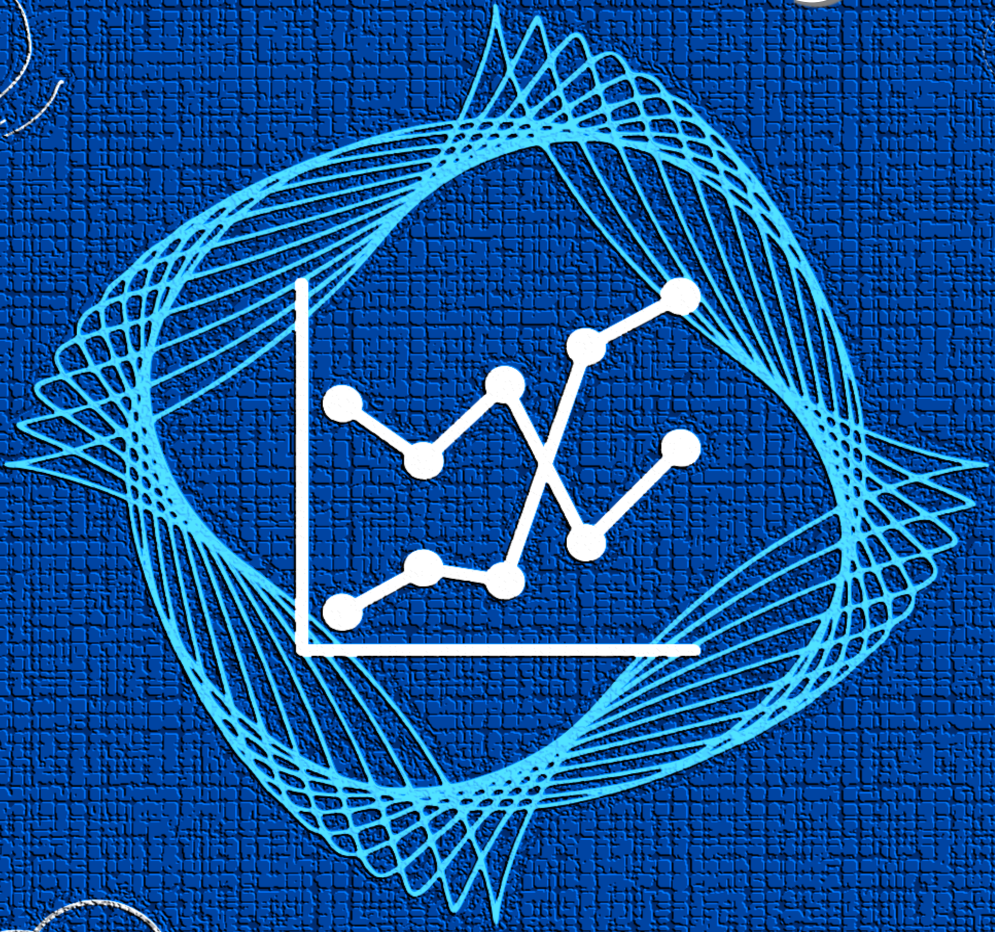
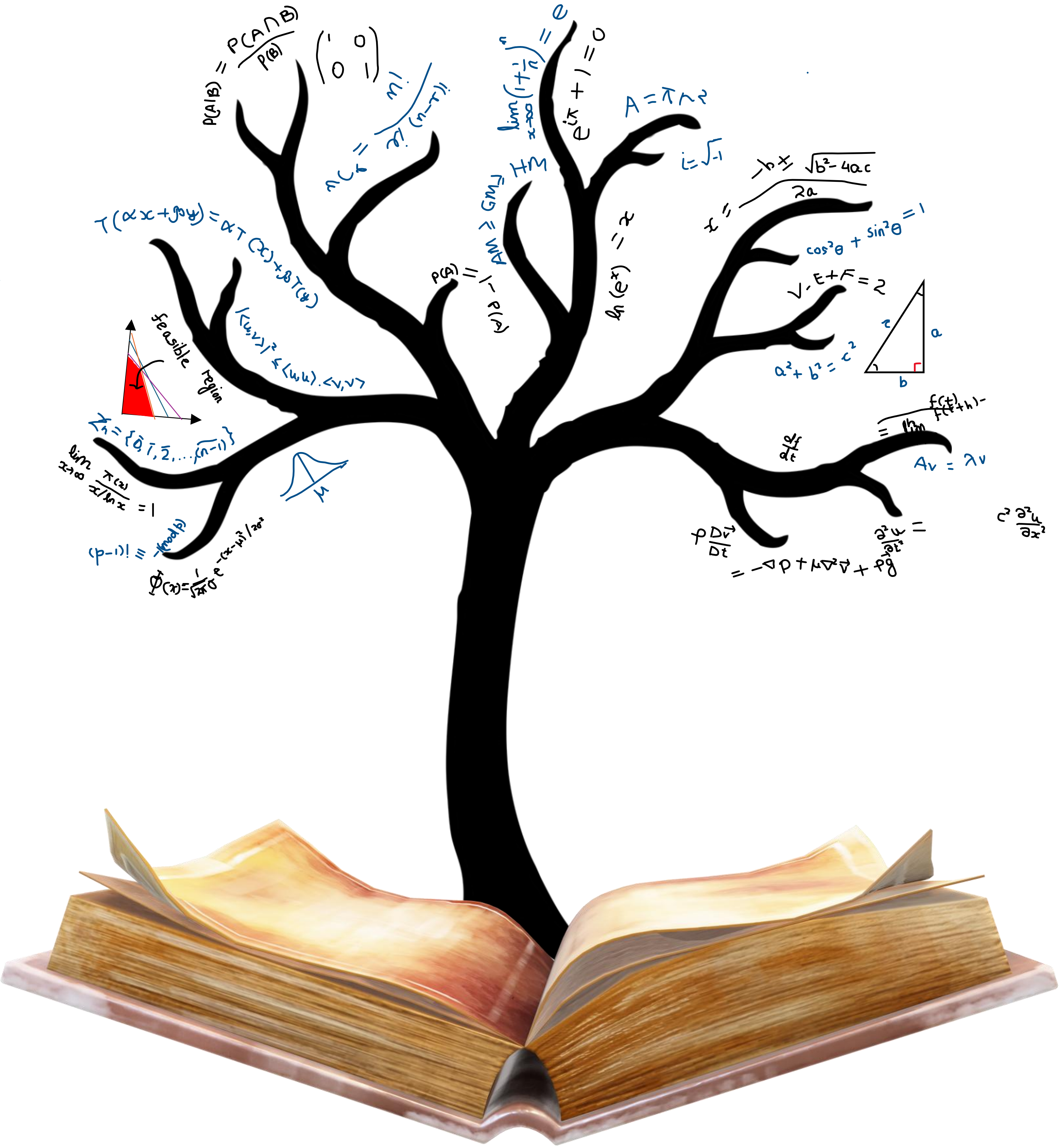
# NITM Mathematical Bi-monthly



August-September 2025

Issue No. 7

Department of Mathematics,
National Institute of Technology Meghalaya



P(A|B) = P(A∩B)/P(B)
e^{iπ} + 1 = 0
A = πr²
i = √-1
AM ≥ GM ≥ HM
ln(e^x) = x
V - E + F = 2
cos²θ + sin²θ = 1
a² + b² = c²
feasible region
Av = λv

“We endeavour to employ only symmetrical figures, such as should not only be an aid to reasoning, through the sense of sight, but should also be to some extent elegant in themselves.”

**— John Venn**

**(4 August 1834 - 4 April 1923)**

# DIRECTOR'S MESSAGE

Dear Students, Faculty, and Readers,

I am immensely pleased to introduce the 7th issue of the Department of Mathematics' bimonthly magazine. This magazine represents a significant step forward in creating a platform where the department can showcase our students and faculty members' intellectual curiosity, talent, and dedication.

Mathematics is not just a subject confined to classrooms and textbooks; it is a dynamic and evolving field with the power to shape the world around us. I am proud of the department's commitment to fostering academic excellence and a spirit of innovation.

This magazine is a testament to that pursuit of knowledge. It will serve as a medium for not only disseminating new ideas and research but also for encouraging discussions, collaborations, and creativity within our vibrant mathematical community. I encourage each of you—students and faculty alike—to contribute actively to the growth of this magazine and make it a reflection of our collective brilliance.

As we move forward, let us continue to strive for academic distinction, intellectual curiosity, and a passion for solving the complex problems that mathematics presents. The journey is as important as the destination. I believe that together, we will continue to make strides toward a brighter future for the department and the world of mathematics.

I congratulate the editorial team on their hard work in bringing this publication to life, and I look forward to seeing the magazine evolve in the years to come.

**With best wishes,**
**Prof. Pinakeswar Mahanta**
**Director, NIT**

# HoD's Message

Dear esteemed readers,

*Greetings from Department of Mathematics, NIT Meghalaya!*

It gives me immense pleasure and sense of honor to write in the 7th issue of our departmental magazine "NITM Mathematical". The magazine provides a platform to present various accomplishments and activities of the department on a bimonthly basis and serves as a channel for encouraging creativity, sharing knowledge, ideas, research activities and insights of our departmental family.

The Department of Mathematics started in 2012 with the inception of NIT Meghalaya in Shillong. The Department currently offers two years M.Sc. program and Ph.D. program in addition to catering the mathematical support to other departments of the institute. At present, the department has six faculty members with strong academic and diverse research backgrounds. Ever since its inception, our department, has been striving to maintain excellence in teaching and research providing solid foundation in Mathematics to our students and accomplishing quality research output. Moving ahead, we aim to be a center of excellence for learning Mathematics globally, with special focus on supporting the mathematical requirements in the regional level.

Our department is committed to be vibrant and is dedicated to the holistic development of our students. The creation of this magazine stems from a collective desire to share our thoughts, accomplishments, and aspirations. Working together as a team to ensure its successful publication brings immense delight and it is a privilege to be a part of this process.

I express my sincere gratitude to the editorial board, and everyone who have contributed to this issue of the magazine. I extend my best wishes and sincerely hope that this tradition of the departmental magazine continues for generations to come, fostering happiness, unity, and intellectual growth.

**Warm regards,**

**Dr. Tikaram Subedi**

**Associate Professor, HoD, MA**

# Editor’s Message

The only way to learn mathematics is to do mathematics. — Paul R. Halmos.

This profound statement not only serves as a guiding principle but also emphasizes the importance of active engagement in mathematics. It brings me great joy to inform you that starting from August 2024, the Department of Mathematics at the National Institute of Technology Meghalaya is introducing its very own publication, the “***NITM Mathematical Bi-monthly.***”

This publication is a collective endeavor by our students and faculty members, designed to ignite a love for mathematics and offer a stage for students to share their insights. Magazines transform the creative potential of our students into tangible contributions, allowing them to identify and showcase their talents through writing. Through this magazine, we aspire to highlight contributions, departmental events, achievements, and the scholarly work of both faculty and students. I encourage all students to participate by submitting interesting mathematical problems, engaging puzzles, stories, and intriguing facts about mathematicians.

I want to express my deepest appreciation to the editorial team—Bankit, Sanchita, Mehjebin, and Dibyasman—for their tremendous dedication and hard work in making this magazine a reality in such a brief period. Our minds are filled with boundless curiosity, and we are continually striving to explore beyond the known. I wish all our students’ immense success as they delve into the magazine's contents and set out on fresh intellectual journeys. May this initiative inspire us all to deepen our grasp of mathematics with steadfast determination.

Thank you, and best wishes.

**Dr. Timir Karmakar**
**Assistant Professor**
**Department of Mathematics**

# Featured articles

## D'Alembert Paradox: When Theory Defies Reality

*Timir Karmakar, Assistant Professor*

Jean le Rond d'Alembert (1717-1783)

In the mid-eighteenth century, the French mathematician Jean le Rond D'Alembert uncovered a startling contradiction in fluid mechanics. In 1752, he demonstrated mathematically that a solid body moving steadily through an ideal fluid one that is inviscid, incompressible, and irrotational would experience no drag force whatsoever.

This astonishing conclusion, now known as **D'Alembert paradox**, challenged physical intuition. Everyday experience tells us that moving bodies in fluids encounter resistance. Ships experience drags in water, and air resists the motion of vehicles and aircraft. How then could mathematics predict zero drag?

The paradox arises because the mathematical model assumes a *perfect* fluid with **no viscosity**. In such an idealized framework, the flow around a body is perfectly symmetrical. The pressure distribution in front of and behind the body balances exactly, so that all horizontal forces cancel. The net drag force becomes zero.

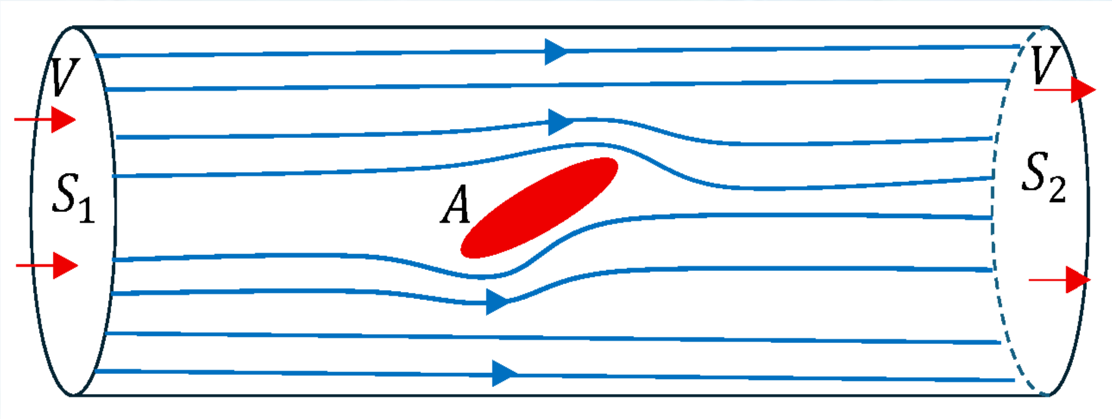



**Fig1: The D'Alembert paradox**

To understand the paradox more concretely, consider a long straight tube through which an inviscid fluid flows with constant speed $V$. Suppose a small obstacle $A$ is placed at the center of the tube (see Fig. 1). Near the obstacle, the flow is disturbed, but sufficiently far upstream and downstream the flow remains uniform and undisturbed.

In order to keep the obstacle at rest, one might expect that a force must be applied. Let $F$ denote the component of the force exerted by the fluid on the obstacle in the direction of the original flow. Neglecting external forces such as gravity, this force arises solely from pressure acting on the surface of the obstacle.

Now consider two cross-sections:

$S_1$: Upstream of the obstacle

$S_2$: Downstream of the obstacle

Both sections are taken sufficiently far from the obstacle so that the flow is uniform at speed $V$. The fluid between these sections forms a stream tube to which Euler's momentum theorem can be applied.

The resultant thrust in the direction of the flow acting on the fluid within the stream tube is

$$-\rho S_1 V^2 + \rho S_2 V^2$$

Since the tube has constant cross-sectional area,

$$S_1 = S_2$$

and therefore, the net momentum flux vanishes.

By Bernoulli's theorem, the pressure far upstream equals the pressure far downstream:

$$P_1 = P_2$$

Applying Euler's theorem to the entire stream tube gives

$$P_1 S_1 - F - P_2 S_2 = 0.$$

Since $P_1 = P_2$ and $S_1 = S_2$, we obtain

$$F = 0.$$

Far from being a mere mathematical curiosity, d'Alembert paradox exposed the limitations of idealized fluid models. The missing ingredient is viscosity.

The resolution of the paradox came much later, particularly through the work of Ludwig Prandtl in 1904, who introduced boundary layer theory. Prandtl showed that even small viscosity fundamentally alters the flow near surfaces, leading to drag.

## References


1. https://en.wikipedia.org/wiki/D%27Alembert%27s_paradox.
2. *M.J. Lighthill (1956), "Physics of gas flow at very high speeds", Nature,* ***178*** *(4529): 343*
3. Batchelor (2000), pp. 264–265, 303, 337.
4. https://farside.ph.utexas.edu/teaching/336L/Fluidhtml/node54.html

# Dido’s Isoperimetric Problem

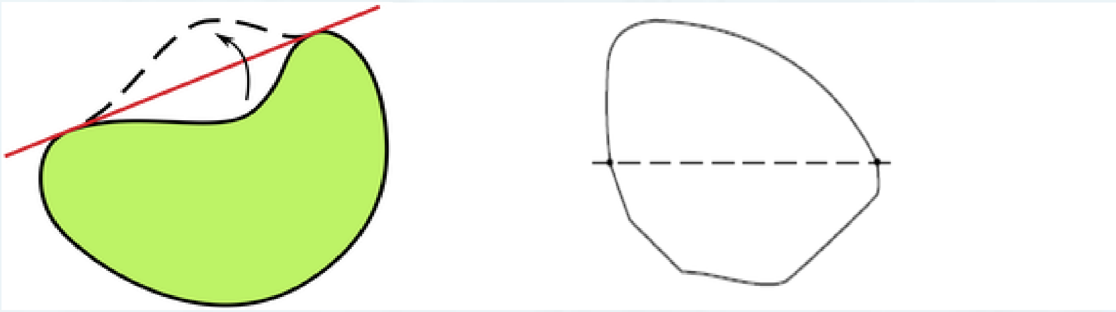
*Sovrin Pal and Bikash Bayan, Research Scholars*

In mathematics, the isoperimetric problem is figuring out the shape of a closed planar curve with a certain length that encloses the maximum area. (In the absence of any restriction on shape, the curve is a circle.) It attempts to solve the brachistochrone (“least-time”) problem and this one led to the development of the calculus of variations. In 1638 the Italian mathematician and astronomer Galileo Galilei first examined the brachistochrone problem, however his answer was faulty. With the discovery of calculus, a new approach to the answer became accessible, and the Swiss mathematician Johann Bernoulli issued a challenge in 1696 to mathematicians. Johann and his older brother Jakob Bernoulli conducted a research into isoperimetric in the 1690, identifying and categorizing numerous curves with maximum or minimum features. When the Swiss mathematician Leonhard Euler published the rule (1744), which became to be known as Euler’s differential equation, it was a significant step toward generalization. It was useful for determining a minimizing arc between two points on a curve with continuous second derivatives and second partial derivatives. The French mathematicians Joseph-Louis Lagrange and Adrien-Marie Legendre, among others, soon added to his work.

**Problem:** Find the curve assumed by wire when it is connected to two points such that area under that curve is maximum. (Given length of wire is more than distance between two given points to which wire is connected.)

**History of the Problem:** This is also known as Dido’s problem, and it is the earliest issue in variational calculus. The Tunisian city of Carthage was established by Dido. According to tradition, she came to the place with her retinue, a refugee from a power struggle with her brother in Tyre in Lebanon. She begged the villagers for as much land as could be bound by a bull’s hide. She cut the hide into a long thin strip and bounded the biggest possible area with this. A circle is the largest area that a curve of a given length can enclose. As a result, the city of Carthage is round. Zenodorus (c. 200 – c. 140 BC), a Greek mathematician, demonstrated that a circle’s area is greater than that of any regular polygon with an equivalently long perimeter.

**An Overview:** Consider a string with length L. We must use the string to design a shape with the largest possible area. The form cannot be dented. If a region is not convex, a “dent” in its boundary can be “flipped” to increase the area of the region while keeping the perimeter unchanged. The shape must be symmetrical with respect to a line that passes through any two places that split the string’s perimeter in half. In order to maximize the overall area, we can repeat the form of the portion with a larger area to the shape with a smaller area if one part has a smaller area than the other. Consequently, the form becomes symmetrical.



Examine one of these segments. Assume it is not a semi-circle. There will be a place on the boundary where lines drawn from points on the symmetry line intersect at an angle that is not perpendicular. Let us presume that the sides of the triangle have lengths a and b. Let θ denote the angle formed between the two arms. The area of this triangle is expressed as $A = \frac{1}{2}ab\sin(\theta)$.

The area between the line of symmetry and the arbitrary curve can be maximized by optimizing the area of this triangle. The area of the triangle is maximized exclusively when θ is 90˚. The maximum area between the line of symmetry and the arbitrary curve is achieved when a right-angled triangle can be inscribed inside this region. This condition occurs exclusively when the curve assumes the form of a semi-circle.

## References

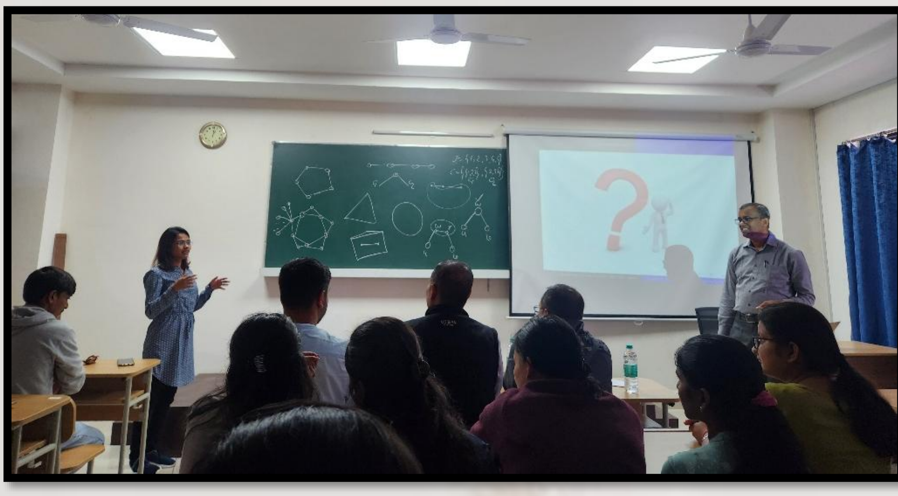

1. Blåsjö, Viktor. "The isoperimetric problem." *The American Mathematical Monthly* 112, no. 6 (2005): 526-566.
2. Porter, Thomas Isaac. "A history of the classical isoperimetric problem." PhD diss., University of Chicago, Department of Mathematics, 1931.

# Departmental Activities

## Invited Talk

The Department of Mathematics organized an Invited Talk delivered by Dr Biswajit Deb, Associate Professor, SMIT Sikkim, at CC301 on 21st August, 2025.

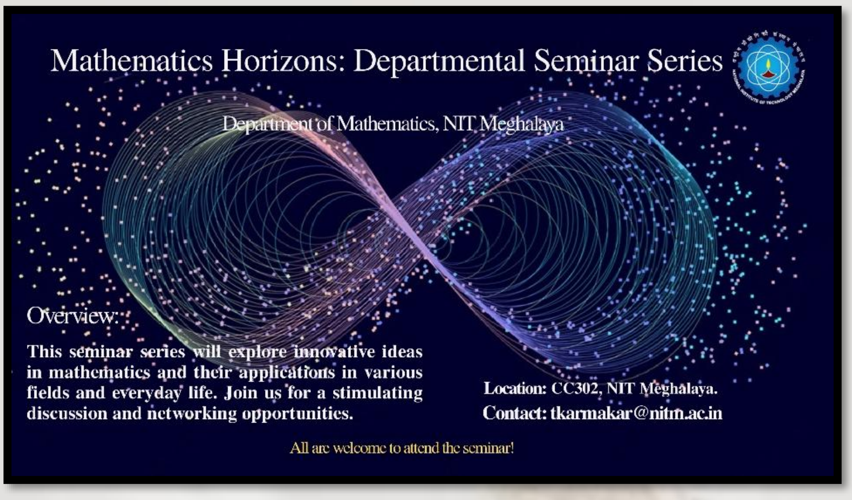
Title of the Talk: *Variation in Graph Domination with focus on $P_3$ Convexity.*



# Inauguration of Mathematics Horizons: Departmental Seminar Series

The Department of Mathematics has inaugurated "Mathematics Horizons: Departmental Seminar Series" on 25th September 2025, a date widely celebrated as *"Mathematics Storytelling Day"*. This seminar series will explore innovative ideas in mathematics and their applications in various fields and everyday life. Prof. Saikat Mukherjee, an esteemed member of the faculty of the Department delivered the inaugural lecture at CC302

Title of the Talk: *Green's Functions to Distribution Theory.*





# Quiz Competition

*A Part of the Pre-Celebration of*

"World Statistics Day 2025"

25.09.2025


# Teachers Day Celebration 2025

# Editorial Team

| | |
|---|---|
|  | Dr. Timir Karmakar (Assistant Professor) |
|  | Bankitdor M. Nongrum (Research Scholar, P22MA008) |
|  | Mehjebin Wahid (Research Scholar, P24MA003) |
|  | Sanchita Pramanik (Research Scholar, P23MA002) |
|  | Dibyasman Sarma (Research Scholar, P22MA007) |

## CONTACT US

Department of Mathematics

National Institute of Technology Meghalaya

Saitsohpen, Sohra (Cherrapunji)-793108

Meghalaya, India

Phone No: 0364-2501294, FAX: 0364-2501113

Editor’s Contact Number: +91 8101058282