the poet and the storyteller of existence. It's not confined to numbers and equations; it's about patterns, choices, connections, and understanding the unseen. Whether you're calculating probabilities in a poker game or marveling at the geometry of a snowflake, mathematics whispers its truth to all who are curious enough to listen. So, math isn't just a subject—it's a way of seeing the world, for everyone, in every way imaginable.

Content- Palak & Priyanshi
Design- Kanika Saroha

INSIDES...

EDITORS' NOTE

"It's not important what we cover in the class, it's important what you discover.
To be truly educated from this point of view means to be in a position to inquire and to create on the basis of the resources available to you which you've come to appreciate and comprehend."
-Noam Chomsky

Algorithm has become a home for me and curious learners alike me, exploring the universe through mathematics, beyond the traditional curriculum. With the eleventh edition, we explore "Mathematics, Unconventionally", which reveals the surprising intersectionalities between mathematics and fields as diverse as art, technology, and philosophy. Mathematics is often viewed as a rigid platform reserved for academics and technicians. We aspire to break that mold, conquer the fear associated with Mathematics and, lastly, get everyone a bit closer to the language of the universe, through this edition.

This edition is also extremely personal for me. If I were to describe myself in six words, it would be *"symphony of several worlds, chaos harmonised,"* and with this edition, we harmonize the universe through mathematics. I have grown tremendously with Algorithm over my journey at JMC, from an enthusiastic fresher hoping for guidance into the crazy realm of Mathematics to forming and subsequently leading the Algorithm team for 2024-25 session, my heart is full with gratitude.

Lastly, Algorithm owes this edition to its incredible team which has worked with passion and unbridled determination. Each word, each design, and each illustration holds special value to us and we hope it leaves you curious and inquisitive. Thank you!

Happy Reading!

Avni Jain
Editor-in-Chief, Algorithm 2024-25

"Pure mathematics is, in its way, the poetry of logical ideas." These words by Albert Einstein beautifully capture the magic of mathematics—a subject that has always been close to my heart. From the intricate patterns of nature to the profound logic that governs our world, mathematics continues to amaze me with its elegance and universality. It has been my favorite subject since the very beginning, and my journey with Algorithm has only deepened this love. Starting as a content team member last year and now stepping into the role of Sub Editor-in-Chief has been an incredible experience, allowing me to blend creativity with logic in ways I never imagined.

This edition of Algorithm is truly special. It is the product of countless hours of dedication, teamwork, and passion. Our team has poured their hearts into every word, every design, and every detail, making this not just a newsletter but a reflection of our collective admiration for mathematics. I encourage every reader to delve into its pages, to explore the beauty of mathematics, and to see how it transcends boundaries and plays a pivotal role in fields far beyond its traditional scope.

The theme for this edition, Mathematics Unconventionally, invites us to view math through a different lens. From the connections between mathematics and English, to its role in psychology—a topic I was personally eager to explore—to its integration with economics and other fields, this theme showcases the versatility of mathematics. It reminds us that math is not just equations and numbers; it is a language, a philosophy, and an art that influences every facet of our lives.

As you journey through Algorithm 11.0, I hope you are inspired, intrigued, and, most importantly, reminded of the magic that mathematics brings to our world.

Happy reading!

Anam,
Sub Editor-in-Chief, Algorithm 2024-25

The Calculus of Cures

Have you ever wondered how doctors decide on the right medication dose for you? This is part of the science behind it! Let us explore how mathematics is related to pharmacodynamics and drug optimization.

What is Pharmacodynamics?

Pharmacodynamics involves studying how drugs affect biological systems. It helps in understanding the relationship between drug concentration and its effect on the body. The pharmacodynamic model, which explains the duration of a drug's effect, is a basic component of pharmacodynamics.

The Pharmacodynamic Model

Mathematical models can predict how different drug doses will interact with the body over time, allowing for better therapeutic strategies. For instance, the **sigmoid Emax model** is commonly used to describe the relationship between drug concentration and effect, often expressed as:

$$E = E_{max} \cdot \frac{C^n}{C^n + EC_{50}^n}$$

where:

- E = drug effect,
- E_{max} = maximum effect,
- C = drug concentration,
- EC_{50} = concentration at which 50% of the maximum effect i
- n = Hill coefficient (indicating the steepness of the curve).

Imagine you have a headache and decide to take paracetamol. At low doses, the pain is minimally reduced. As the dose increases, the pain relief becomes more significant. However, at a certain point, the medicine arrives at its maximum limit after which the further pain relief is minimal. At higher doses, it may even lead to liver damage. Using the Sigmoid Emax model in pharmacologists visualize this as an S shaped curve. Isn't it exciting that even an everyday medicine like paracetamol has mathematics behind its functioning?

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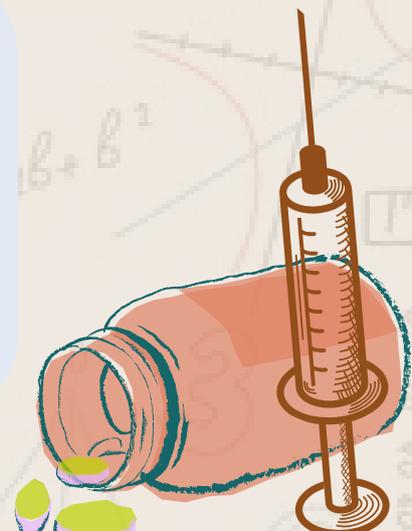
Role of Calculus

Calculus, particularly differential equations, is essential for modelling how a drug behaves over time. Imagine tracking how a medication is absorbed, distributed, metabolized, and eventually eliminated from your body. By using these equations, researchers can determine the optimal dosage and timing to maximize therapeutic effects while minimizing side effects. Just like solving a puzzle where every piece represents a different drug concentration! The rate of change of drug concentration in a compartment can be described by a first-order differential equation:

Restoril is a medication used to help people sleep. Imagine someone taking Restoril before bed. As their body absorbs it, the drug concentration rises, helping them to sleep. Eventually, it starts to wear off as their body eliminates it. But, if the dosage is inappropriate, they may not get adequate sleep. By using this simple equation, doctors can figure out the right dose and timing to help them sleep soundly without any side effects.

$$\frac{dC}{dt} = -k \cdot C$$

where:

- C = drug concentration,

- k = elimination rate constant,

- t = time.

Role of Linear Programming

Linear programming is another fascinating mathematical approach in pharmacology. When tackling complex diseases, researchers can optimize drug combinations to enhance benefits while reducing toxicity. By setting up a system of linear equations and inequalities, they can find the ideal mix of medications.

Conclusion

Pharmacodynamic models show how drug concentration affects the body. By predicting the intensity and duration of these effects, they help researchers find the optimal dose to maximize therapeutic benefits and minimize side effects.

FROM TRIGONOME-TREES AND GEOGRAPH-THEORY

world of math and map
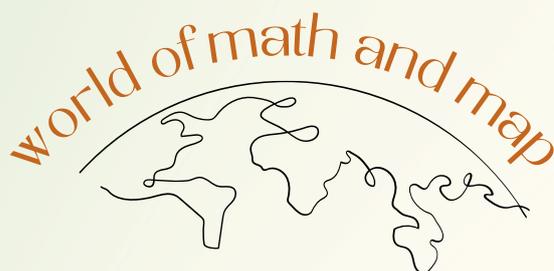
Mathematics is a wide concept that is there behind each and every action being performed. From the trivial matter of paying a street vendor to launching big projects like Chandrayan, everything involves mathematics. It is closely connected to Geography too.

Mathematics behind Tsunami :

Tsunami is a natural calamity that occurs by the tectonic movement of ocean plates, resulting in a series of huge ocean waves. As the waves approach land, their energy increases, and the height of the waves can go up to 60 meters. There are three mathematical factors involved in relation to tsunamis: speed, height, and energy power.

Speed : It is calculated by taking the square root of the product of acceleration (9.8 m/s) and water depth (averages about 4000 m), i.e., Speed = square root (9.8 * water depth)

Height : As waves approach shores, speed of the waves slows down, but on the contrary, height of the waves increases at the opposite rate.

Power : Energy power is proportional to the square root of how long the wave is, i.e., wavelength. The longer the wave, the greater would be power of tsunami making it more dangerous

Graph Theory to Control Traffic :

With the application of graph theory, controlling of traffic can be successfully done. It represents the entire traffic signal network that acts as nodes, and the connectivity of signals is represented as edges to build a network and through this network, the appropriate routes can be found by modelling the system of traffic flows into compatible graphs. 2 vertices are represented as the flow connected by an edge if and only if the flow at the crossroads can be moved simultaneously without causing crashes.
.
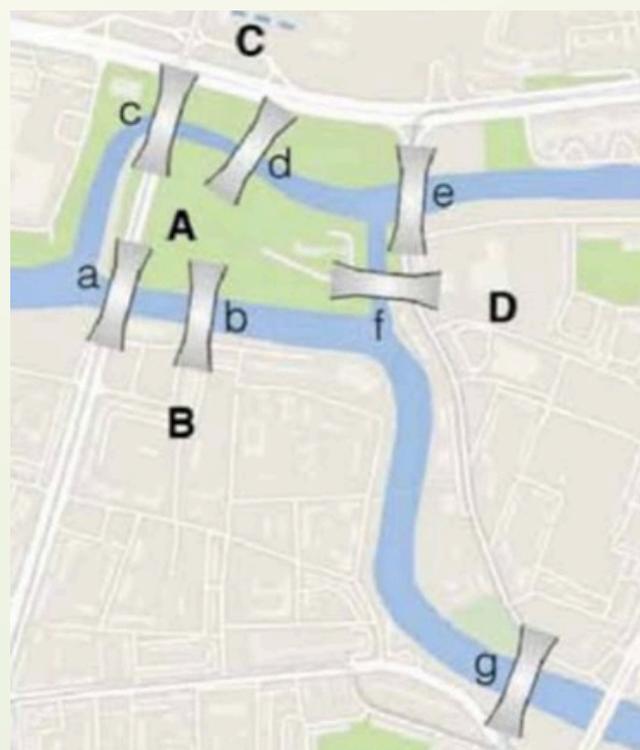
Source of Images : Google Images

Differential Equations in Climate Modelling :

Climate modelling plays a crucial role in understanding and predicting the Earth's climate system. Calculus and differential equations help us predict climate impacts by simulating past, present, and future climate scenarios. Energy balance equation (EBM) is used to model the Earth's temperature :

$$R. \, dT / dt = Q(1 - \alpha) - \sigma T^4$$

- **R** is the heat capacity of the Earth.
- **Q** is the solar constant defined as energy incident per unit area per second.
- **α** denotes the solar energy reflected by Earth's surface and atmosphere.
- **σ** is a constant of proportionality.
- **T** is Earth's effective temperature in Kelvin

Trigonometry in Navigation :

Trigonometry helps in determining precise locations using the Earth's coordinate system. Lines of longitude run from North to South and lines of latitude run from East to West. The Global Positioning System (GPS) uses a network of over 30 satellites to figure out longitude and latitude. These satellites orbit Earth twice a day and communicate with receivers to transmit signals. A fundamental technique is used for precise location called trilateration which involves measuring the distance from the receiver to at least three satellites and using this information to pinpoint the receiver's location. Additionally, a fourth satellite is often used to adjust for errors in the receiver's clock.

Distance from one satellite -

Distance = signal speed x signal time

The signal speed is the speed of light and the signal time is how long it takes for the signal to travel from the satellite to the receiver
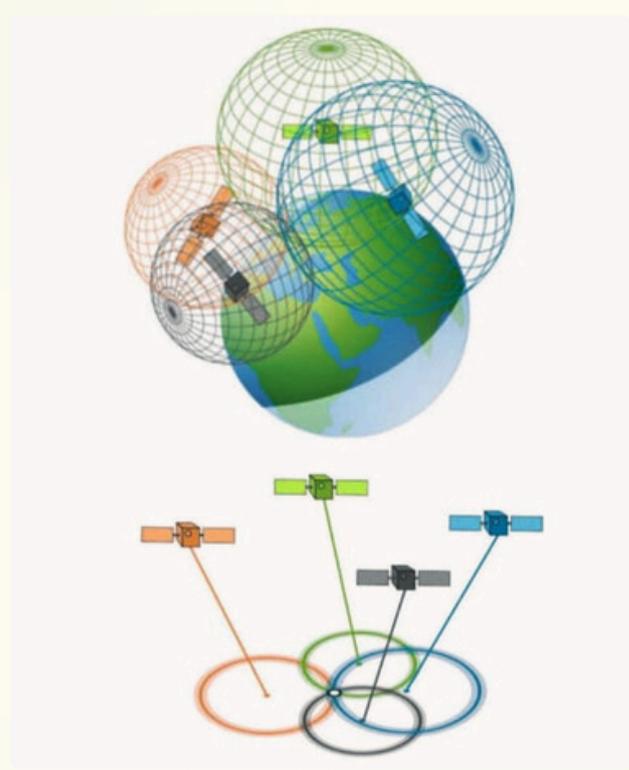
Source of Images : Google Images

Probability and Statistics in Climate Change :

Statistics plays a crucial role in uncovering patterns between different geographical phenomena by providing various techniques like correlation analysis and regression analysis. With correlation it is seen how two factors are related, for instance: change in temperature often strongly correlates with greenhouse gas levels helping to understand patterns of climate change and with regression analysis it is possible to predict future climate change.

In conclusion, mathematics is essential in geography as it helps us understand and analyse various patterns on Earth. From mapping locations to studying climate trends, math enables accurate insights that guide important decisions about our environment.

Stranger Theorems

Exploring the upside down of maths and philosophy

At first glance , mathematics a subject associated with quantification and structure , and philosophy with theory and ethics may seem like oil and water . However , the truth is that these two disciplines are deeply intertwined , more so than we often realise . Therefore in this article we will talk about the nature and the essence of mathematics through a philosopher's eyes .

Before we go any further we need to look briefly at the nature of mathematics itself. On one hand, there are at least two ways to characterize mathematics negatively: mathematics is neither empirical science nor arithmetic. It is not concerned with predictions or explanations, and it is not concerned with numerical calculations. On the other there are at least three ways to characterize mathematics positively: firstly as logic (logicism); secondly as the study of formal systems (formalism); and thirdly as intuitive constructions (intuitionism).

For Nietzsche, math is an artistic and moral activity. Nietzsche's philosophy of mathematics is best summarized by aphorism 246 of the Gay Science: "Let us introduce the refinement and rigor of mathematics into all sciences as far as this is at all possible, not in the faith that this will lead us to know things but in order to determine our human relation to things. Mathematics is merely the means for general and ultimate knowledge of man." In this , he claims that mathematics is the means to ultimate knowledge about the world and oneself .

Content- Prashasti

In contrast , Leibniz views tend to logicism , but it was only in the 19th century that detailed logicist programs became possible thanks to the work of mathematicians like Dedekind and Peano, and the logician Frege. Frege worked hard to show that mathematics could be derived
from logic. He succesfully derived Peano's arithmetic principles from basic logical laws.

However, he used one principle, Frege's Basic Law V, which was later found to be flawed and not actually a logical principle. This mistake led to what's known as Russell's paradox in today's time.
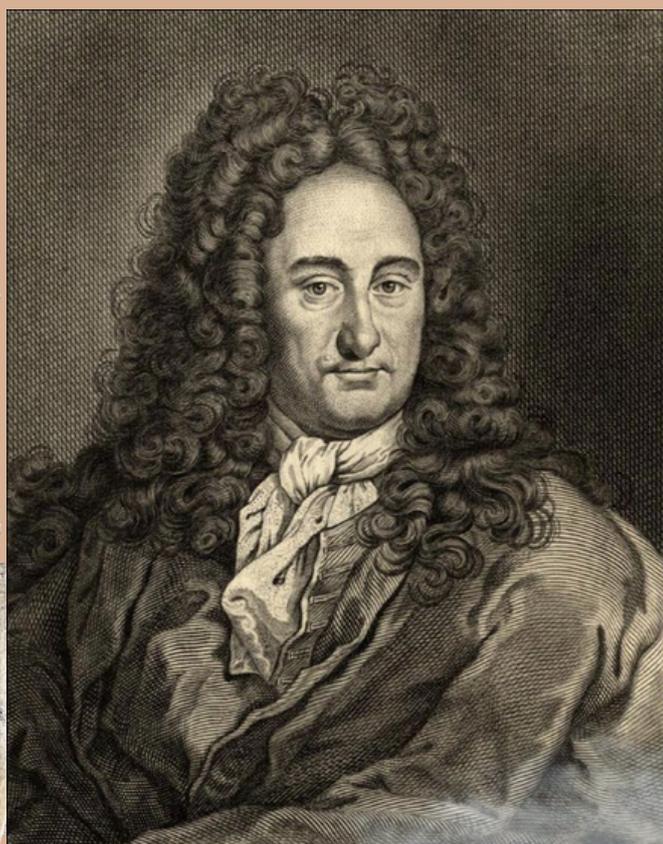

$$\{x \,|\, Fx\} = \{x \,|\, Gx\} \ \ if \ and \ only \ if \ \forall x (Fx \equiv Gx),$$
$$\{x \,|\, Fx\} = \{x \,|\, Gx\} \ \ if \ and \ only \ if \ \forall x (Fx \equiv Gx)$$

In words: the set of the 𝔉s is identical with the set of the 𝔊s iff the 𝔉s are precisely the 𝔊s.

Other than the theoretical applications , we can see the how mathematics and philosophy go hand in hand in practical and real life situations through the Aumann's agreement theorem.

In layman language this theorem states that two rational people willing to listen to other's beliefs cannot agree to disagree or will reach an agreement given they have all relevant information prior.

One such example is arguing to learn , when you and your friend have different music taste or favourite cuisine but as long as you guys talk further you shall be able to find a middle ground and come to an agreement to dance and explore cafes together .
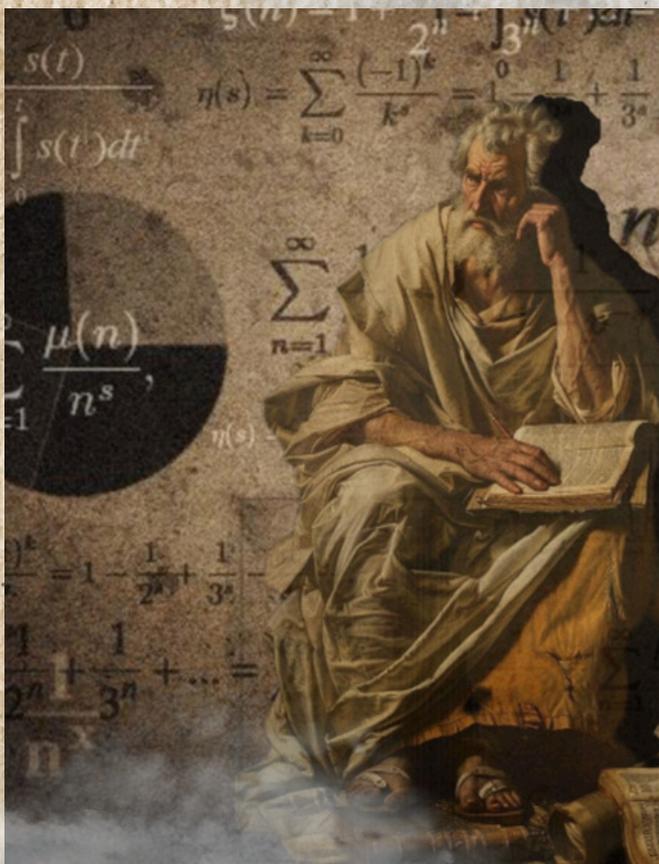
In conclusion, Mathematics and philosophy work together to help us understand the world better. Mathematics provides clear and logical ways to solve problems, while philosophy makes us think deeply about why things are the way they are. Combining both helps us learn more about our existence and gain knowledge.

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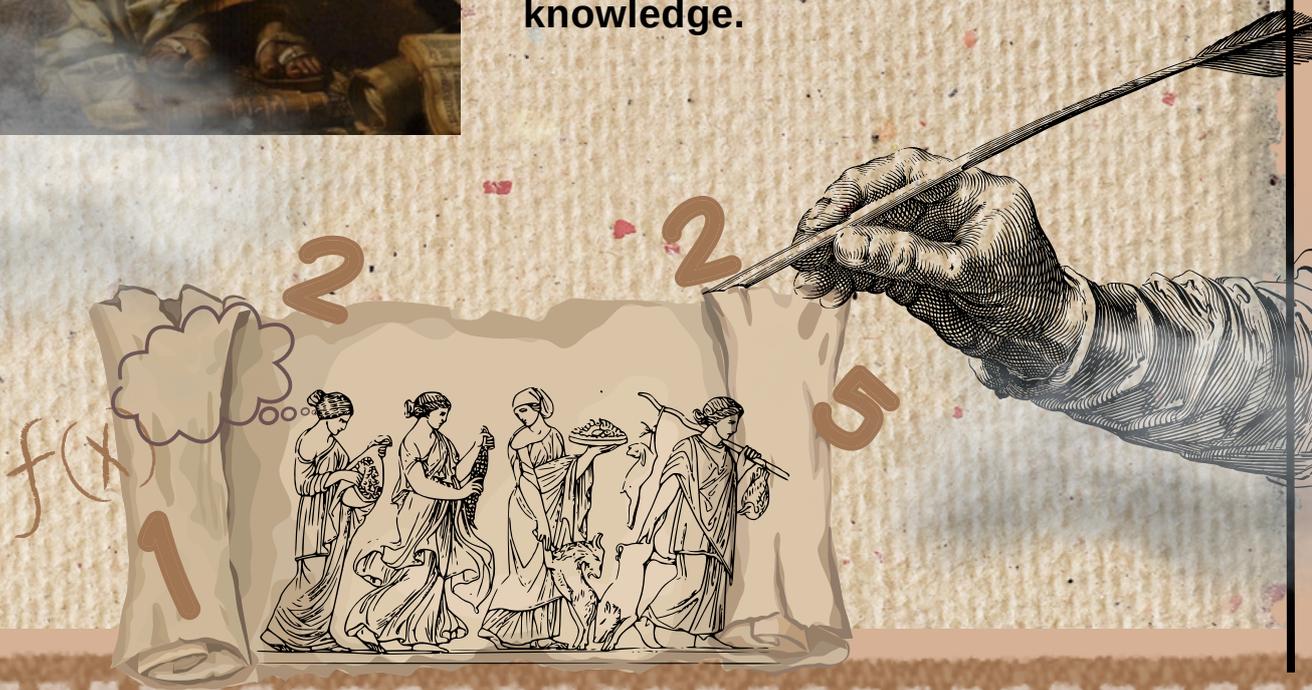
Breaking Down Math Anxiety and Imposter Syndrome

Content- Suhani, Vrinda

UNDERSTANDING CHALLENGES IN MATHEMATICS LEARNING

Mathematics, in its simplest form is the study of numbers—and numbers are truly everywhere. Mathematics is both inherent in the world and a human construct. It existed long before us and will continue to exist well after us. While language and basic skills are things we naturally develop, whether or not we study them formally, the same cannot be said for mathematics. After centuries of research, mathematics has expanded far beyond basic numerical skills, evolving into a complex structure that many find daunting.

Interestingly, understanding the difficulties some face with math, like math anxiety, requires insights from cognitive psychology—a field focused on how people think. Math anxiety is the fear or nervousness people experience when taking a math test, solving a problem, or even dealing with numbers in everyday situations.

For people with math anxiety, working with numbers isn't just challenging—it can feel almost painful. Some even experience physical symptoms, like a racing heartbeat, feeling overheated or flustered, and sweating. Research shows that 20 to 25 percent of children experience moderate to high levels of math anxiety. While studies have established a link between math anxiety and math ability, no research has yet determined which comes first.

ALGORITHM   11.0

Researchers have two main ideas about how math anxiety might develop. One theory suggests that children who struggle with learning numbers at an early age are more likely to develop math anxiety once they begin school, though this has not yet been tested in young children. Another theory proposes that math anxiety arises from specific social situations that shape a child's thoughts or feelings.

In other words, a child's emotions, opinions, or behaviors may be influenced by the actions or words of others. When considering the gender aspect, studies have found that math anxiety is more prevalent in women than in men. This does not mean that men are inherently better at math; rather, it reflects a social construct in which mathematics is often viewed as a male-dominated field, leading to higher levels of math anxiety among women.Math anxiety can cause students to perform below their true potential on tests. A study suggests that when children solve math problems, those with high

math anxiety activate brain regions associated with anxiety, whereas children with low math anxiety activate brain regions focused on problem-solving. Imposter syndrome is another concept in psychology where individuals doubt their own success or academic abilities, even when there is ample evidence to the contrary. People in mathematics often experience imposter syndrome as well. This phenomenon is especially common in academic fields, particularly in mathematics, where mathematicians have long held themselves to high standards.

Mathematical talent is often stereotyped as an innate gift, rather than something that can be nurtured through practice and effort.

This misconception creates the impression that mathematicians are "naturally smart," leading to the belief that ability in the field is fixed rather than developed over time. As a result, mathematicians may fear being exposed as "frauds" or "imposters" if others see them struggling with difficult concepts or hitting dead ends in their research —a normal part of the learning process.

These worries often arise from the pressure to seem effortlessly brilliant, even though real progress in mathematics involves persistence, learning from mistakes, and tackling setbacks. This is also one reason people develop math anxiety, as mathematics is perceived to be more challenging than other subjects. Being surrounded by people in schools or universities who might downplay their efforts can lead individuals to internalize these doubts and develop imposter syndrome.

In conclusion, math anxiety and imposter syndrome illustrate how deeply psychological and social factors impact the learning of mathematics. Recognizing these challenges is essential to helping students gain confidence and perform at their best. By fostering a supportive environment and rethinking how we approach math education, we can make the subject more accessible and less intimidating for everyone.

Design- Srishti Dey

Econometrics & Cobb Doughlas Production function

Economics is a lot about developing hypotheses and using statistical methods for proving our assumptions and theories. Econometrics is a branch in economics which is solely based on this. Econometrics was pioneered by Lawrence Klein, Ragnar Frisch, and Simon Kuznet.

All three of them won the Nobel Prize in economics for their appreciable contributions. The Cobb Douglas Utility function is one of the most common functions used theoretically, but not so common to a common man.

 To get a basic idea of what production functions do, they are a way to establish a relationship between what goes in (input) and what comes out (output). Among numerous production functions, we have the Cobb Douglas production function which builds relationships between the technology and the inputs and outputs used.

History

In 1927, A Theory of Production. The American Economic Review, was a research paper presented by mathematician Charles W. Cobb and economist Paul H. Douglas wherein the Cobb Douglas Function was born. An important point to be noted here is that the Cobb Douglas function had already been mentioned by the economist Knut

Wicksell in its various different forms; however, the simple and easy formation given by Cobb and Douglas became the most prominent out of all. The paper proposed the relationship between labor, capital and output in the form of the Cobb Douglas function which can be most commonly seen as:

$$Y = A(L^{\wedge}\alpha)(K^{\wedge}\beta)$$

Where L= Labour, K= Capital A= Technology and α >0, β >0 where α + β = 1

Visibly, the Cobb Douglas Production Function is a linear homogeneous production function and hence gives constant returns to scale, meaning, if all the inputs are increased by the same proportion, the output will increase by the same proportion as well. This may not be true everytime, as if α + β <1 or α + β > 1, then we obtain decreasing and increasing returns to scale, respectively.

Practical Applicability

A very famous research work (Hassani, Ashkan. "Applications of Cobb-Douglas Production Function in Construction Time-Cost Analysis." (2012)) includes a time-cost trade off analysis.

We help determine the right amount of labor and equipment to use for a project (say, a construction project), subsequently minimizing the cost and duration of the project.

The reason for conducting this research was that there was barely any existing data based on exploring the origin of crashing costs which can be defined as the extra cost required to shorten the duration of a project.
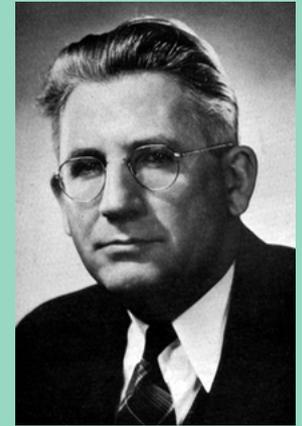
Charles Cobb (1875-1949)
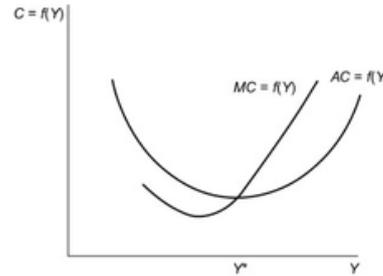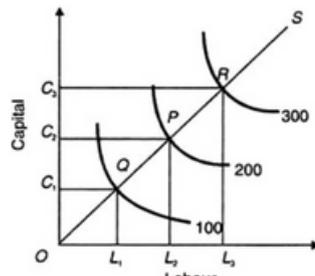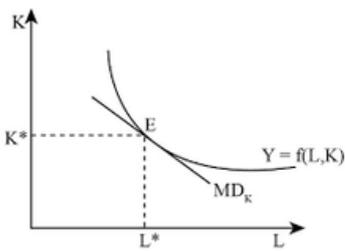
$$Y = AL^{\alpha}K^{\beta},$$

$$\frac{\partial Y}{\partial L} = \alpha \frac{Y}{L}$$

$$\alpha = \frac{\partial Y}{\partial L} \frac{L}{Y}$$

It was observed that connecting the concept of time-cost trade off with the Cobb Douglas brought in different insights and perspectives to looking at how a project duration can be cut down. A significant feature of the study was that the Cobb Douglas effectively showed quantitatively, its crashing costs and the combination of labor and capital needed to minimize the given problem.

Paul Douglas (1892 – 1976)
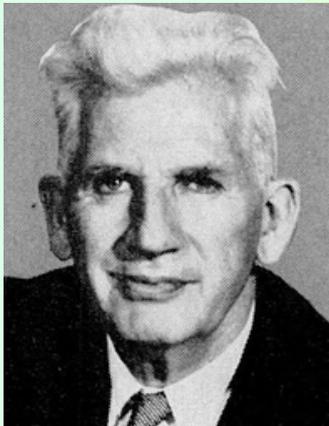
For example, to construct a highway it is required to complete the work before a deadline. To do so, the project manager of the same can either hire additional workers or bring in more machinery to speed up the task. Using Cobb Douglas function, they can estimate how much more labour and capital is required to reduce time while keeping the budget in mind. So by investing in a specific ratio of capital or labour is the most effective way to achieve a deadline without any unnecessary expenses. Another research work (LiWei Wang, "The Application of Cobb Douglas Production Function in Urban Local Economic Growth Management Under Computer Big Data."(2020)) talks about urban economic growth.

It talks about how the Cobb-Douglas production function can be utilized to effectively manage urban economic growth. Wang begins by explaining the resources of Cobb Douglas Function-labor and capital (just like shown above). This paper shows that by using big data, we can analyze how resources should be allocated to encourage economic growth in cities. With these insights, city planners and investors can make smarter decisions about managing resources, which at the end leads to more effective and efficient economic growth.

For example, A city wants to boost their economic growth by starting small businesses in sectors like technology, retail etc. Using big data, the analysts can see how the labour and capital (investment in technology) boost the growth in these sectors. The cobb douglas function shows that investing in coworking spaces, internet infrastructure and grants for startups leads to growth in specific areas by guiding people toward resource allocations that maximize both employment and productivity.

13

IS DEMOCRACY MATHEMATICALLY POSSIBLE?

CONTENT- DISHA JAIN

DESIGN- DIZA PAULSON

> *Imagine a system where every voice is heard and every vote counts.*
>
> *That's the promise of democracy. But is it mathematically possible?*

Social choice theory is a branch of mathematics that analyzes how to make collective decisions based on individual preferences and interests. By using models and equations, social choice theory helps us understand the limitations and potential of voting systems. For instance, when students vote on activities for a school event, social choice theory can provide a framework to ensure that everyone's choices are considered. Recent advancements in this field even incorporate technology, like artificial intelligence, to handle more complicated voting scenarios, such as summarizing open-ended feedback. While social choice theory has improved how we approach group decisions, it still faces challenges in making sure that all voices are heard and that everyone feels represented in the final outcome.

A foundational result of social choice theory is the groundbreaking work by the Economist Kenneth Arrow. Essentially, Arrow's impossibility theorem identified five fairness conditions that an ideal voting method should meet: unrestricted domain, weak Pareto efficiency (meaning if everyone prefers one option, it should be chosen), independence of irrelevant alternatives, non-dictatorship, and transitivity. His theorem, however, proves that no voting system can meet all these criteria simultaneously, suggesting that "perfect" fairness is mathematically impossible. Arrow's findings build on insights like the Condorcet Paradox, which illustrates how group preferences can end up in cycles and contradictions, making it hard to identify a single, clear winner. Furthermore, research even suggests that voting systems meeting these standards tend to be dictatorial, further limiting practical options

Game theory is the study of how people make decisions when their choices affect one another. In elections, candidates use game theory to figure out the best strategy for themselves, considering how their experience and promises would affect peoples' choices. They also use it to plan their campaigns- deciding what promises to make, which voters to target, and how to respond to opponents. Combining game theory with artificial intelligence, it is an efficient tool to make the process of political decision making drastically more efficient.

However, It's important to remember that while game theory offers helpful insights into political dynamics, its effectiveness can be limited by the unpredictability of human behavior and the complexities of real-world scenarios that may not always align with rational models.

*F*irst-Past-The-Post (FPTP) voting, while widely used, has significant drawbacks that impact democratic representation. One major issue is minority rule; candidates can win without a majority, meaning the elected representative may not reflect the preferences of most voters. This system also fosters negative voting, where people vote against disliked candidates rather than for their preferred ones, often out of fear that their favored choice has little chance of winning. Additionally, FPTP tends to lower voter turnout by making elections feel predictable in areas with strong partisan divides, leaving many to feel their vote won't impact the outcome.
Lastly, the spoiler effect means third-party candidates can split the vote, unintentionally aiding the victory of a less popular candidate.

Alternatively, voting systems that focus on ranking or approving multiple candidates offer fairer approaches compared to First-Past-The-Post (FPTP), though they come with their own flaws. In rank-based voting, like ranked-choice voting, voters rank candidates by preference, reducing the "spoiler effect" and often leading to a winner with broader support. Approval-based voting allows voters to approve multiple candidates, creating a fuller picture of public sentiment. However, these systems can be complex to implement and may still fail to fully capture the majority's will, highlighting that no voting method is entirely without limitations.

In conclusion, the mathematical challenges of designing a truly fair democratic system reveal the inherent complexity of balancing representation, accountability, and individual rights, prompting ongoing debates about the best approaches to governance in diverse societies. Arrow's impossibility theorem shows us that no voting system can perfectly satisfy all fairness criteria, while social choice theory and game theory highlight the strategic interactions among voters and the potential for manipulation in electoral processes. While the first-past-the-post system is deeply flawed, other voting methods like rank-based and approval-based systems could improve representation. These alternatives help reduce strategic voting and create a more inclusive political environment that better reflects what voters want. Ultimately, the pursuit of a mathematically "ideal" democracy may be impossible, but understanding these limitations drives us to continuously refine our systems in the quest for a fairer, more inclusive democracy.
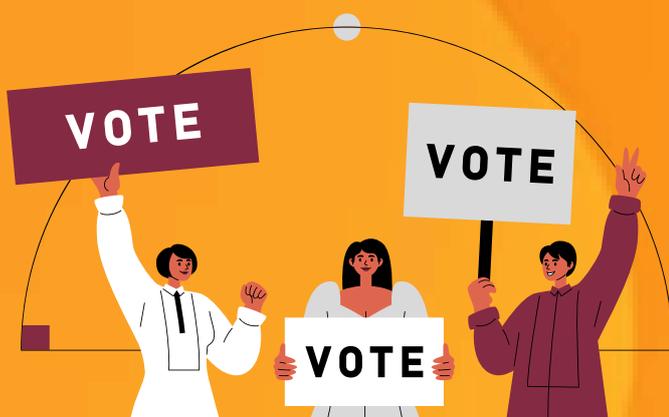
The Best Place to Learn: Math Adventures Await!
(inspired by the tagline of Lego)

Mathematics is regarded as a logical and analytical discipline that deeply impacts cognitive development, brain plasticity, self-efficacy, geometry, and spatial reasoning. Together, these psychological and neurological factors reveal how math is not merely a skill but a transformative experience that shapes how our brains process and analyze information.

Cognitive Development and Mathematical Thinking

Cognitive development refers to how a person perceives, thinks, and gains an understanding of his or her world through the interaction of genetic and learned factors.

Jean Piaget's theory of cognitive development suggests four stages of intellectual development each reflecting the increasing sophistication of their thoughts.

Stages of Development

STAGE	AGE	GOAL
Sensorimotor	Birth to 18-24 months	Object permanence
Preoperational	2 to 7 years	Symbolic thought
Concrete operational	7 to 11 years	Logical thought
Formal operational	Adolescence to adulthood	Scientific reasoning

In the **Sensorimotor Stage** infants develop basic motor skills and learn to perceive and interact with their environment through physical sensations and body coordination. The child can store information about the world, recall it, and label it. For example, a baby learns that even if a toy is hidden under a blanket, it still exists.

The **Preoperational Stage** is marked by the non-usage of operations; hence, thinking is influenced by how things look or appear to them rather than logical reasoning. For example, A child might imagine that their toy car can fly or has magical powers.

The next stage is called the **Concrete Operational Stage** because children think logically- if they can manipulate real (concrete) materials or images. They conserve-something stays the same in quantity despite its appearance changes-, numbers (age 6), mass (age 7), and weight (age 9).

For example, a child can understand that if they cut a sandwich into four pieces, it's still the same amount of food.

Lastly, the **Formal Operational Stage** involves adolescents who can think abstractly, combine and classify items more sophisticatedly, and use higher-order reasoning to solve hypothetical (imaginary) problems. For example, they might imagine how gravity affects a ball differently on Earth versus on the Moon.

Neuroplasticity: The Brain's Adaptation to Mathematical Learning

Neuroplasticity or brain plasticity is the brain's ability to reorganize and restructure itself on a cellular level. Mathematical learning has significant impacts on the brain's plasticity and cognitive functions. Engaging in mathematical activities such as problem-solving, mental calculations, and arithmetic practice can enhance neural connections, promote the formation of new brain cells, and enhance cognitive abilities. When we perform mathematical tasks, neurons are activated together, strengthening their connections. As a result, brain plasticity increases, and cognitive function improves. For example, Imagine a student practicing mental math, like adding or subtracting numbers in their head while waiting in line at the grocery store. Each time they calculate, their brain activates specific neural pathways for math and working memory. Over time, as they repeat these mental exercises, the brain strengthens these pathways, making them faster and more efficient. The Hebbian principle, a neuroscientific theory, explains how neural connections are formed in the brain. According to this principle, when two neurons are consistently activated simultaneously, their relationship becomes more robust. In other words, the more frequently we use a particular neural pathway, the stronger it becomes. Learning mathematics requires us to consistently activate specific neural pathways in the brain, strengthening the connections between neurons and promoting neuroplasticity.
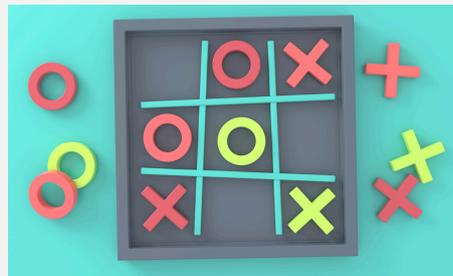
Self-Efficacy and its Role in Mathematical Achievement

In addition to cognitive benefits Mathematical self-efficacy- an individual's belief in their ability to perform mathematical tasks and is considered a predictor of math anxiety and performance has a profound impact on learning outcomes. Collins (1982) demonstrated that students with stronger self-efficacy, show more persistence on difficult items. Randhawa et al. (1993)' structural equation modeling showed mathematics self-efficacy was a mediator variable between mathematics attitude and mathematics achievement. Students (or adults learning a new math skill) having high self-efficacy set incremental goals to build their math skills, such as practicing specific types of problems. Each small achievement reinforces their belief in their abilities. For example, a student may set a goal to learn how to solve subtraction problems, practicing them daily until they feel confident.
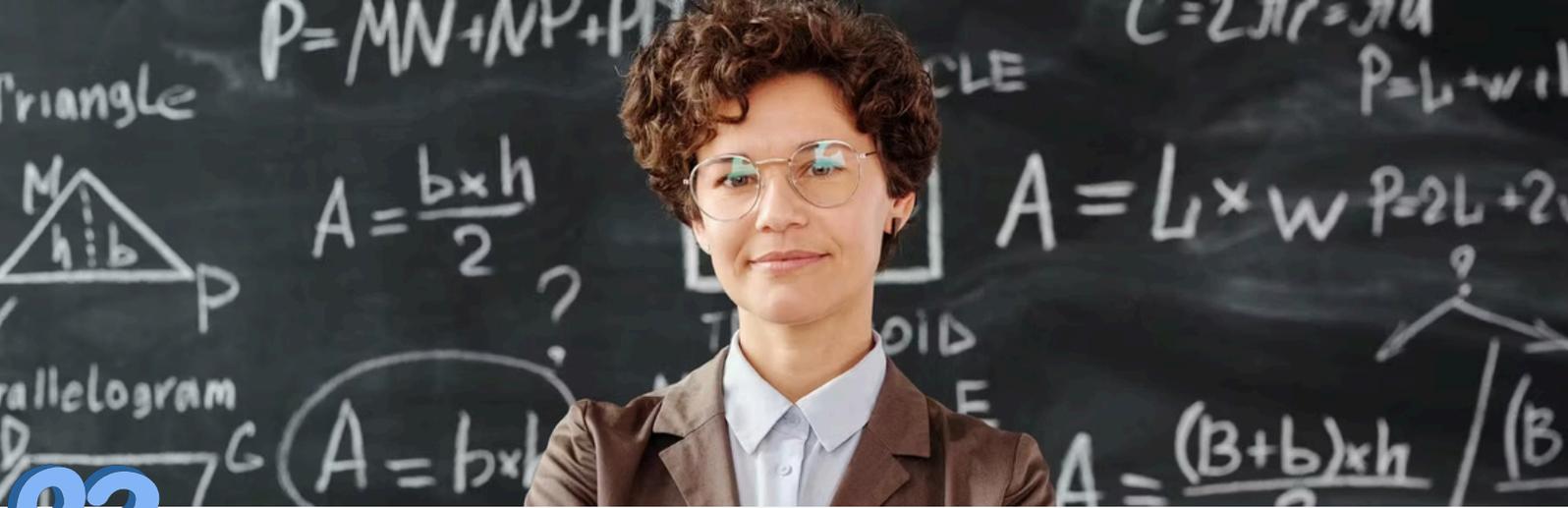
# The Importance of Geometry and Spatial Reasoning

Geometry is a mathematics branch that studies shapes, sizes, positions, directions, and movements. It forms the foundation for understanding higher-order mathematics thinking skills. They support the development of numerical abilities such as understanding quantity, numeral identification, counting, place value, and arithmetic concepts and skills.

The definition of visual-spatial relations is the ability to visually perceive two or more objects concerning each other and to yourself. Spatial reasoning is how we understand how things (including ourselves) move and interact concerning the physical space around them. It also involves understanding the relationships of objects as they change position.

Some of the Real-Life Applications of Geometry and Spatial Awareness are :

1. Classroom Arrangements: Arranging desks in a classroom requires spatia
awareness. Students learn how to organize space to allow everyone to sit comfortably.

2. Art and Crafts: Students learn about shapes, symmetry, and patterns while
drawing, cutting, or assembling paper crafts, building a foundation for geometry skills.

3. Building with Blocks: Stacking or arranging blocks helps children develop spatial reasoning by visualizing and experimenting with structures.

4. Organizing Personal Space: When a student arranges their desk or backpacks, they use spatial reasoning to fit items efficiently, much like a puzzle.

The notion that mathematical ability is not fixed but can develop with practice is a crucial shift that encourages educators to adopt strategies that foster brain plasticity and self-efficacy, such as personalized feedback, real-world math problems, and positive reinforcement. The fostering of these skills allows individuals to think critically, navigate complex challenges, and cultivate confidence, resilience, and lifelong learning.

$$\cos(\theta) = \frac{adj}{hyp}$$
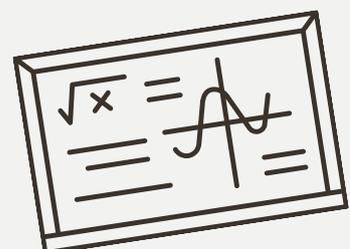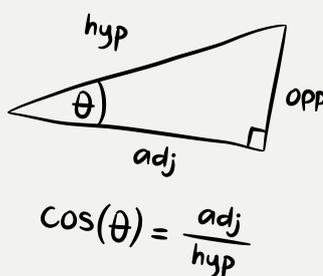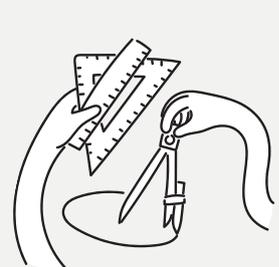
IS ZERO A NUMBER?

DESIGN & CONTENT- MUSKAN

The room is buzzing with excitement as some of the greatest minds in mathematics gather for the most exciting debate.In the room we have two legends: the renowned mathematician René Descartes, known for his logic and reason, and the brilliant, passionate Srinivasa Ramanujan, who is the master of discoveries.

The audience leans forward, eager to witness the intellectual discussion. Today's topic? A question that has puzzled scholars and sparked debates across centuries: Is zero truly a number? Descartes steps forward with a smirk, while Ramanujan's eyes light up with intensity. The crowd holds its breath, sensing that this will be no ordinary debate.

Moderator: Ladies and gentlemen, you are about to witness a clash of mathematical Legends! Prepare yourselves as René Descartes and Srinivasa Ramanujan take on the question: Is zero really a number?

René Descartes: Ladies and gentlemen, gather around! Today, we're diving into a fascinating topic: is zero really a number? I, René Descartes, argue that zero is NOT a number! It represents nothing, a emptiness! When we count, we count things—like apples or oranges. Zero stands for the absence of anything! How can we call it a number when it signifies nothing?

Srinivasa Ramanujan: Oh Poor Descartes, I can't help but feel excited about this discussion! I must passionately disagree! Zero is absolutely a number, and it plays a crucial role in mathematics! It's like the hero of our number system! Think about it: zero helps us understand the space between positive and negative numbers. It allows us to make sense of the world around us!

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Descartes: I appreciate your enthusiasm, Ramanujan, but let's be clear: zero doesn't measure anything real! It's a placeholder! When we write 10, the zero tells us we have ten of something. Without it, we'd just have a 1! It doesn't represent a quantity; it signifies emptiness!

Ramanujan: But isn't that the beauty of zero, Descartes? It's not just an empty space; it's full of potential! Can you live a life without zero? I doubt. Imagine trying to do calculations without zero! How would we express the idea of nothingness in a meaningful way? Zero is a number that lets us explore and understand complex mathematical ideas! It is absolutely essential!

Descartes: I see your point, but what about the fact that zero is often treated as an abstraction? It represents a concept rather than a physical quantity. Can we really count it among numbers that have tangible meaning? In geometry, for instance, it marks a point of intersection, but it doesn't measure anything!

Ramanujan: Ah, but that's where you're mistaken! Zero has real power in mathematics! It allows us to express complex equations and functions. In my work with infinite series, zero is necessary. It helps us define limits and understand how numbers behave as they approach zero. Without it, many mathematical concepts would simply collapse.

Descartes: your passion is contagious, Ramanujan! I can't deny that zero has made a huge impact on modern mathematics. But does that mean we can treat it as a number? It feels more like a special case that challenges our traditional views of counting.

Ramanujan: absolutely! Let's celebrate zero for what it represents,a bridge between nothing and something, a crucial part of our mathematical toolkit! It embodies the balance of the number system, and that's something worth cheering for! So, here's to zero—an extraordinary number that allows us to explore the infinite world of mathematics!
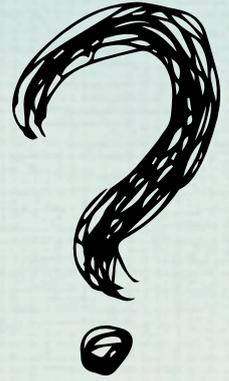
As the debate draws to a close, There is loud whispers and applause all over the room. Both Descartes and Ramanujan have presented their cases with passion, challenging each other's perspectives and expanding the audience's understanding of zero.

Moderator: What a fantastic debate! Today, we've seen how zero, a concept so simple yet so profound, can spark endless questions and insights. Descartes, Ramanujan—thank you for your incredible arguments and enthusiasm

Descartes and Ramanujan shake hands, each with a newfound respect for the other's perspective. The audience is left inspired, realizing that mathematics is more than just numbers—it's a language of ideas, and even mysteries. Whether zero is truly a number or a concept, one thing is clear: it has the power to challenge our minds and deepen our understanding.

Guide To Be A Future Mathematician

CONTENT & DESIGN- DISHA SHARMA

Mathematics is frequently perceived as a formidable subject often intimidating for individuals who do not have a conventional educational background in the field. However it's important to recognize that <u>one doesn't need formal training in mathematics to embark on a journey toward becoming a mathematician</u>. If you have the ambition to explore this discipline despite lacking extensive experience, the first step is to enhance your foundational math skills. To assist you on this path, numerous online platforms offer a wide range of engaging courses that cater to learners at all levels, helping you to develop and solidify your basic mathematical knowledge and techniques. Some of these websites are :

➥ Coursera:

The platform offers online courses from universities around the world, catering to a variety of learners. It features math-related courses suitable for beginners, non-math majors, and those seeking to study mathematics at a higher level. Some of the available courses include **mathematics for machine learning, mathematics for data science, and mathematics for engineers.** For beginners, there are options like math preparation, introduction to calculus, and basic mathematics. The courses typically last between 1 and 4 months, and access requires a monthly subscription fee.

➥ edX:

It's a website that helps clear the fundamentals and basics of mathematics, gradually advancing to more complex concepts. The courses are designed by leading universities such as University of California and MIT. Some advanced and specialized mathematics courses include **Abstract Algebra from MIT, Differential Equations: Linear Algebra and Applications from MIT, and Real Analysis from Harvard University.** Duration of the short courses are 2-6 weeks and advanced courses are around 12-16 weeks.

➥ *Future Learn:*

This is a great site for learning about mathematical diversity. Offers a variety of online courses in mathematics and related fields, with opportunities for certification. Many courses are free to audit. Some of the courses offered here include **calculus, recreational mathematics, and essential mathematics for data analysis.** Time span of these courses is usually between 3 to 6 weeks.

➥ *Udacity:*

It's known for it's nanodegree programs in **data science and analytics**, which include significant mathematical components. Both advanced and intermediate courses are offered here. The courses usually last between 3 weeks and 4 months. Certificates are awarded upon completion.

Mathematics is frequently viewed as an abstract and theoretical discipline. But hands-on experience is essential for deepening understanding and improving skills in this field. Engaging with mathematics through practical applications not only reinforces theoretical concepts but also enhances critical thinking, problem-solving abilities, and appreciation for the subject. There are many websites from which you can find math-related jobs and internships that will help you enhance your skills. Some of those sites are-

➥*Glassdoor:*

This site not only lists jobs but also internships. You can search specifically for math-related roles or internships in industries that use math. Many companies like **Google, Amazon and IBM hire interns through glassdoor.** Mode of the work will depend on your role in the company. It pays around 60k-70k per year.

➥*WayUp:*

It focuses on internships and entry-level jobs for college students and recent grads. It features opportunities in various fields, including analytics and finance. There are many job opportunities for positions such as **Quantitative Analyst, Data Engineer, Actuary, etc.**

➥ *Internshala:*

A popular platform in India that offers internships across various fields, including mathematics, data analysis, and finance. Some examples of such jobs are **Mathematics Tutor, Actuarial Intern, Mathematics Research Assistant and Data Science Intern.** These jobs are available in offline, online mode and hybrid mode and you can expect a salary of around 15k-20k per month.

➥ *Internship.com:*

This site specializes in internships and has a wide range of opportunities in various fields, including math-related positions. Most of the internships here are of duration of 2 to 3 months. There are various math-related internship available like **Data Science Internships, Quantitative Analyst (Quant) Internships, Actuarial Science Internships, etc.**

The journey to becoming a mathematician is both challenging and fulfilling. It demands dedication, hard work, and a passion for problem-solving. This process will help you to cultivate a diverse set of skills. Moreover, a strong foundation in mathematics can open the door to numerous career opportunities. The pursuit of mathematics not only prepares you for various professional pathways but also equips you with a way of thinking that is applicable in everyday decision-making. Embrace the challenges ahead, stay curious, and remember that your journey in mathematics can lead to endless possibilities and contributions to society!

Calculating Lives.

Content- Disha Jain
Design- Disha Sharma

Neena Gupta

Dr. Neena Gupta, an associate professor at Indian Statistical Institute, Kolkata, made history in 2014 by being the first person to solve the world's most significant math problem, "the Zariski cancellation problem" which was unsolved for as much as 70 years winning the Young Scientists Award from the Indian National Science Academy (INSA). In 2012, she became an INSPIRE faculty at ISI Kolkata, and has been working there as an associate professor there ever since. She specializes in commutative algebra and affine algebraic geometry.

She became the 4th Indian to win the prestigious Ramanujan Prize for young mathematicians. She has been showered with many accolades and honors for her path breaking research including the Shanti Swarup Bhatnagar Award (2019) and the inaugural Saraswathi Cowsik Medal in 2013, awarded by the TIFR Association.
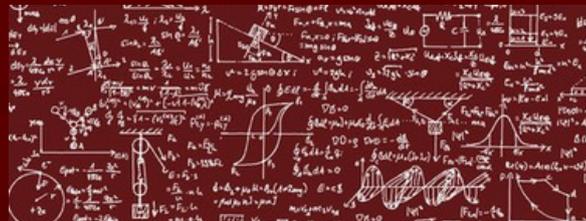
Katherine Johnson

Katherine Johnson was a NASA mathematician and aerospace technologist who worked on the calculations for America's first space trip with Alan Shepherd's 1961 mission the calculations for the first actual Moon landing in 1969. Johnson worked at the agency until 1986, when she retired after 33 years of service. During her tenure at NASA, Johnson received many prestigious awards. Among them were the NASA Lunar Orbiter Award and three NASA Special Achievement Awards. She was named Mathematician of the Year in 1997 by the National Technical Association. In addition to these NASA awards, Johnson was honored with an honorary Doctor of Law degree from the State University of New York and honorary Doctor of Science degrees from Capitol College in Maryland and Old Dominion University in Virginia.

Maryam Mirzakhani

Maryam was an Iranian mathematician and a professor of mathematics at Stanford University. On 13 August 2014, Mirzakhani was honored with the Fields Medal, the most prestigious award in mathematics, becoming the first woman to win the prize, as well as the first Iranian. The award committee cited her work in "the dynamics and geometry of Riemann surfaces and their moduli spaces"Her research focused on Teichmuller Theory, hyperbolic geometry, ergodic theory, and symplectic geometry. After receiving her Phd from Harvard University, Mirzakhani became a research fellow of the Clay Mathematics Institute and a professor at Princeton University before transferring to Stanford University in 2009.
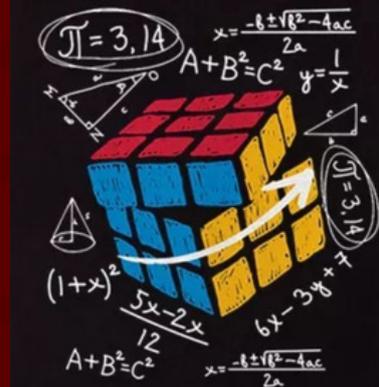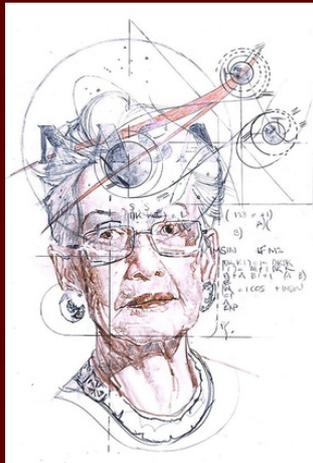
Sujatha Ramdoarai

Sujatha Ramdorai is a distinguished Indian mathematician known for her contributions to algebraic number theory. With a Ph.D. from Tata Institute of Fundamental Research, her research primarily focuses on the areas of Iwasawa theory and arithmetic geometry. She was awarded the prestigious Shanti Swarup Bhatnagar Prize for Science and Technology, making her the first Indian woman to receive this honor in mathematics. Ramdorai's work extends internationally, as she has held faculty positions at the University of British Columbia and is involved with India's National Knowledge Commission, advocating for math and science education reforms. Her research and leadership have made her an influential figure in mathematics, inspiring future generations of mathematicians worldwide.

Content-Vrinda   Design- Gauri Rihan

Mathematics Revolution

In 2024 alone, teenagers published a paper proving the Pythagorean theorem using trigonometry, while two others solved long-standing math problems that had puzzled experts for years. Let us now talk about two of the most significant awards in this field of study that are considered equivalent to noble prizes: Abel Prize and Field Medal.

Mathematics is all around us, woven into everything we do. From ancient herders counting their sheep to today's world, where numbers drive almost every aspect of life, math is essential. Some of the biggest questions, like the Riemann hypothesis and the Goldbach conjecture, still remain unsolved. Math is a field that keeps evolving, with new ideas and discoveries emerging all the time, and countless people working on these fascinating problems.
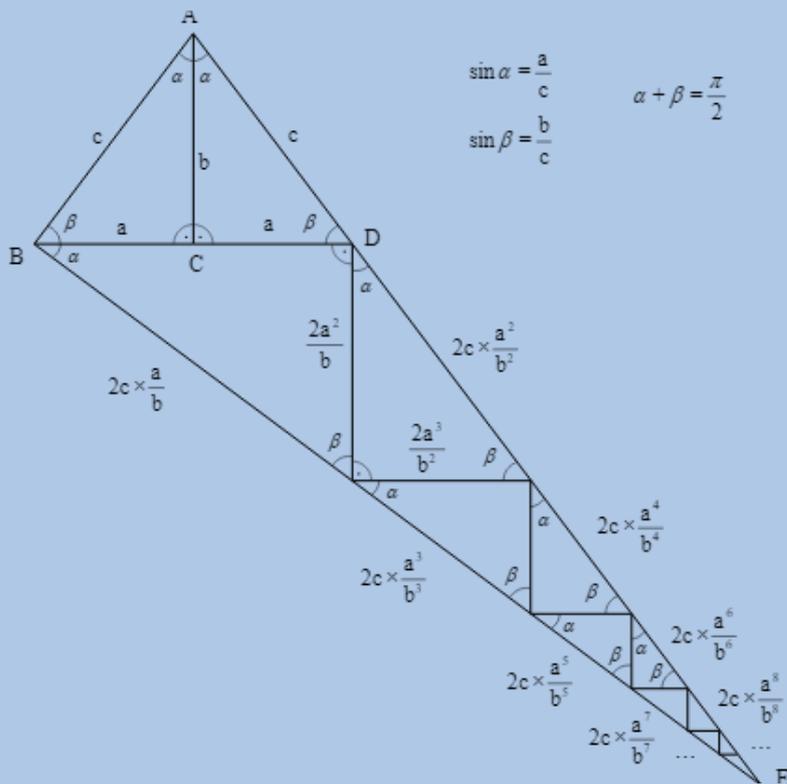

Riemann Hypothesis

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \frac{1}{1^s} + \frac{1}{2^s} + \frac{1}{3^s} + \cdots$$

Goldbach Conjecture
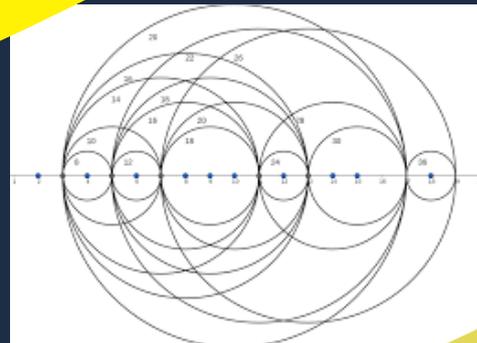
The Abel Prize is an international honor awarded by the King of Norway to recognize outstanding mathematicians, named in memory of Norwegian mathematician Niels Henrik Abel. Abel published his first papers in 1823 on functional equations and integrals, becoming the first to formulate and solve an integral equation. The Fields Medal, considered the "Nobel Prize of Mathematics," is awarded to two to four mathematicians for significant breakthroughs. It's reserved for those under 40 years old. The first Abel Prize was awarded in 2003 to French mathematician Jean-Pierre Serre, while the first Fields Medals were given in 1936 to Finnish mathematician Lars Ahlfors and American mathematician Jesse Douglas.

In 2024, the Abel Prize was awarded to Michel Talagrand from the French National Center for Scientific Research (CNRS) in Paris, France. "Talagrand is known as an "exceptional and highly productive mathematician". celebrated for his "groundbreaking contributions to probability theory and functional analysis, with remarkable applications in mathematical physics and statistics," as stated by the president of the Norwegian Academy of Science and Letters during her speech.
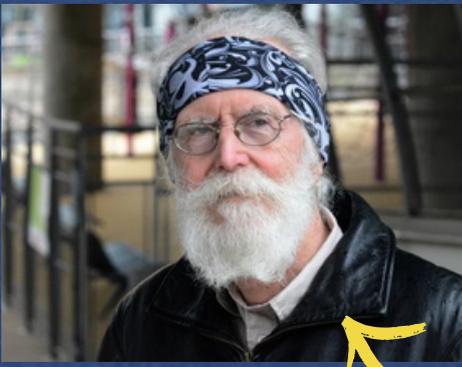
In 2024, the Abel Prize was awarded to Michel Talagrand from the French National Center for Scientific Research (CNRS) in Paris, France. Talagrand has spent 15 years working on probability theorems and random processes, aiming to understand complex systems around us. His work has practical applications across fields like machine learning, data mining, finance, and economics, and is particularly valuable in genomics and drug discovery, where analyzing gene expression data and molecular structures requires managing high-dimensional datasets.

In 2022, Maryna Viazovska became the first Ukrainian to receive the Fields Medal, while June Huh was the first person of Korean descent to earn the honor. Maryna won the medal for her solution to the sphere packing problem in eight dimensions. June Huh, a professor at Princeton University, is recognized for solving the Heron-Rota-Welsh conjecture using methods from algebraic geometry.

In conclusion, mathematics is always progressing, with research breakthroughs. The work of mathematicians like Michel Talagrand, Maryna Viazovska, and June Huh highlights the incredible contributions being made in various fields, from probability theory to geometry. The prestigious Abel Prize and Fields Medal serve as important acknowledgments of these achievements, celebrating the mathematicians who shape our understanding of the world. As mathematics moves forward, it will keep solving complex problems and making a difference in many areas. Mathematicians continue to explore uncharted territories, their work will undoubtedly contribute to solving some of humanity's greatest challenges, paving the way for new technologies and insights that will shape the future.
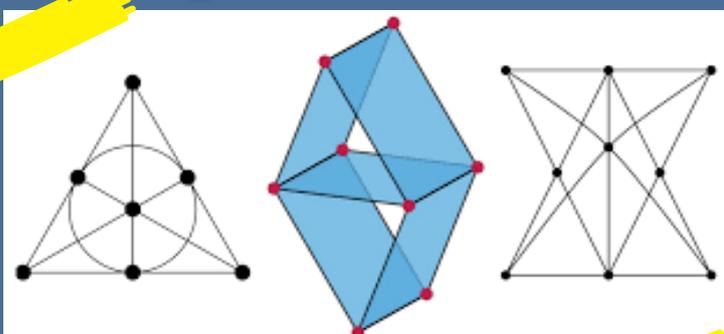
The journey of mathematical discovery is far from over—it is an ever-deepening exploration, inspiring and driving progress that touches every aspect of our lives. As mathematics moves forward, it will keep solving complex problems and making a difference in many areas.

ALGO RECOMMENDS

🔴 🟢 🟡 BOOKS

A Mathematician's Apology by G.H. Hardy

This book was published in the year 1940, wherein Hardy describes how a mathematician's patterns must be beautiful, just like a poet or painters. There must be harmony in its patterns. It attempts to explore pure mathematics and explain its beauty.

Fun Fact: G.H.Hardy, the famous mathematician won a lot of prizes and awards in school, however he was too shy and timid to take them in front of a crowd.

The Music of the Primes by Marcus Du Sautoy

This is a 2003 book which talked about the history of mathematics. In the book, he attempts to give an explanation to the unsolved mystery of the unusual pattern of prime numbers.
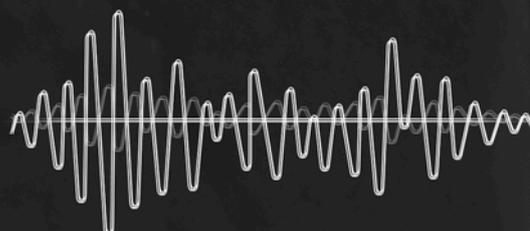
PODCASTS

Women in Math: The Limit Does Not Exist

This podcast promotes visibility to women in math. A typical episode contains a biography and conversations. It comes from a background of seeing how there are a less percentage of women in STEM courses.

Platforms to listen on: Soundcloud

Travels in a Mathematical World podcast

The podcast includes talk about the work of math graduates, mathematicians, and their work. You'll hear from researchers in areas like math, transport modelling, fluid dynamics and invisibility cloaking. Hear from maths graduates working in mathematical modelling, education, engineering and finance.

MOVIES

The man who knew infinity (2015)

The movie is based on an Indian mathematician, Srinivasa Ramanujan, exploring his brilliant life and mind. Ramanujan belonged to a poor family in Madras, and soon after he became a pioneer in mathematical theories with the guidance of his professor, G. H. Hardy.

Fun Fact : In a famous anecdote, Hardy took a cab to visit Ramanujan. When he got there, he told Ramanujan that the cab's number, 1729, was "rather a dull one."
Ramanujan said, "No, it is a very interesting number. It is the smallest number expressible as a sum of two cubes in two different ways, $1729 = 1^3 + 12^3 = 9^3 + 10^3$. This number is now called the Hardy-Ramanujan number. The next number in the sequence, the smallest number that can be expressed as the sum of two cubes in three different ways, is 87,539,319.

Platforms to watch on: Prime Video

Ramanunjan (2014)

Platforms to watch on: Prime Video

The movie Ramanunjan is a Telugu movie based on the life of the famous mathematician Srinivasan Ramanunjan. Being a college dropout from a background of a poor family, he made many extraordinary discoveries in isolation. The movie also received the Tamil Nadu State Film Award.

X+Y (2014)

Platforms to watch on: Prime Video

A movie about an awkward teenage prodigy, Nathan, who participates in an International Mathematics Olympiad and finds himself in new confidence and friendships who once had a hard time forming relationships with people around him.

DOCUMENTARIES

N is a Number: A portrait of Paul Erdos (1993)

Paul Erdos was one of the most prolific mathematicians and this documentary aims to recite the story of a man who once had no home or a job.

Fun fact: Erdos Erdös established himself as a serious mathematician at the age of 20 when he devised a more elegant proof for Chebyshev's theorem, i.e., that there is always a prime number between any number and its double.

Platforms to watch on: Kanopy

The Secret Rules of Modern Living: Algorithms

Professor Marcus du Sautoy attempts to explain how our lives are touched by algorithms everyday, and how unaware we are of it.

Platforms to watch on: Prime Video

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MaTHeMaTicS

2025

DEPARTMENT REPORT

FAREWELL'24

On May 3, 2024, the Department of Mathematics hosted a heartfelt farewell ceremony for the graduating class of 2024 in Room 408. Organized by the first and second-year students, the event featured vibrant dance performances, a nostalgic Bollywood medley, and a talent round where the third-years competed for the titles of Miss Mathematics and Miss Personality. Professors shared their experiences and extended their best wishes to the outgoing batch. The celebration concluded with Aditi Joshi being crowned Miss Personality and Ojasvi Kapoor as Miss Mathematics, making the farewell a memorable tribute to their journey and future aspirations.

TEACHER'S DAY

On 5th September 2024, the Department of Mathematics celebrated Teacher's Day with a vibrant event in Room 408, from 9:30 to 11:00 am, honoring their esteemed professors. The students meticulously planned the celebration, which began with a warm welcome and heartfelt thanks from the anchors, followed by a thoughtful address by President Tanisha Dosi. The event featured energetic dance and musical performances, refreshments, and interactive games that brought laughter and camaraderie. The day's highlights included a joyful cake-cutting ceremony, thoughtful gifts for the teachers, and a heartfelt vote of thanks by Vice President Raghavi Gupta. The celebration concluded with a group photo and lively dancing, leaving both students and teachers with cherished memories of warmth and gratitude.

FRESHER'S DAY

On 27 September 2024, the Department of Mathematics hosted a magical "Freshers" event with the theme "Reimagining Disney," offering a warm and creative welcome to its newest members. Starting with an inspiring

speech by President Tanisha Dosi, the event featured a thrilling ramp walk, a talent round showcasing diverse abilities, and captivating performances, including a mesmerizing Kathak dance by Manya Bhatia, who was crowned "Fresher of the Year." The celebration included delicious refreshments, a crowning ceremony with Sarah Singh as "Miss Mathematics" and Pari Nayyar as "Miss Personality," and a special dance performance by the President and Vice President. The day ended with a heartfelt speech, a group photo, and a lively dance party, leaving everyone with cherished memories.

SPEAKER SESSION

On October 16, 2024, the Department of Mathematics hosted an insightful session on "Harnessing AI Tools," led by Dr. Ritesh Yaduwanshi, Assistant Professor at IGDTUW and a Ph.D. holder in Computer Science from JNU. Renowned for his expertise in AI, Blockchain, and Algorithms, Dr. Yaduwanshi introduced a variety of AI tools, including ChatGPT for content creation, QuillBot for academic writing, SciSpace for research drafting, Jarvis for marketing content, Runway AI for video editing, and Google Trends for analyzing public interest. Through live demonstrations, he highlighted their practical applications in academia, industry, and daily life, emphasizing their role in boosting productivity and decision-making. The session concluded with a vote of thanks, leaving attendees inspired and equipped to leverage AI solutions in their work.

ACHIEVEMENTS

Anam- General Secretary of Sunny Mugs

Avni Jain- Vice President of Sunny Mugs

Divanshi Chhatani- Lead Organizer of TEDx

Lavanya Singh- President of Troubadours

Manya Bhatia- Fresher of the Year'24

Riddhi Singhal- Interned with Vedantu as a Subject Matter Expert - Mathematics. Volunteered with- Project Surya as a member of design team and outreach team and as a campaign execution manager for their T1 IN A MILLION CAMPAIGN

Ritika Gandhi- Vice President of 180dc

Sanjana Nahar- Grade A in course EC101 at LSE Summer School
• Overseas Consultant at LSE

Vijay Bharti- 2nd position in AdVenture: an inter-college advertisement competition organized by students union in collaboration with Enactus Maitreyi

Nandini Gupta- Cleared Actuarial exam CM1.

FACULTY

Prof. Alka Marwaha Dr. Anu Ahuja Ms. Rama Saxena Ms. Richa Krishna Ms. Sunita Narain Dr. Ambika Bhambani Dr. Indrakshi Dutta Dr. Rashmi S.Thukral Dr. Shruti Tohan Dr. Khaiminthang Vaiphei

OFFICE BEARERS

PRESIDENT- Tanisha Dosi
VICE PRESIDENT- Raghavi Gupta
TREASURER- Sneha Gupta

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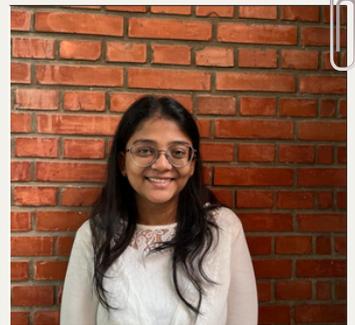
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SM Outreach

DISHA DAGA
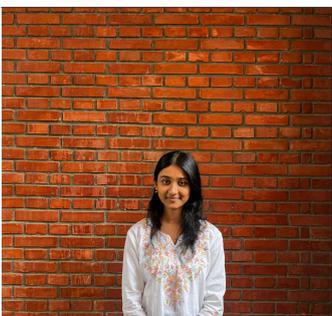*Content & Design*

DISHA BANSAL
Design

SANIYA DASS
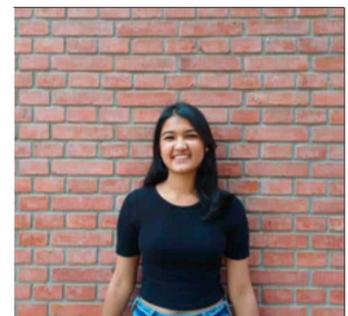*Design & Content*

SOUMYA JACOB
Content

SUHANI
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SRISHTI DEY
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