Department of Mathematics,
Shivaji College, University of Delhi

2022-23

READ-O-MATH

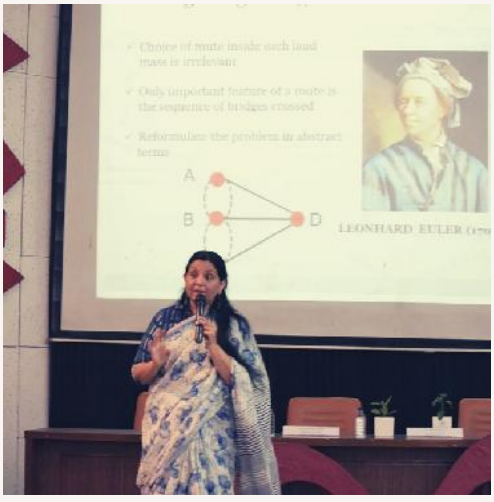
The Annual Newsletter

Contents

DEPARTMENT

READ-O-MATH

The newsletter bares the view of the inner workings of the department, presenting the year round-events in the Department incorporating the faculty, students as well as our alumni.



Contents

FROM PRINICIPAL'S DESK

Let's hear from our respected Principal.

Dear Students,

I am thrilled to extend my heartiest congratulations on the release of the E-Newsletter 2022-23. It is with great pride and admiration that I see the continuation of this tradition for yet another year. The E-Newsletter is a testament to the department's unwavering commitment to academic excellence.

The department has continued to foster a dynamic learning environment that combines traditional and contemporary approaches to learning. The students have shown exceptional dedication, enthusiasm, and creativity in their pursuit of academic excellence. This year, the department has organized an International Conference on Analysis and Applications, which was attended by distinguished speakers from various countries such as Japan, Turkey, UAE, & scholars & researchers from all over India and the world. It was an enriching experience for our students, who were able to interact with some of the leading experts in the field of Mathematics.

Furthermore, our students participated in XIOM-23, a series of competitions held in Goa, where they showcased their skills and knowledge in Mathematics. It was a proud moment for us to see our students competing and excelling at the national level.

The E-Newsletter is a true testament to our students' academic skills and the result of the department's continuous efforts to provide a rich and diverse learning experience.

I extend my heartfelt congratulations and best wishes to all the students for their future endeavors. May they continue to excel and achieve great things in all their future pursuits.

Prof. Shiv Kumar Sahdev
Principal
Shivaji College

MESSAGE FROM TIC

Dear Students,

I am delighted to congratulate the Tesseract Mathematics Society of Shivaji College for their remarkable efforts throughout the academic year 2022-23. The society has conducted a range of online events aimed at advancing the academic and professional growth of the students, with great enthusiasm and excellent team spirit. I am proud to lead such a talented and dynamic team.

I am particularly proud to announce that our department recently organized an International Conference on Analysis and Applications, inviting esteemed scholars and researchers from all over India and the world. We had the honor of hosting speakers from countries such as Japan, Turkey, and the UAE, and it was truly a global celebration of Mathematics.

It is also my pleasure to acknowledge the students' participation in XIOM-23, a series of Mathematics related competitions held in Goa. The students represented our department with dedication and skill, and their hard work was reflected in the excellent results.

Furthermore, I am happy to see that the tradition of the department's E-Newsletter continues for another year. The newsletter provides an excellent platform for sharing information about the various events and activities organized by the department, along with engaging articles and puzzles related to Mathematics. I appreciate the dedication and hard work of the student council in bringing out this newsletter.

I would like to express my sincere gratitude to our Principal, Prof. Shiv Kumar Sahdev, for his consistent support, as well as to my colleagues and the student team, whose efforts have made Tesseract one of the most effective and efficient functionaries.

I congratulate all students of the Department of Mathematics on their achievements so far and encourage them to continue striving for excellence in their future endeavors.

Best wishes to all of you.

Dr. Deepti
Teacher-In-Charge
Department Of Mathematics
Shivaji College

FROM THE TEAM OF NEWSLETTER

Dear Readers,

We are thrilled to present the second volume of Read-O-Math, the annual newsletter of the Department of Mathematics, Shivaji College. This newsletter holds the hard work, creativity, thoughts, and ideas of every student in the department. From knowledgeable facts to fun-filled activities, from research and projects to poetry and art, this newsletter is a testament to the ingenuity and imagination of our gifted students.

We received an overwhelming number of entries, and while we were unable to incorporate everything, we are delighted with the quality and originality of the submissions. The team of Tesseract also deserves recognition for their determination and passion. With their full potential and collective efforts, they made this newsletter a stroke of genius.

As you embark on this journey, we hope this plethora of creativity will provide you with a wondrous experience. The voices in these pages will leave you touched with amazement. Thank you for taking the time to read Read-O-Math.

Best Regards,

Newsletter Team

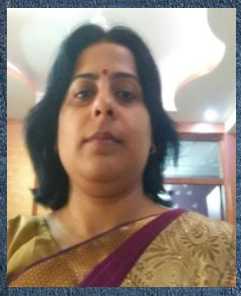
FACULTY MEMBERS :
DEPARTMENT OF MATHEMATICS

Dr. Babita Gupta
Associate Professor

Dr. Aparna Jain
Associate Professor

Prof. Mridula Budhraja
Professor

Dr. Surbhi Madan
Associate Professor



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Assistant Professor

Dr. Vandana
Associate Professor

Mr. Manish Kumar Meena
Assistant Professor

Dr. Neetu Rani
Associate Professor

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Dr. Jeetendra Aggarwal
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Dr. Deepti
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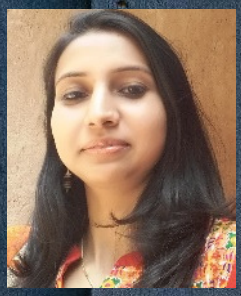
Mr. Ankush Kumar
Assistant Professor

Mr. Nitesh Kumar
Assistant Professor



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Assistant Professor

Mr. A.K Jharwal
Assistant Professor

MEET OUR TEAM

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Department of Mathematics

Mathematics, the study of quality, structure, and space, serves as the foundation for many disciplines and continues to evolve with time, creating new theories to solve real-world problems. The Department of Mathematics at Shivaji College has been a trailblazer since the college's inception, with modern educational programs that have put it at the forefront of academic institutions in Delhi University.

The department's distinguished faculty members are experts in a variety of fields, including algebra, real analysis, partial differential equations, dynamical systems, and sampling theory. They work tirelessly to assist students and remain actively engaged in research projects, staying up-to-date with the latest knowledge in the field.

In addition to academics, the department places a strong emphasis on student skill development. The department's society, "TESSERACT," invites students with a range of capabilities and provides them with opportunities to enhance their skills in areas such as writing, graphic design, social media handling, leadership, and event management. By hosting several seminars and events, including the society's flagship festival, "INFINITY," students are empowered to develop their creative thinking, public speaking, and leadership abilities.

The department's success is a product of the hard work and cooperation of all involved, including the principal, professors, and students.

STUDENT COUNCIL

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INFINITY ' 2022 - ANNUAL FEST

On April 11, 2022, the Department of Mathematics hosted its annual fest "INFINITY" with the guidance of the esteemed Principal, Prof. Shiv Kumar Sahdev, and the Teacher In-Charge of the Department of Mathematics, Dr Jeetendra Aggarwal. The fest kicked off with two concurrent competitions, the rangoli competition and the poster-making competition, which began at 9 a.m.

The participants showcased their creativity and ingenuity by incorporating the Mathematical concepts into their artwork, and the resulting masterpieces were mesmerising. The enthusiasm of the participants was contagious, and the competitions provided a platform for students to showcase their artistic skills.

In addition to the competitions, a seminar on an intriguing topic related to graph theory was conducted in the auditorium at 10 a.m. The seminar began with a lamp-lighting ceremony and was followed by the esteemed speaker of the day, Prof. Shobha Bagai, professor at Cluster Innovation Centre, University of Delhi who took the stage for the session. The topic of the seminar was the road colouring problem, which deals with the synchronized instructions.

Prof. Bagai presented the issue using a range of examples that made it easier for the students to understand. The seminar was informative and engaging, and students were able to ask questions during the Q&A session. After the seminar, Prof. Shiv Kumar Sahdev and Dr Jeetendra Aggarwal appreciated Prof. Bagai's contribution and launched the department's first annual newsletter, "Read-O-Math."

Simultaneously, the quiz competition (preliminary round) and the paper presentation were conducted. The quiz competition required students to answer questions within a given time frame, with the winner being the team that answered the most questions correctly.

The paper-presentation competition, which was held in the auditorium, was judged on the basis of the quality of the presentation. Following that was an intriguing round of treasure hunt which had the participants scratching their heads while deciphering the clues. The talent hunt, where students showcased their singing, dancing and other talents, was captivating.

The college's dance society and music society put on a number of performances, which kept the audience engaged and entertained. At the end of the fest, the winners of the various competitions were awarded certificates and prizes. INFINITY was an exemplar of a perfect balance between learning, knowledge, and entertainment.

The success of the event can be attributed to the hard work and dedication of the organising team, as well as the support and encouragement of the Principal and faculty members. The fest also served as a platform for the development of leadership, event management, and public speaking abilities among the students, as well as providing an opportunity for them to hone their creative skills.

FAREWELL PARTY

"When one journey ends, another begins."

As the batch of 2022 departed from the college, they left behind a legacy of memories, forged over years of shared experiences in classrooms, corridors, and, of course, during the era of online classes. On the 28th of April 2022, we gathered to celebrate all that they had achieved and to wish them well on their next adventure..

From musical performances to speeches by the President of Tesseract, the farewell was filled with mesmerizing yet emotive moments. The seniors took the stage with their own dance performance, and games like Dumb Charades, Whisper Challenge, Truth & Dare, made everyone laugh with abandon. A Ramp walk was also organised to celebrate the seniors, with crisp Titles such as Fashion-ista, Born Leader, Artist, Perfect Attendance, and more.

The farewell event was packed with fun and frolic, as we gathered to bid adieu to our beloved seniors. Our esteemed faculty members offered their guidance, with our honourable Principal Sir leading the formal goodbye note. Dearest teachers of the department joined in to share their best wishes for our seniors, who reciprocated with memories in the form of beautifully crafted poetry. This emotional start to the program took everyone on a journey through their cherished moments together.

As the event drew to a close, the DJ took over and everyone danced with all their might. With tears in our eyes, we all tried to capture the moment and etch the memory deep in our hearts. The truth is, while we feel happy for what our seniors have achieved, we also feel the void they will leave behind. No more goofing off at C-point, canteen or Hawa Mahal, no more sharing gossip as we used to. It is a bittersweet goodbye, but they will always have a special place in our hearts.

With lots of love,

From your juniors who love you to infinity!

Teacher's Day

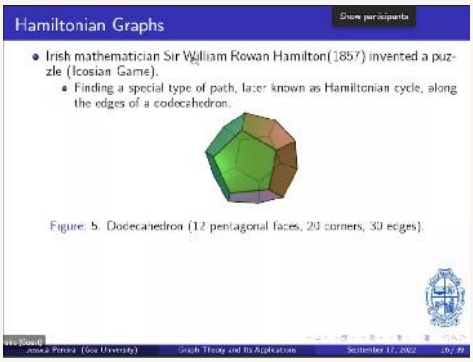
"The essence of teachers can be summed up in their ability to inspire, educate, and guide students towards academic and personal success. Teachers are not only responsible for imparting knowledge and skills to their students, but also for instilling a love of learning, a sense of curiosity, and a desire to achieve their full potential."

ACADEMIC TALK

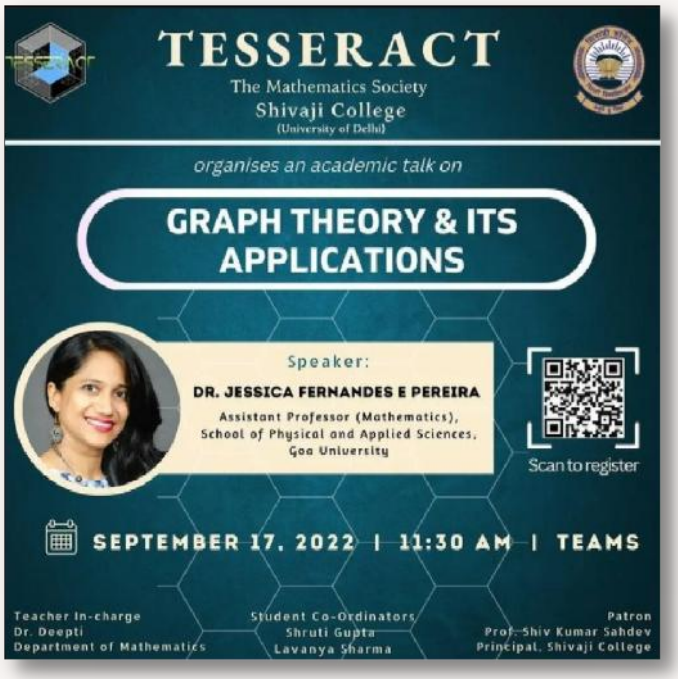
GRAPH THEORY AND ITS APPLICATIONS

On the 17th of September 2022, "Tesseract" - the Mathematics Society of Shivaji College, orchestrated an online webinar titled "Graph Theory & Its Applications," under the guidance of the esteemed Principal of Shivaji College, Prof. Shiv Kumar Sahdev, and the Teacher-in-Charge of the Department of Mathematics, Dr Deepti, on the platform, Microsoft Teams. The webinar was an endeavour to delve into the intricate concept of graph theory and its multifaceted application to solve real-world problems.

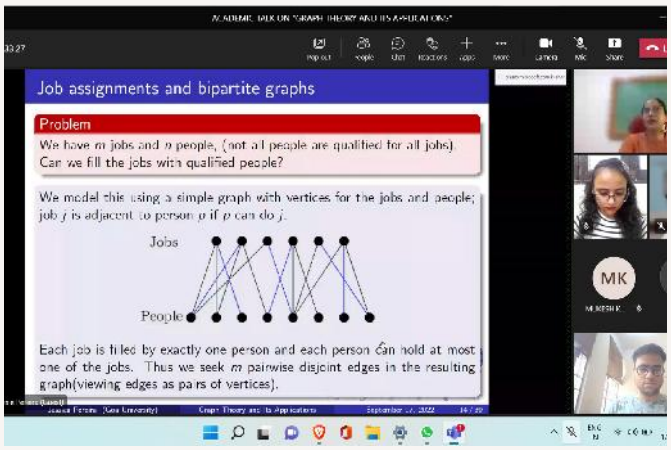
The event commenced by introducing the distinguished speaker, Dr Jessica Fernandez E Pereira, and inviting Dr Deepti to welcome the revered speaker with her kind words and usher the audience to the event.



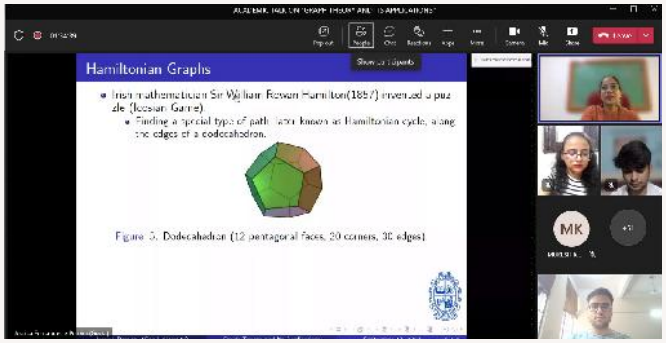
Dr Jessica commenced her address by thanking the organisers for conducting the event and then unfurled the history of graph theory, narrating how the Swiss Mathematician, Leonard Euler, presented a solution to the Konigsberg bridge problem, thereby laying the foundation for graph theory.

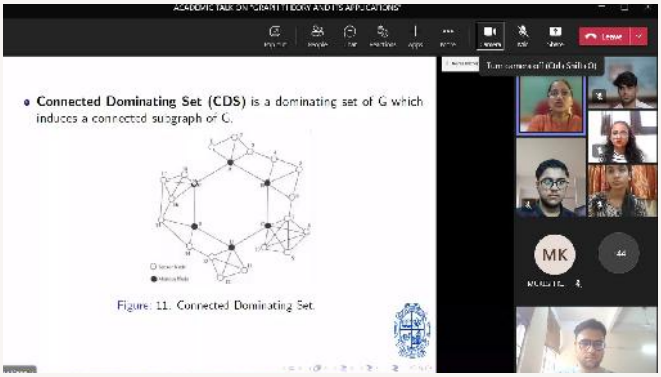


She then raised an intriguing question, "What is a graph?" and presented her perception of graphs after acknowledging answers from various students.



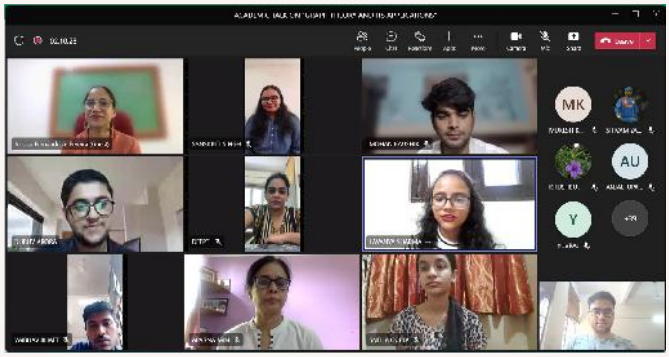
She went on to explain various terminologies related to the subject, apprising the attendees that in graph theory, a real-life problem is modelled as a graph and then worked upon. With various examples, she demonstrated how graphs can be related to real-world conundrums.





Towards the end of the session, the Q&A round was conducted, and Dr Jessica enthusiastically and patiently answered all the queries posed by the students. She appreciated the students for their thought-provoking questions, reflecting their keen interest in the subject. The event concluded with the Vote of Thanks by the Associate Professor, Dr Aparna Jain, who extended her gratitude to the guest speaker for her time and positive response throughout the webinar. She also acknowledged the student council of the Department of Mathematics for the successful completion of the event.

Dr Jessica expounded on several concepts such as the Eulerian graph, Acquaintance relation, Graph model, Job assignment and Bipartite graphs, and their applications. Delving into the Hamiltonian graph and Hamiltonian cycle, she explained its application in puzzle games and how humans become addicted to such games.



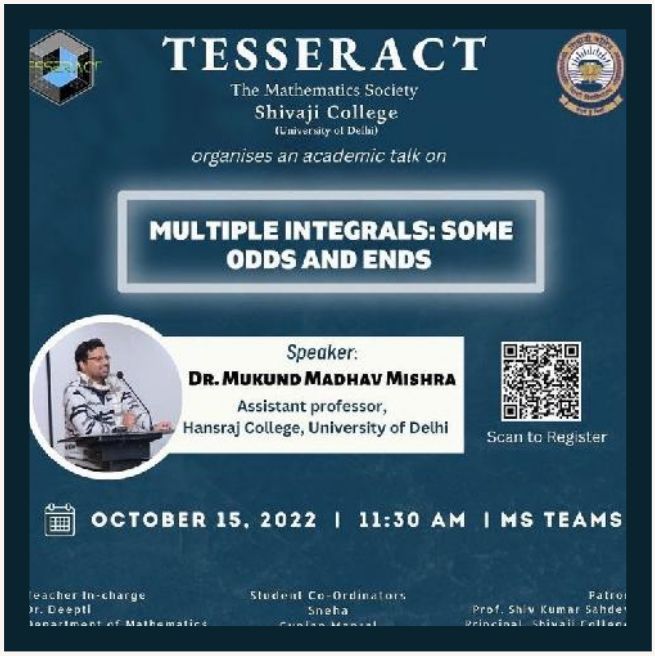
The event went on to enlighten listeners about other notions of graph theory, such as Isomorphism, Planar & Utility graph, graph colouring and graph labelling, and how graph theory has its implemented in every field, from DNA sequencing to software testing, modelling urban cities, and solving day-to-day problems.

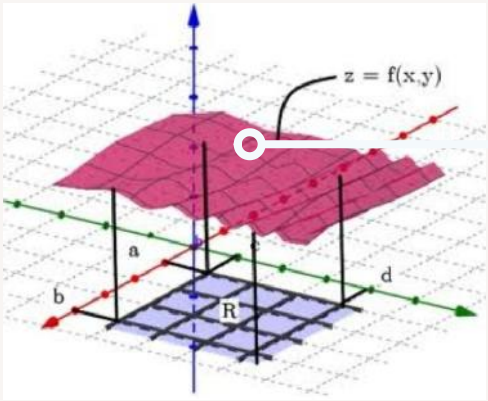
All in all, the event was an informative and comprehensive session, which provided an excellent platform for the attendees to gain insights into the complexities of graph theory and its practical applications.

ACADEMIC TALK

MULTIPLE INTEGRALS : SOME ODDS AND ENDS

The Mathematics Society of Shivaji College, popularly known as "Tesseract", organised an enlightening online academic talk on the intriguing topic of "Multiple Integrals: Some Odds and Ends" on 15th October, 2022, under the guidance of esteemed Prof. Shiv Kumar Sahdev, the Principal of Shivaji College and the Teacher-in-charge of the Department of Mathematics- Dr Deepti, on the Microsoft Teams platform. The webinar was a comprehensive exploration of the concept of multiple integrals and their different approaches.



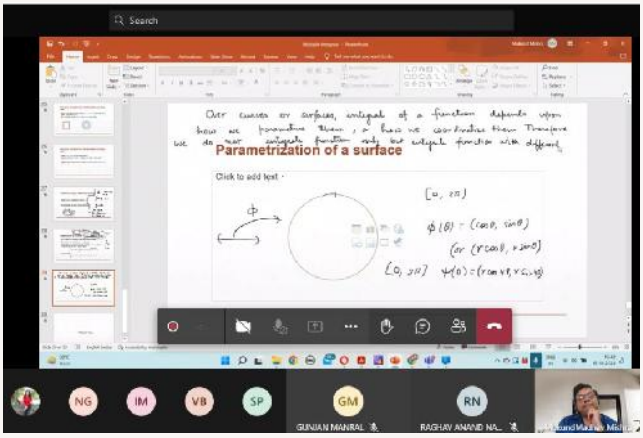


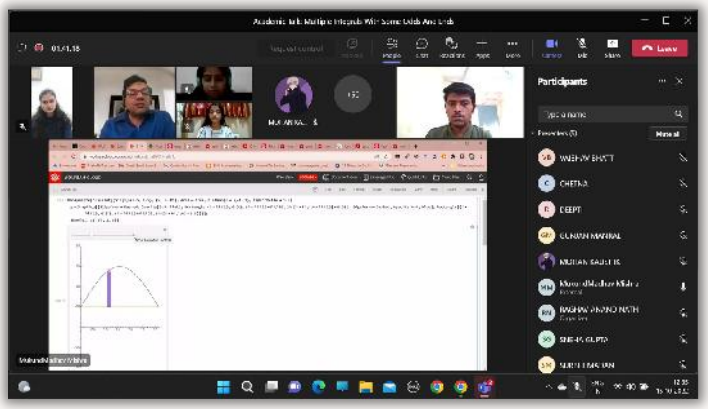
The event commenced with the introduction of the distinguished speaker, Dr Mukund Madhav Mishra, and welcoming him with kind words by Dr Surbhi to carry forward the talk. Dr Mukund expressed his gratitude to the organisers and the student council for the opportunity to present. He began with a crisp and precise definition of the double integral, which laid the foundation to highlight the issues with different definitions of multiple integrals.

He explained that for double integrals, the concept of partial differentiation in two variables is employed and is termed "Iterated Integrals." He also raised the question of the correctness of the definition of Iterated Integrals, making the talk more engaging.

The talk continued with an explanation of the "Riemann Integral," and Dr Mukund effectively involved the audience by asking them a question about the definition of the Riemann Integral. He further made a conclusion that the two approaches of Double Integrals are consistent. Dr Mukund then expounded on what can go wrong while using the Riemann Integral method and elucidated the Fundamental Theorem of Integral Calculus.

The webinar was rich in content and effectively explained various concepts and examples such as Fubini's theorem and its failure, double sequence examples, the positive and negative parts of a function, multivariate integrals, computation of double/triple integrals, change of variables, Jacobian of transformation and its role, Zero Jacobian and non-zero Jacobian, integral over a surface, and parametrization of a surface. Dr Mukund used Wolfram Mathematica to showcase the Riemann-type approach in two variable cases and make the talk more interactive.

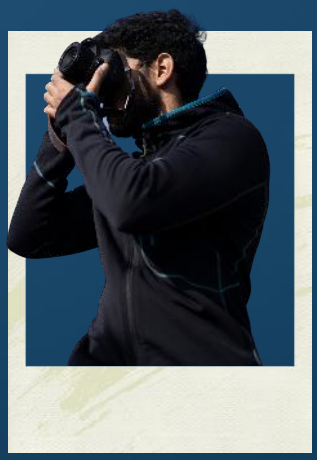




The Q&A round that followed the talk was interactive and thought-provoking. Dr Mukund patiently answered all the queries of the students and appreciated their enthusiasm and engagement throughout the session. The event concluded with a final vote of thanks by Dr Deepti, acknowledging the guest speaker, Dr Mukund, for his time and effort, and expressing her gratitude to the honourable Principal, Prof. Shiv Kumar Sahdev, for providing the opportunity to conduct the academic talk. She also recognized the student council of the Department of Mathematics for the successful completion of the event.

In conclusion, the online academic talk was an informative and engaging session, which undoubtedly contributed to the enhancement of the attendees' knowledge and understanding of the concept of multiple integrals and their different approaches.

PHOTO MATICS



The Department of Mathematics organized a submission-based photography competition on the theme "Symmetry and Puzzles." The competition received an overwhelming response from students of college and universities across the state, showcasing their artistic skills in capturing the essence of Mathematics.

The entries were evaluated on the basis of originality, creativity, and relevance to the theme. In addition to this, number of likes on their entries on our instagram page also added to the judging criteria. We were impressed by the quality of the submissions and found it challenging to select the top entries.

The winning entries were posted on our social handles by the Department. The photographs showcased a wide range of interpretations of symmetry and puzzles, highlighting the beauty and diversity of Mathematics along with our heritage.

The competition proved to be a great opportunity for the students and faculty members to showcase their creativity and appreciation for the subject. The Department plans to organize more such events in the future to promote interdisciplinary learning and foster a creative culture within the Mathematics community.

WINNING ENTRIES

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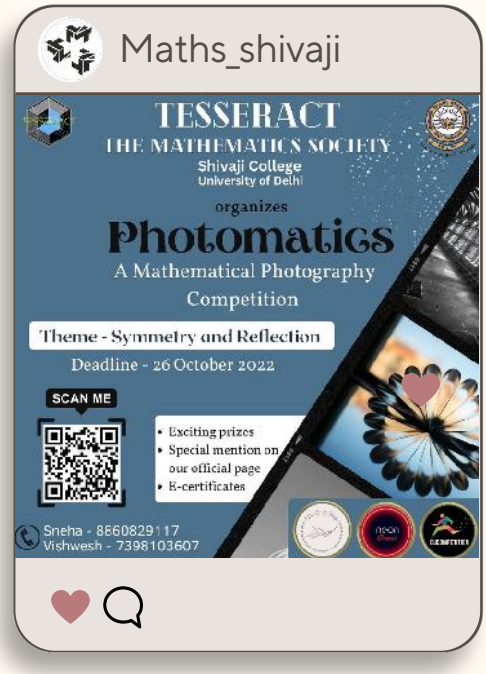
1st



Fresher's Party

"The more you praise and celebrate your life, the more there is in life to celebrate."

This quote holds true for every student who eagerly anticipates their most memorable occasion - the freshers' party, from the moment they are admitted. The purpose of a freshers' party is to create a warm and friendly atmosphere that encourages creative impulses and boosts confidence. "TESSERACT" - the Mathematics Society - lived up to this purpose by organising a freshers' party "Euphoria" with 90s nostalgia to welcome the freshmen to the department, with energy, joy, and excitement filling the air.The participants were exquisitely attired, with hints of the 90s theme and partying like it's 1999.

Upon entering the auditorium, the new students were greeted with a personalised welcome letter and a gift box. The beginning of the party was bolstered by cheery grins and positive attitudes, with the newcomers walking enthusiastically to 90s music.

Both freshmen and seniors got a chance to display their talent through a variety of dance performances, including solo, couple, and group dancing, as well as by playing a variety of instruments. The live singing performance of 90s songs enthralled everyone, and the magical violin performance enhanced the atmosphere of the auditorium.For the newcomers, there were numerous games with fantastic prizes.

The freshers had an incredible zeal for those games, especially the memorable "Draping the Saree," which brought a lot of laughter and excitement among the audience.

Dr Deepti, the head of the Department of Mathematics, gave blessings to the newcomers and shared her valuable experiences with them, providing them with inspiration and guidance. The chunk of the party was the "Titles." The titles awarded were Mr Fresher and Miss Fresher, with special awards for the best-dressed, Mr Hotshot and Miss Chandni, and others like Showstopper and Disco Dancer. All title winners were given amazing prizes.

The party concluded with the cake cutting and dance, making it a special and treasured day for all those who attended. The freshers' party organised by TESSERACT truly lived up to its purpose, welcoming the newcomers and encouraging them to pursue their creative impulses with confidence, setting the tone for the rest of their academic journey.

International Conference on Analysis and its Applications

The Mathematics Department of Shivaji College hosted a 2-day “International Conference on Analysis and its Applications" on 27th and 28th February 2023.

The first day of the conference started off with the inauguration ceremony, conducted by Dr. Neetu Rani, Assistant professor, Department of Mathematics, Shivaji College, in the college auditorium with the lamp lighting ceremony under the guidance of our honorable Principal, Prof. Shiv Kumar Sahdev. The ceremony was honored by two distinguished guests, Prof. Balaram Pani, Dean of Colleges, University of Delhi, and Prof. Ajay Kumar, Senior Scientist, Department of Mathematics, University of Delhi.

Thereafter began the plenary talk session after a short breakfast, chaired by Prof. Renu Chug - a renowned expert with a specialization in Non-Linear Functional Analysis, Fuzzy Mathematics, Fractals, and Chaos, introducing her speaker, Prof. Y. Kimura, Department of Information Science, Toho University, Japan, who gave an incredible talk on the topic, "A variation of the shrinking projection method on geodesic spaces' “. It was an interesting and educational session that undoubtedly benefited in comprehending the subject better.

Furthermore, Prof. Anuradha Gupta - an exceptional scholar with specialization in the Theory of Operators, took the stage and introduced her speaker, Prof. Kapil K. Sharma, Department of Mathematics, South Asian University, New Delhi, who gave an instructive and fascinating session on the topic, "Singularity Perputed Problem and its Solution", for the proper understanding.

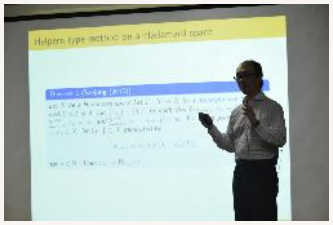
Following a brief lunch break, the second phase of the plenary talk started. We were joined by Dr. Izhar Uddin, Department of Mathematics, Jamia Millia Islamia, New Delhi, chaired by Dr. Neetu Rani - an exceptional scholar with specialization in Seismology, Applied
Mathematics, and Operational Research. He took the stage and introduced the audience to the recent progress in Fixed Point Theory, keeping the talk vibrant and enlightening.

Then, Prof. Y. Rohen Singh, Department of Mathematics, Manipur University joined the stage, under the chairperson, Dr. Jeetendra Aggarwal - a highly accomplished scholar with a specialization in Topology. Prof. Singh delivered an enlightening session on his topic -

"Fixed Points and Generalisation of Metric Spaces-A Survey" and kept the session lively and informative.

Moving forward began the paper reading session after a short tea break. It was conducted simultaneously in three different locations - in Computer Lab-3, Computer Lab-4, and Auditorium, Jijabai block. The sessions were chaired by Prof. Mridula Budhraja - a highly distinguished scholar with a specialization in Dynamical Systems, Dr. Preeti - a highly acclaimed scholar with a specialization in the field of Functional Analysis and Operator Theory, and Dr. Pragati Madan - a distinguished scholar with specialization in Operator Theory. All the paper reading sessions were really insightful and fascinating, with presenters sharing their extensive knowledge with the audience.

And with this, came the end of the first day of the conference



The Second day started off with online plenary talks, beginning with Prof. Fathalla A. Rihan, Department of Mathematical Sciences, UAE University, Al Ain, UAE, on the topic- "Delay Differential Equations and Applications to Immunology". He was chaired by Dr. Deepti - an extremely qualified scholar with a specialization in Fluid Dynamics and Statistics. The talk was really enlightening since he was going through every concept patiently.

After that, we were joined by Prof. Ahmed Al Rawashdeh, Department of Mathematical Sciences, UAE University, Al Ain, UAE, under the chairperson, Dr. K. Priyanka - an exceptionally qualified scholar with specialization in Sampling Theory, Statistical Inference, Sensitive Estimation Theory, Statistical Modelling,

and Missing Data Analysis. He began with the session on his topic - "Classifications of C* - Algebras using Unitary Groups" and made the talk instructive and insightful. Further, we were joined by Prof. E. Malkowski, Department of Mathematics, State University of Novi Pazar, Serbia. He was introduced by Dr. Babita - an extremely qualified scholar with a specialization in the field of Functional Analysis. He spoke on the topic- "Some measures of Non- Compactness and their Applications". It was a knowledgeable session with interesting concepts.

After a short tea break began the paper reading session and just like the previous day, it was conducted simultaneously in three different locations - in Computer Lab-3, Computer Lab-4, and Auditorium, Jijabai block. The sessions were chaired by Prof. Y. Rohen Singh - a highly accomplished scholar with a specialization in Functional Analysis, and Prof. Anju Gupta - a highly distinguished scholar with a specialization in multiple domains like Generalized Exponential

Operators and Difference Equations, Fuzzy linear programming, etc., and Prof. R. D. Sharma - an eminent scholar with specialization in Topology and Fuzzy Set Theory. With the in-depth knowledge of the presenters, the session was incredible. An online session was also conducted concurrently during this period, chaired by Dr. Surbhi Madan - a highly distinguished scholar with a specialization in Algebraic Coding Theory.

Furthermore, after a short lunch break, the plenary talks began. It began with Dr. Aparna - a highly distinguished scholar with specialization in various domains, some being Algebra, Fuzzy Set Theory, Fuzzy Algebra, Discrete Mathematics, etc., taking the stage to introduce her speaker to the audience, Prof. Sachi Srivastava, Department of Mathematics (South Campus), University of Delhi, New Delhi. She spoke on the topic - "Polynomial Stability, Delay Semigroups, and Damped Wave Equations" and made the session educational with intriguing and interesting concepts.

After that, we were joined by Dr. Hazel Yuksekkaya, Department of Mathematics, University of Dicle, Diyarbakir, Turkey, under the chairperson, Dr. Javed Ali - a highly accomplished scholar with specialization in multiple domains like Non - Linear Functional Analysis, Fuzzy Metric Spaces and many more. She began the session with her topic - "Existence and Blow-up of Solutions for a Wave Equation with Time-Delay ". The session was really insightful and fascinating with interesting concepts.

Moving further with the conference began the valedictory session conducted by Dr. Surbhi Madan where our distinguished chief guest, Prof. Ruchi Das, Head of the Department of Mathematics, was honored by the honorable Principal, Prof. Shiv Kumar Sahdev, and the participants were also felicitated with certificates for showing enthusiasm and for sharing their extensive knowledge.

And this brought us to the end of an amazing, comprehensive, and insightful 2-day conference. Taking this opportunity, the Department of Mathematics of Shivaji College would like to thank the speakers from both days for taking their valuable time and enriching us with the knowledge shared via this conference, which is definitely going to assist many in the long run, and since our department always works in the direction of progress, we will soon be back with another such wonderful event.

X-IOM - 2023
Battle of Minds

"Challenges play a crucial role in personal and professional development, providing opportunities to learn new skills, gain valuable experience, and grow as individuals."

The Department of Mathematics at Shivaji College was presented with such an opportunity in the form of a competition held at Government College of Arts, Science and Commerce, Sanquelim-Goa.

The College of Arts, Sciences, and Commerce Sanquelim invited the Department of Mathematics at Shivaji College to participate in their annual Math Department's fest, Xiom 2023 organized by the Post-Graduate Department of Mathematics, in association with the D.H.E and the D.S.T.W.M on 3rd and 4th March, 2023. The festival was designed to celebrate the beauty of Mathematics through a variety of competitions.

Around 11 teams from different states of India participated in the competition. The invitation was accepted by a team of 18 students who were eager to demonstrate their Mathematical

prowess along with 2 teachers to guide and mentor them. The team from Shivaji College began preparing for the competition, focusing on honing their Mathematical skills and techniques. They were determined to prove their mettle and make a strong showing at the festival.

Participating in the Math Xiom-23 festival presented several challenges for the team from Shivaji College. They had to prepare for a variety of competitions, which involved paper presentation, standup comedy, quizzes, rapid fire rounds, dance competition, treasure hunt, etc. each requiring different skills and approaches.

The team members had to work hard and collaborate effectively to ensure they were ready for each competition. They had to prepare a mascot as well which would represent them & their thoughts.

Despite the challenges, the team from Shivaji College persevered and ultimately made an impressive showing at the Math Xiom-23 festival. The students of Shivaji made their presence louder by grabbing a total of 8 medals, 2 gold, 5 silver and 1 Bronze and gave a tough battle in almost all competitions.

Among all the students who showed their tremendous performances, following won the medals in the respective competitions:

GOLD MEDAL

MATH WHIZ (HIGHER LEVEL MATHEMATICS QUIZ COMPETITION)

Sanskriti (IIIrd Year)
Amit Gupta (IIIrd Year)

Silver Medal

SLIDE WARS (PAPER PRESENTATION)

Mohan Kaushik (IIIrd Year)

LAND PIRATES (GAMING COMPETITION)

Rakshit Yadav (IIIrd Year)
Shashank Dandriyal (IInd Year)

PLANET OF THE APPS (GEOGEBRA)

Shruti Gupta (IIIrd Year)
Rahul Chaurasia (IIIrd Year)

Bronze Medal

MATH KRAFT(POSTER MAKING)

Sneha Gupta (IInd Year)

We truly believe that participating in competitions and taking on challenges is essential for personal and professional growth. The experience gained through such endeavors is invaluable and can help individuals develop important skills and abilities that will serve them well in their future endeavors. The Department of Mathematics at Shivaji College rose to the challenge presented by Math Xiom-23 and demonstrated their passion and expertise in Mathematics.

Despite of the hectic schedule during the 2 day event, the organisers of the event hosted a full day Goa tour for the outstation students as well!

BERTNARD'S PARADOX

-Akshali Gupta (Ist Year)

Within the traditional view of probability theory, the Bertrand paradox presents a challenge. It was first used by Joseph Bertrand in his book Calcul des probabilités (1889) as an illustration to demonstrate how, in the case of infinite possibilities, the principle of indifference may not give outcomes for probabilities that are clear-cut and well-defined.

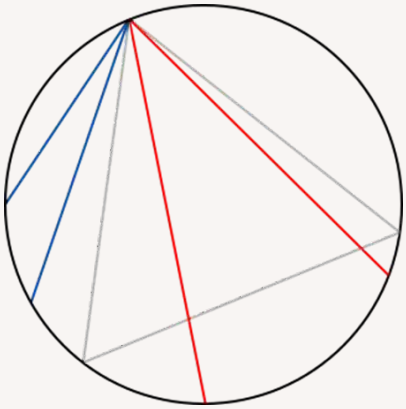
A. Bertrand's formulation of the problem.

The following is how the Bertrand paradox works:

Think about an equilateral triangle that is encircled by a circle. Let's say a circle's chord is selected at random. How likely is it that the chord will be longer than one of the triangle's sides?

Bertrand gave three arguments, all valid, yet yielding different results.

1. THE RANDOM ENDPOINTS METHOD

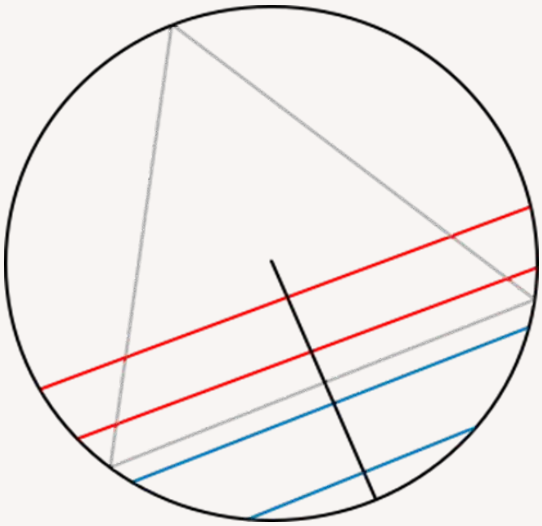


red = longer than triangle side, blue = shorter side.

Choose two random locations on the circle's perimeter, and draw a chord connecting them. Consider rotating the triangle so that its vertex lines up with one of the chord endpoints to compute the probability of the issue.

Remember that if the other chord ends, the chord, which is longer than a triangle side, rests on the arc between the triangle's opposite initial point's endpoints. The arc is one in length. Third of the circle's circumference, hence there is a 1/3 chance that a given chord will be longer than one of the triangle's sides.

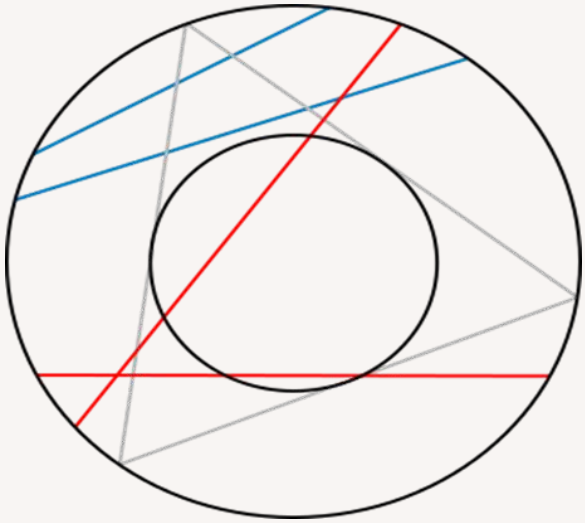
2. THE RANDOM RADIUS METHOD



Choose two random locations on the circle's perimeter, and draw a chord connecting them. Consider rotating the triangle so that its vertex lines up with one of the chord endpoints to compute the probability of the issue. Remember that if the other chord ends, the chord, which is longer than a triangle side, rests on the arc between the triangle's opposite initial point's endpoints. The arc is one in length. Third of the circle's circumference, hence there is a 1/3 chance that a given chord will be longer than one of the triangle's sides.

2. THE RANDOM MIDPOINT METHOD

Wherever on the circle, choose a point, and use that point as the midway of a chord. A chord if the selected point lies within a concentric circle with a radius 1/2 the bigger circle, is longer than a side of the inscribed triangle. The probability that a random chord is longer than a side of the inscribed triangle is one since the size of the smaller circle is one-four that of the bigger circle.



The following is another way to visualize the selection processes.

A chord's midway serves as a defining characteristic. The three selection techniques described above each produce a unique distribution of midpoints. Techniques 1 and 2 produce two different non-uniform distributions, whereas technique 3 produces a uniform distribution. Yet, if one examines the photos of the chord, method 2's chords give the circle a uniformly shaded appearance while methods 1 and 3 do not.

It is simple to envision further distributions, many of which will yield a different proportion of chords that are longer than a side of the inscribed triangle.

B. Classical solution

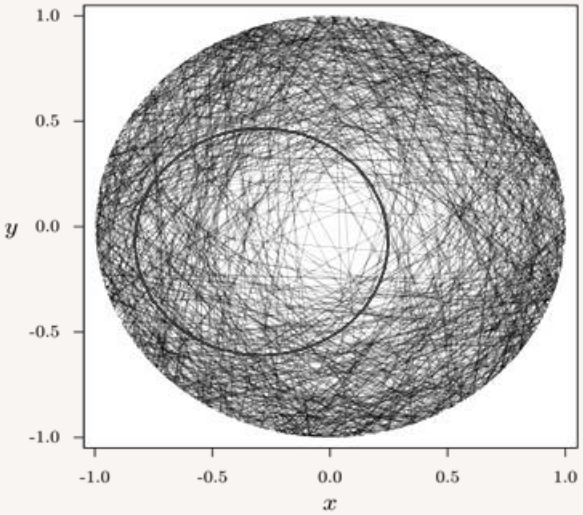
The process for selecting a chord "at random" is therefore crucial to the classical solution of the problem. It turns out that the problem has a clear solution if, and only if, the mechanism of random selection is given. There cannot be a unique solution because there is no unique selection technique. There is no reason to favor one of Bertrand's three solutions over the others in the absence of additional information because they correspond to various selection methodologies.

Stricter formulations, such as frequentist probability and subjectivist Bayesian probability, were justified by his and other paradoxes of the classical interpretation of probability.

C. Jayne's solution using the "maximum ignorance" principle

Edwin Jaynes provided a solution to Bertrand's paradox in his 1973 work The Well-Posed Problem, based on the "maximum ignorance" tenet, which states that we shouldn't use any information not provided in the problem statement. As neither the position nor the size of the circle is specified in Bertrand's dilemma, Jaynes argued that any definite and objective solution must be "indifferent" to both. In other words, the solution has to be the translation- and scale-invariant.

To give an illustration, imagine that chords are randomly placed on a circle with a diameter of two, perhaps by tossing straws onto it from a distance. Now a circle with a smaller diameter is placed inside the larger circle.



While it is more difficult to see in a graphical form, approach 1 also exhibits the same behavior. The only approach that is both scale and translation invariant is method 2; method 1 is neither, while method 3 is merely scale invariant.

However, Jaynes did not merely rely on invariances to accept or reject the suggested techniques because this would leave open the potential that there may be an additional, as-yet-undisclosed approach that would satisfy his pragmatic standards. In this case, the random radius approach, referred to as "Method 2", is the only way to solve the integral equations.

D. Physical Experiments

"Method 2" is the only solution that fulfills the transformation invariants that are present in certain physical systems such as in statistical mechanics and gas physics as well as in Jaynes's proposed experiment of throwing straws from a distance onto a small circle. Nevertheless, one can design other practical experiments that give answers according to the other methods. For example, to arrive at the solution of "method 1", the random endpoints method, one can affix a spinner to the center of the circle, and let the results of two independent spins mark the endpoints of the chord. To arrive at the solution of "method 3", one could cover the circle with molasses and mark the first point that a fly lands on as the midpoint of the chord. Several observers have designed experiments to obtain different solutions and verified the results empirically.

E. Recent Developments

Nicholas Shackel states in his 2007 essay Bertrand's Dilemma and the Principle of Indifference that following more the paradox continues to stand in contradiction to the alleged concept of indifference after more than a century of debate. In his 2013 paper, Bertrand's paradox revisited, he further discussed why all of Bertrand's "solutions" are inapplicable. Bertrand's proposed solutions are all invalid for his problem, as demonstrated by Darrell P. Rowbottom, making it more difficult than previously thought to resolve the conundrum. To address Bertrand's paradox, Shackel highlights that two separate techniques have typically been used: those where a distinction between non-equivalent problems was explored,

and those where the problem was presumed to be well-posed.

Louis Marinoff is cited by Shackel as the authors refer to as a universal average. To deal with it, they employ a discretization technique that draws inspiration from how the probability rule is defined in the so-called Wiener techniques. Even though their well-posed problem is distinct from Jaynes', their numerical answer is in agreement with Jaynes' result.

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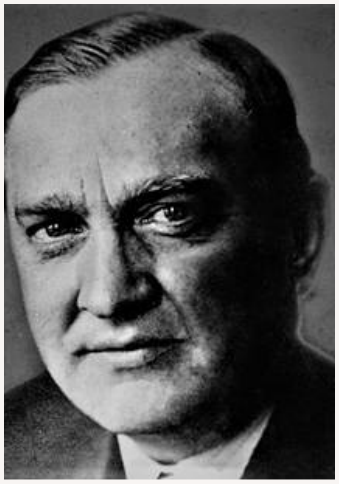
BANACH - TARSKI PARADOX

- Archita Gupta (Ist Year)

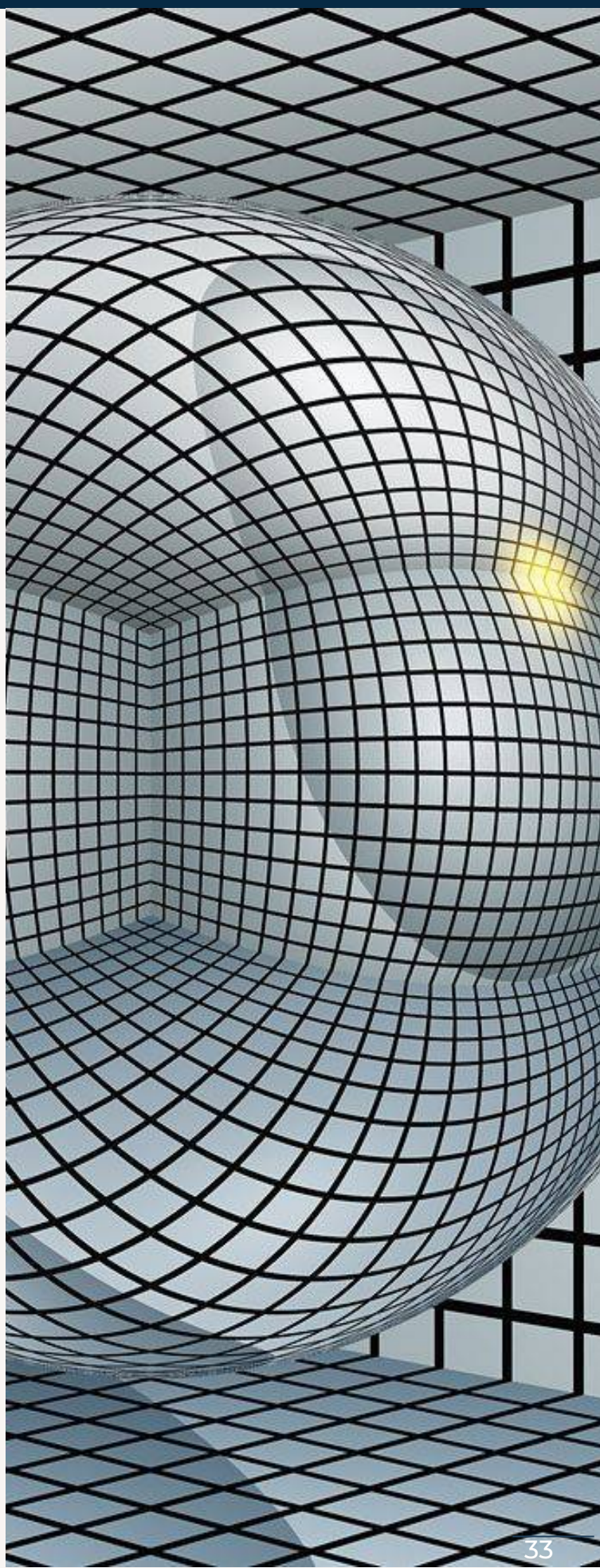
The Banach–Tarski Paradox is a theorem in set-theoretic geometry, which states the following: Given a solid ball in three-dimensional space, there exists a decomposition of the ball into a finite number of disjoint subsets which can then be put back together in a different way to yield two identical copies of the original ball.



STEFAN BANACH
(1892-1945)

ALFRED TARSKI
(1901-1983)

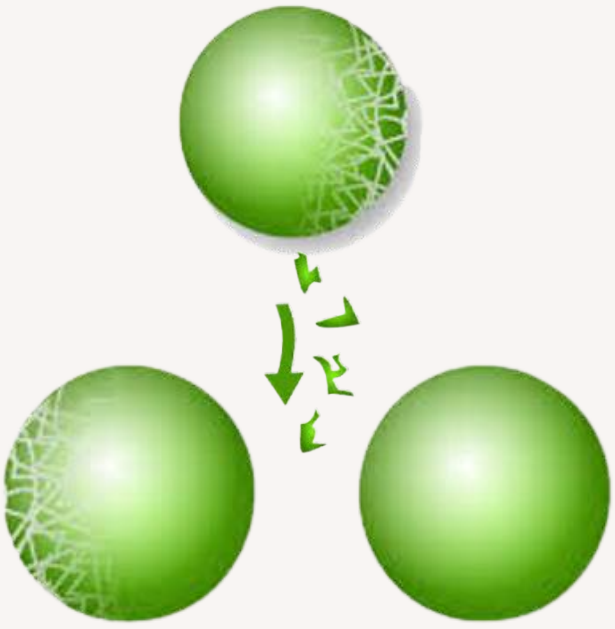
Indeed the reassembly process involves only moving the pieces around and rotating them without changing their shape. However, the pieces themselves are not ‘solids’ in the usual sense, but infinite scatterings of points. The reconstruction can work with as few as five pieces. The theorem is called a paradox because it contradicts the basic geometric theory, of "Doubling the ball" by dividing it into parts and moving them around by rotations and translations without any stretching, bending or adding new points which seems to be impossible, since all these operations ought, intuitively speaking, to preserve the volume. The theory that such operations preserve volumes are not Mathematically absurd and it is even included in the formal definition of volumes.



However, this is not applicable here because in this case, it is impossible to define the volumes of the considered subsets. Reassembling them reproduces a set that has a volume, which happens to be different from the volume at the start.

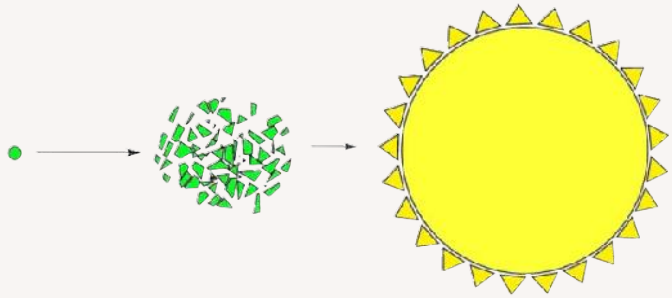
The strong form of the Banach–Tarski Paradox is false in dimensions one and two but Banach and Tarski showed that an analogous statement remains true if countably many subsets are allowed. The difference between dimensions 1 and 2 on the one hand and 3 and higher on the other hand, is due to the richer structure of the group E(n) of Euclidean motions in 3 dimensions. For n = 1 and 2 the group is solvable but for n ≥ 3, it contains a free group with two generators. John von Neumann studied the properties of the group of equivalences that make a paradoxical decomposition possible and introduced the notion of amenable groups. He also found a form of the paradox in the plane which uses area-preserving affine transformations in place of the usual congruences.

Tarski proved that amenable groups are precisely those for which no paradoxical decompositions exist. Since only free subgroups are needed in the Banach–Tarski Paradox, this led to the long-standing Von Neumann conjecture, which was disproved in 1980



Banach Tarski Paradox for chocolate balls

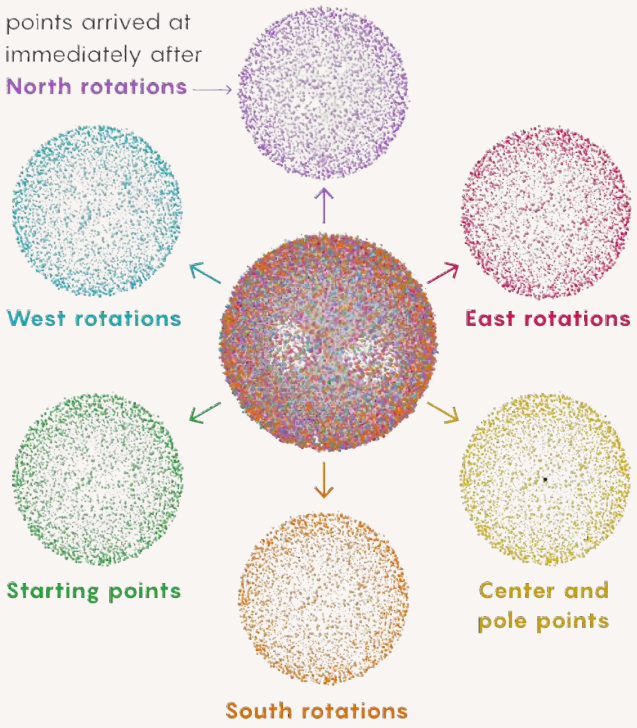
It basically says that you can take a ball and break it into some pieces, then just rearrange them to get two exact copies of the object you started with. While we reassemble the ball, the process involves only moving the pieces around and rotating them without changing their shape. But keep in mind that the pieces themselves are not what we usually call 'solids'. They're infinite scatterings of points. The strange thing is that the reconstruction can work with as few as five pieces. So, according to this paradox (with a bit of inaccuracy), if we have just one perfectly spherical chocolate ball, we should be able to create an infinite number of perfectly spherical solid chocolate balls from it that are of the same size and shape of the original one.



Obtaining infinitely many balls from one

Using the Banach–Tarski Paradox, it is possible to obtain k copies of a ball in the Euclidean n-space from one, for any integers n ≥ 3 and k ≥ 1, i.e. a ball can be cut into k pieces so that each of them is equidecomposable to a ball of the same size as the original. Using the fact that the free group F2 of rank 2 admits a free subgroup of countably infinite rank, a similar proof yields that the unit sphere Sn–1 can be partitioned into countably infinitely many pieces, each of which is equidecomposable (with two pieces) to the Sn–1 using rotations. By using analytic properties of the rotation group SO(n), which is a connected analytic Lie group, one can further

prove that the sphere Sn–1 can be partitioned into as many pieces as there are real numbers



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PRISONER'S DILEMMA

-Dhruv Arora (2nd Year)

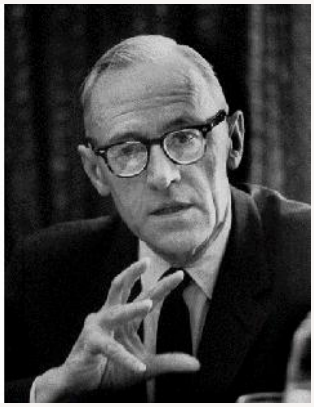
What Is a Prisoner's Dilemma?

The prisoner's dilemma is a decision-making and modern game theory paradox that illustrates how two reasonable persons stuck in the same scenario are most likely to react to it despite not knowing the other's perspective. They either act selfishly or refuse to collaborate, resulting in sub-optimal or non-optimal outcomes.

What Is a Game Theory?

Game theory is a relatively new school of Mathematics that was devised to resolve economic issues by the Hungarian-born American Mathematician John Von Neumann (1903-1957) and the German-born American economist Oskar Morgenstern (1902-1977).

John Von Neumann (1903-1957)



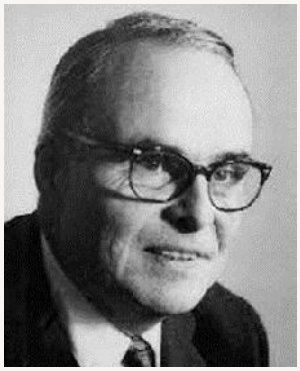
Oskar Morgenstern (1902-1977)

Game theory is referred to as the investigation of strategies in which the interdependence of player actions is the core of the game. It outlines the logical and Mathematical measures that players should engage in to get the optimum potential results in the games. Chess, tennis, and child-rearing are some examples of games explored in game theory. Yet all of these games have one thing in common: they are all interdependent, which means that the outcome for each player is determined by the strategies of the others.

In other words, game theory is associated with Mathematical models of rational decision-makers' cooperation and conflict. The game theory focuses on the study of decision-making in situations where players must make decisions that influence the interests of other players.

Prisoner's Dilemma

The prisoner's dilemma was devised in 1950 by Canadian Mathematician Albert W. Tucker (1905-1995), using prior work by Merrill Flood and Melvin Dresher. Two robbers are caught for a bank heist but the police have no concrete proof for the major crime; just enough evidence exists to convict on a lesser crime. The two convicts are separated and questioned individually, with no way for them to communicate with one another. Each prisoner has the choice of betraying the other by testifying against them or assisting the other by remaining quiet.



They are informed of the following results:

1. If prisoner 1 testifies and prisoner 2 stays silent, prisoner 1 will be released while prisoner 2 will be sentenced to three years in jail.

2. If prisoner 2 testifies and prisoner 1 stays silent, prisoner 2 will be released while prisoner 1 would be sentenced to three years in jail.

3. If both convicts betray one another and testify against each other, they both will be sentenced to two years in jail.

4. If both convicts stay quiet, they both will be sentenced to one year in jail for the lesser crime.

A payoff matrix can illustrate these four outcomes.

THE PRISONER'S DILEMMA

	B stays silent (cooperates)	B betrays A (defects)
A stays silent (cooperates)	Both serve 1 year	A serves 3 years, B goes free
A betrays B (defects)	A goes free, B serves 3 years	Both serve 2 years

What Do the Prisoners Do?

According to the payoff matrix, the best choice for each prisoner is to betray the other and testify. On average, this alternative results in shorter jail terms, 0 and 2 as opposed to 1 and 3. Therefore, whichever option one prisoner chooses, the other prisoner will be better off betraying and testifying than staying silent. As a result, each prisoner may betray the other and receive a two-year term.

The problem is that, despite what appears to be the ideal course of action, the captives would have been better off if they had both trusted one other and kept silent.

Implications of the Prisoner's Dilemma

The prisoner's dilemma demonstrates that when individuals follow their self-interests, the outcome is significantly worse than if they collaborate.

ImplicatiReal-world examples include:
ons of the Prisoner's Dilemma

- A firm slashing prices to steal customers from a rival, but the rival then cuts their prices as well, and both businesses lose out due to decreased profit margins;

- An arms race between two nations in which they both grow strength at the same time, resulting in no net gain in power, but the spending necessary to acquire strength leaves them both worse off compared to if the status quo had been maintained.

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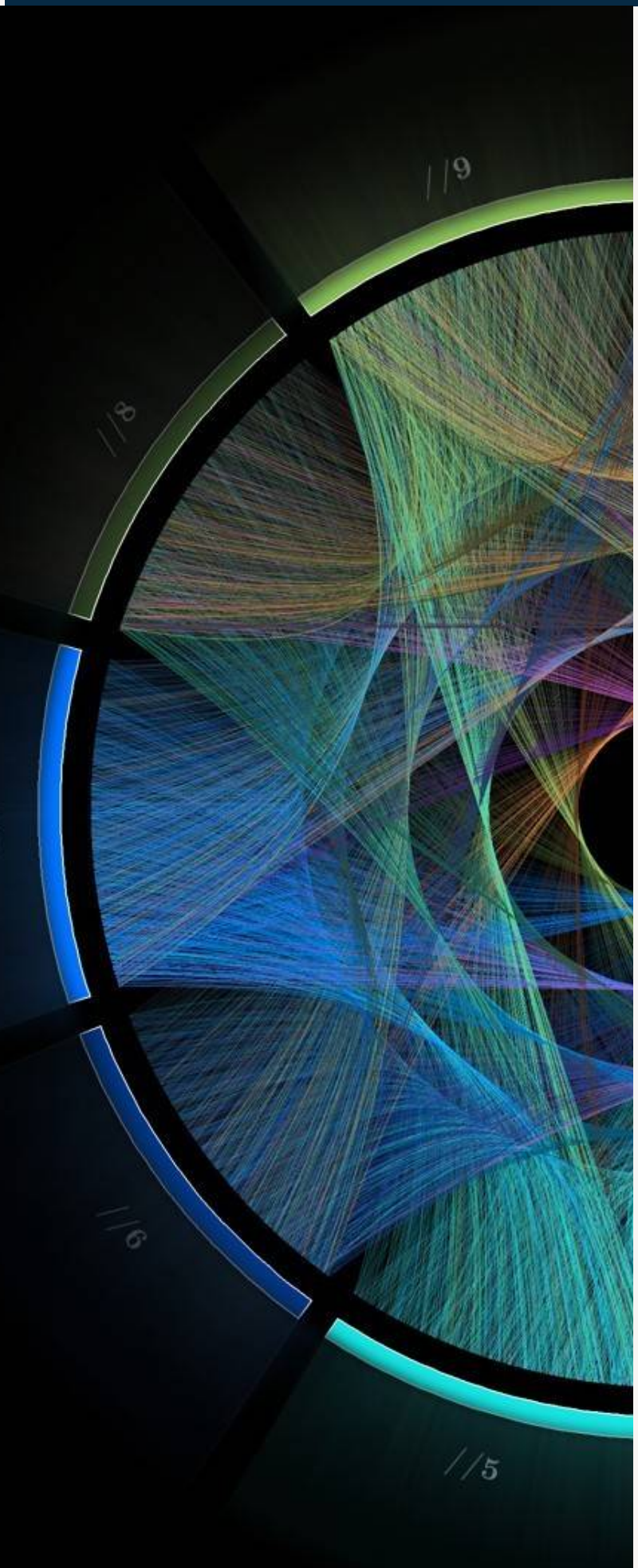
THE CONUNDRUM OF GABRIEL'S HORN & PAINTER'S PARADOX

- Vaibhav Bhatt (2nd Year)



Background :

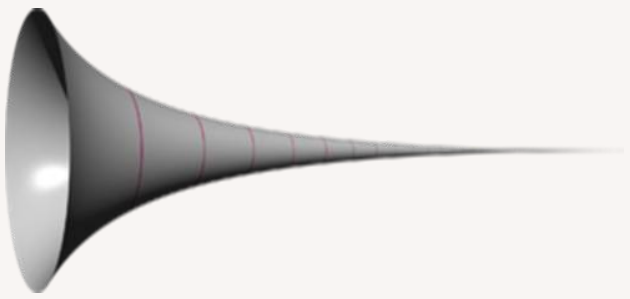
Imagine a painter named Josh who is commissioned to paint an object known for its peculiar structure. This object popularly known as Gabriel's horn (or Torricelli trumpet) is said to have a capacity of about 3 units of paint, but as Josh starts to paint it, he realizes that the object's surface area is infinite and no amount of paint would be enough to color its surface leaving him perplexed. How can such an object that can hold only 3 units of paint have an indefinite surface area? This is precisely known as the painter's paradox. So, let's dive deep into the concept of Gabriel's horn and see how it challenges our intuition.

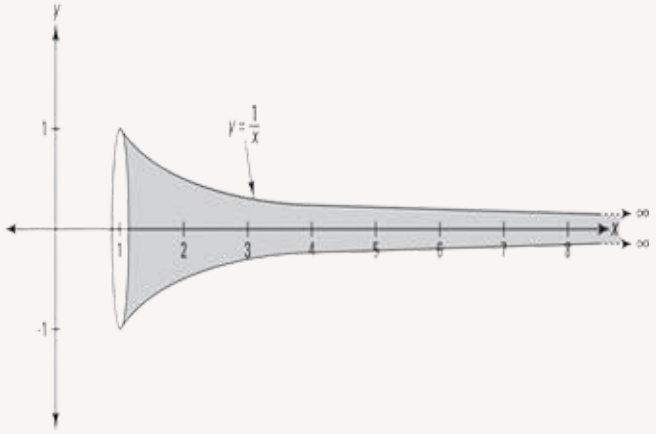
About the structure :

Gabriel's horn (or Torricelli's trumpet) is a fascinating three-dimensional shape that has intrigued Mathematicians and scientists for centuries. It is a geometric figure formed by rotating the curve y=1/x around the -axis, where x is greater than or equal to 1. This process creates a shape that appears conical in nature, with the tip of the cone extending towards infinity at the right-end of the horn

Surface area of the trumpet:-

For calculating the surface area, we first need to get the length of the graph of f in a small interval before revolving.





For this we will use the Pythagoras theorem. If we consider a small increment in the direction of the -axis and call that Δx and a small increment in the direction of the f-axis defined by Δf= (x+Δx)- f(x) , then we have ourselves a right triangle and we can approximate the length of the graph of f by letting Δx go to zero and taking the integral would yield the length of the graph of f from a to b.

$$\Delta L = \sqrt{\Delta x^2 + \Delta f^2}$$

$$= \sqrt{\Delta x^2 \left(1 + \left(\frac{\Delta f}{\Delta x}\right)^2\right)}$$

$$= \sqrt{1 + \left(\frac{\Delta f}{\Delta x}\right)^2}\,\Delta x$$

But we wanted the surface area. Again, we know that the circumference of a circle is given by 2πr where r is the radius of the circle which in our case is f(x). Therefore, the surface area of the slanted cylinder when we revolve the graph around the x-axis with x greater than equal to 0 is given by:-

$$S = 2\pi \int_a^b f(x\sqrt{1 + f'(x)^2})dx$$

Let us call the surface S(t). The antiderivative can be easily calculated using comparison test for improper integrals that is x is running from 1 to ∞ , and therefore the square root factor in the integrand is strictly greater than 1 on the interval of integration. So,

$$S(t) = 2\pi \int_1^t \frac{1}{x}\sqrt{1 + \left(-\frac{1}{x^2}\right)^2}\,dx$$

$$= 2\pi \int_1^t \frac{1}{x}\sqrt{1 + \frac{1}{x^4}}\,dx$$

$$S(t) > 2\pi \int_1^t \frac{1}{x}dx$$

$$= 2\pi\, ln(t)$$

$$S(t) \to \infty \text{ as } t \to \infty$$

Now, since 2πln(t) approaches infinity as t approaches infinity and S(t) is greater than it. Therefore, S(t) approaches infinity as well. Hence, the surface area comes out to be infinite.

Volume of the trumpet :

For volume, we would like to add infinitely many thin cylinders with radius f(x) and width Δx. The circle has area π r^2 where r is the radius of the circle, so in our case, it becomes π f(x)^2 and therefore the formula for the volume of such a cylinder is π[f(x)]^2Δx.

Summing up of all of these cylinders can be done via an integral. We let Δx go to zero and our general formula for the volume of revolution of the graph of f, from a to b is:-

Now, simply inserting the values of a, b and f(x) gives us the volume of the trumpet that is,

$$V = \pi \int_a^b f(x)^2 dx$$

$$V = \pi \int_1^{\infty} \left(\frac{1}{x}\right)^2 dx$$

$$= \pi \lim_{t \to \infty} \int_1^{t} \left(\frac{1}{x}\right)^2 dx$$

$$= \pi \lim_{t \to \infty} -\frac{1}{x} \Big|_1^t$$

$$= \pi \lim_{t \to \infty} -\frac{1}{t} + 1$$

$$= \pi$$

Therefore, the volume of Gabriel's horn comes out exactly to be π.

Explanation :

Although it seems totally weird to us that one can have a shape with finite volume and infinite surface area, the reason for this weirdness is because of the differences in the physical and Mathematical worlds. This is only an apparent paradox because we can work it out and the Math doesn't lie. But of course, the paradox emerges because of the misleading nature of how we phrase it. The paradox arises from the fact that Gabriel's horn is a trumpet-shaped object that extends infinitely in one direction but has a finite volume. This means that the object becomes infinitely thin at its "end," or at the point where it extends infinitely. This thinning property leads to the paradoxical result that the object has a finite volume, but an infinite surface area.

To understand why this paradox occurs, we need to consider the Mathematical properties of infinite series. In particular, when we add up an infinite series of terms, even if each term is very small, the sum can still be infinite. This is because the number of terms in the series is infinite, and as we add more terms, the sum continues to grow.

In the case of Gabriel's horn, we can think of the object as a series of infinitely thin circular disks stacked on top of one another. Each disk has a finite surface area, but as we stack more and more disks, the total surface area approaches infinity. At the same time, because the diameter of each disk becomes infinitely small as we move towards the "end" of the horn, the volume of each disk also becomes infinitely small and because there are infinitely many disks, the total volume of the horn remains finite.

References :

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RAMANUJAN SUMMATION PARADOX

- Shashvat Mishra (Ist Year)

IThe Ramanujan paradox, also known as the Ramanujan summation, is a Mathematical phenomenon that arises when infinite sums are evaluated using certain techniques.

The paradox is named after the famous Indian Mathematician Srinivasa Ramanujan, who discovered a way to assign a value to some divergent series that would otherwise be considered Mathematically undefined. For example, consider the sum:

$$1 + 2 + 3 + 4 + \ldots$$

This sum diverges to infinity, which means that it does not have a finite value. However, using Ramanujan summation, one can assign a finite value to this sum:

$$1 + 2 + 3 + 4 + \ldots = -1/12$$

This result may seem counterintuitive, but it is a consequence of a Mathematical technique known as analytic continuation. The technique involves extending a function defined in a certain region to a larger region using complex analysis. In the case of the Ramanujan summation, the technique involves applying an analytic continuation to the zeta function, a Mathematical function that is defined for complex numbers.

AIt is important to note that the value obtained using Ramanujan summation is not the same as the sum of the infinite series in the usual sense. Rather, it is a value obtained by a Mathematical technique that assigns a finite value to a series that would otherwise be divergent.

To further illustrate the Ramanujan paradox, let's consider another example:

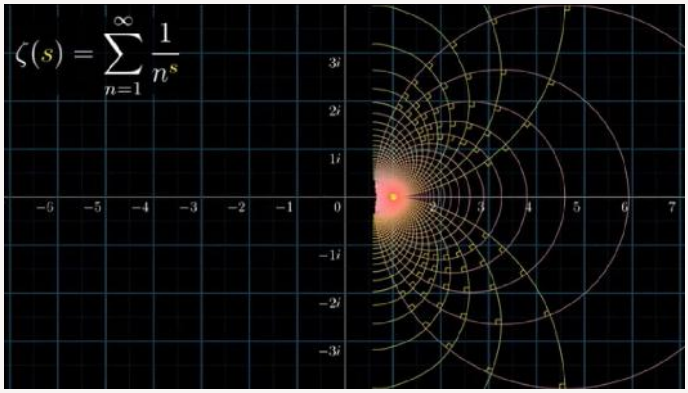
$$1 + 2 + 3 + 4 + \ldots + n + \ldots$$

This is another divergent series, as it continues infinitely without converging to a finite value. However, using the Ramanujan summation technique, we can assign a value to this sum as well:

$$1 + 2 + 3 + 4 + \ldots + n + \ldots = -1/12$$

Again, this result may seem surprising or counterintuitive, but it is a consequence of the Mathematical technique used to evaluate the sum.

It is important to note that the Ramanujan summation technique is not always applicable or appropriate for evaluating infinite series. In fact, it is often criticized for being misleading or misused in certain contexts. The technique should be used with caution and with a clear understanding of its limitations & applications.



Despite its controversial nature, the Ramanujan summation has had important applications in various branches of Mathematics and physics, including number theory, string theory, and quantum field theory. It has also inspired further research & development of analytic continuation techniques in cr.

The Ramanujan summation has been used in a variety of contexts in Mathematics and physics, including in the study of modular forms and their associated L-functions, and in the calculation of string amplitudes in string theory.

In number theory, the Ramanujan summation has been used to evaluate the sum of the first n natural numbers raised to a power, known as the Faulhaber formula. For example, the sum of the first n natural numbers raised to the fourth power can be evaluated using Ramanujan summation as:

$$1^4 + 2^4 + 3^4 + \ldots + n^4 = n^5/5 + n^4/2 + n^3/3 - n/30$$

In physics, the Ramanujan summation has been used in the study of quantum field theory, where it has been applied to the calculation of Casimir energy, which is the energy of the vacuum state between two parallel conducting plates. The Ramanujan summation has also been used in the study of black hole physics and the AdS/CFT correspondence, which relates gravity in a higher dimensional anti-de Sitter space to a conformal field theory living on its boundary.

Despite its usefulness, the Ramanujan summation remains a controversial topic in Mathematics and physics. Some researchers argue that the technique is misleading or incorrect, while others maintain that it is a powerful tool that can be used to obtain meaningful results in certain contexts. Ultimately, the validity of the Ramanujan summation depends on the specific Mathematical or physical problem being studied, and on the appropriateness of the technique in that particular context.

Unsung Mathematical Heroes

Shakuntala Devi: A Human Computer

Shakuntala Devi, a Mathematician born in Bangalore, India in 1929, was renowned for her exceptional talent in arithmetic calculations. At a young age, she demonstrated her abilities in Math shows worldwide and gained fame for her mental calculations of two 13-digit numbers in just 28 seconds. She earned the nickname "Human-Computer" and was also an author, writing books on astrology, puzzles, and Mathematics. Devi secured a place in "The Guinness Book of World Records" for her intellectual Mathematical talent and inspired many through her motivational speaking.

Brahmagupta

Brahmagupta was an Indian Mathematician and astronomer who described Zero and Negative Numbers. His book, 'Brahmasphutasiddhanta,' described negative and positive numbers and their multiplications. He contributed to the concept of negative numbers and discovered the principles of positive and negative multiplications. He introduced principles and rules of trigonometry and found the value of Pi. Brahmagupta also introduced the formula of cyclic quadrilaterals and was one of the early Mathematicians who conceptualized the earth as round.

Bhaskara

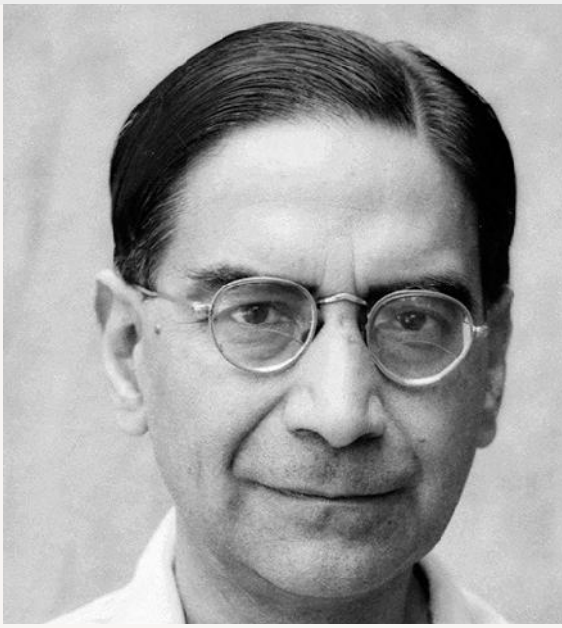
Indian Mathematician Bhaskara II, who lived in the 12th century, made significant contributions to Mathematics and astronomy. He discovered differential calculus centuries before European Mathematicians like Newton and Leibniz. Bhaskara II was the first to use the decimal number system and correctly described many astronomical quantities. His works covered various Mathematical methods and astronomical observations of celestial locations, conjunctions, eclipses, cosmography, and geography. Bhaskara II has been recognized as the greatest Mathematician of medieval India for his invaluable contributions.

Srinivasa Ramanujan

Srinivasa Ramanujan, one of the greatest Mathematicians, was born in India in 1887. He made exceptional discoveries in Math and compiled around 3,900 results, including an infinite series for pi. He described the mock theta function, which is now recognized as holomorphic parts of mass forms. His contribution to game theory and the concept of modular forms are still valued. One of his notebooks, discovered in 1976, was published as a book. He is known for the Ramanujan number and his contributions to complex analysis, number theory, and other Math fields.

Prasanta Chandra Mahalanobis

P.C. Mahalanobis is known as the father of Indian Statistics for his innovative techniques in conducting large-scale sample surveys, calculating acreages and crop yields, and introducing statistical methods for economic planning. He played a key role in India's five-year plans, emphasising industrialisation and employing his variant of the input-output model, the Mahalanobis model. He also encouraged the development of a statistical infrastructure and played a critical role in bringing India its first digital computers. Mahalanobis died at the age of 78 while still active in research work and as the director of the Indian Statistical Institute and the honorary statistical advisor to the Cabinet of the Government of India.



The Numeric Times

The Fastest Human Calculator Secures $15 Million in Funding

Hyderabad-based Math-learning platform Bhanzu has raised $15 million (Rs 119.76 crore) in Series A round, led by venture capital firm Eight Roads Ventures.

Bhanzu uses a curated curriculum - designed on the basis of Prakash's journey of fastest human calculator - to help students between the age of 6-16 years learn Mathematics.

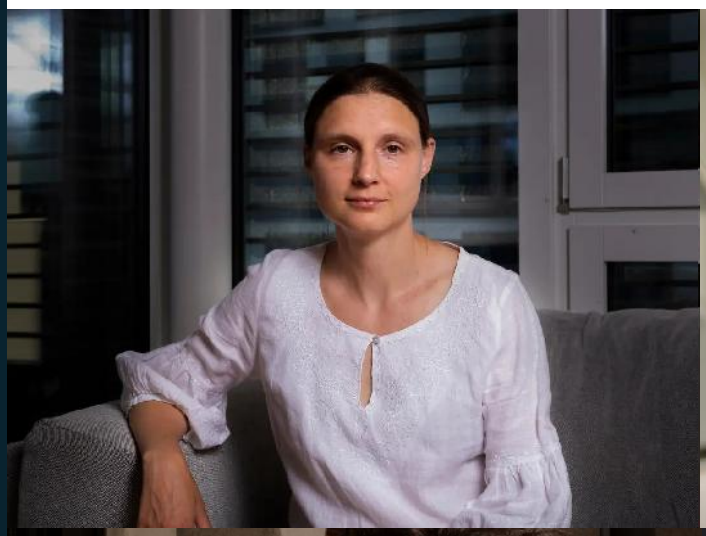
Known as the World's Fastest Human Calculator, Hyderabad's Neelakantha Bhanu Prakash is the Founder and CEO of Bhanzu, an Indian Maths ed-tech platform aiming to revolutionise the learning experience of Maths globally.

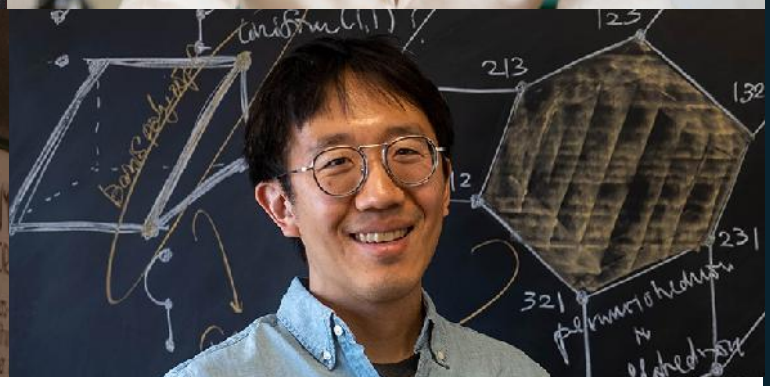
01 By the age of 17, he had broken world records of Maths legends like Shakuntala Devi.

In the 2020 Mind Sports Olympics held in London, Neelakantha Bhanu became the first Indian and Asian to win a gold medal in the Mental Calculation World Championship. His achievement was celebrated by various global personalities including the President and Vice President of India

Teenager Cracks Riddle of Carmichael ~~Numbers~~

High school senior, Daniel Larsen, has solved a problem about Carmichael numbers, which look like prime numbers but can be factored. Carmichael numbers have been a difficult problem for Mathematicians for years, and Larsen's work has provided a new bound on the gaps between pseudoprime, and Larsen's work has been recognized by the Mathematical community.





(Clockwise from top left)
Maryna Viazovska, James Maynard, June Huh, Hugo Duminil-Copin

Fields Medal 2022

The Fields Medal is considered the highest honor in Mathematics, awarded every four years to Mathematicians under the age of 40 who have made significant contributions to the field.

Four Mathematicians have been awarded the prestigious Fields Medals at a ceremony in Helsinki, Finland, as announced by the International Mathematical Union jury on July 5, 2022. The awardees of the prestigious prize are France's Hugo Duminil-Copin, US-based June Huh, Britain's James Maynard, and Ukraine's Maryna Viazovska.

02 The Fields Medal is a prestigious award in Mathematics.

considered to be the equivalent of the Nobel Prize. It was first awarded in 1936 in honor of Canadian Mathematician John Charles Fields, who founded the award and left funds for it in his will. The medal is named after him

Since its inception, the Fields Medal has been awarded to 62 Mathematicians, including four recipients in 2022. It is awarded by the International Mathematical Union.

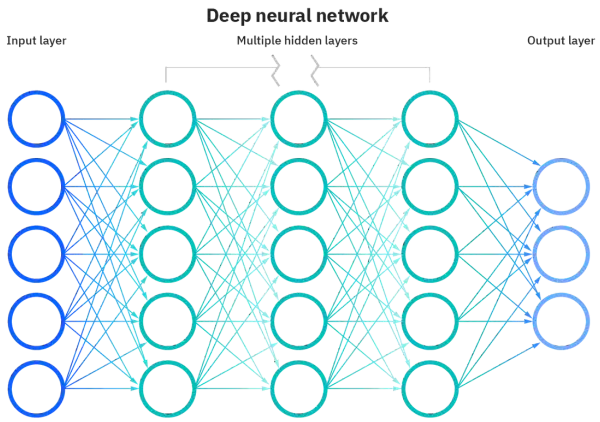
Mathematicians Prove Stability of Kerr Black Holes in Milestone Achievement

Mathematicians from Columbia University, and Princeton University have made a breakthrough in the study of black holes, proving that slowly rotating Kerr black holes are stable. The achievement is based on the work of Roy Kerr, who in 1963 found a solution to Einstein's equations that described the space-time outside a rotating black hole. For nearly 60 years, researchers have been attempting to prove the stability of Kerr black holes.

The significance of this achievement is that it rules out Mathematical instability, which would have required the modification of Einstein's theory of gravitation. The research effort took years and involved the publication of a 912-page paper, an 800-page paper, and three background papers, totaling 2,100 pages in all.

The proof that slowly rotating Kerr black holes are stable is a milestone in the Mathematical development of general relativity, according to Demetrios Christodoulou, a Mathematician at the Swiss Federal Institute of Technology Zurich. The achievement is expected to further our understanding of black holes and help in the study of other related astrophysical phenomena.

Math Meets Deep Learning



Deep learning, a widely-used AI technique, is now being used in certain areas of Mathematics research. A group of researchers has utilized it to search for unusual singularities in equations that model fluid flow. Another team used computer-assisted proofs to prove the breakdown of a particular version of the Euler equations that model ideal fluids. Additionally, some Mathematicians are exploring whether the Navier-Stokes equations, which model most real-world fluids, might also break down.

Meanwhile, other researchers are using machine learning to solve problems in graph theory and combinatorics, develop better techniques for multiplying matrices, and propose new conjectures in knot theory. Sébastien Bubeck and Mark Sellke used Mathematical techniques for analyzing neural networks to prove how big they must be to work robustly.

These applications of deep learning in Mathematics research show great promise in helping to solve complex problems and advance the field. The use of AI techniques in Math may lead to groundbreaking discoveries and further our understanding of complex Mathematical concepts.

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MATHEMATICS

Through the Ages

Ancient Mathematics 3000 BCE - 500 CE

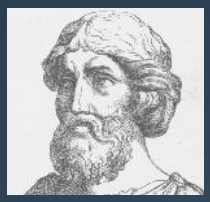
Euclid's Elements

During this period, Mathematics was used primarily for practical purposes such as measuring land and keeping track of trade.

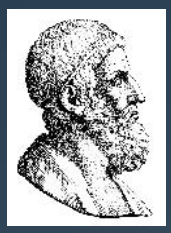
Egyptian and Babylonian Mathematics were among the earliest forms of Mathematical inquiry. Euclid's Elements, written in the 3rd century BCE, is a collection of Mathematical proofs that remain influential to this day.

Euclid

The Pythagorean Theorem, named after the Greek Mathematician Pythagoras, is one of the most famous and widely used theorems in Mathematics.



Pythagoras



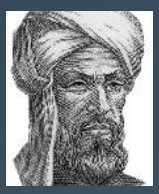
Archimedes

Archimedes, a Greek Mathematician and physicist, developed the Method of Exhaustion, which he used to determine the area of a circle.

Medieval Mathematics 500 CE - 1500 CE

During the medieval period, Mathematics was heavily influenced by the Islamic world during the Golden Age of Islam. Indian Mathematics also had a significant impact during this time, including the development of the concept of zero.

Aryabhatta



Al-Khwarizmi

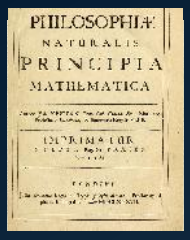
Al-Khwarizmi, an Islamic scholar and Mathematician, is credited with developing the foundational concepts of algebra.

Fibonacci, an Italian Mathematician, introduced the Fibonacci Sequence to Europe, which has since been used to describe many natural phenomena.

Fibonacci

Omar Khayyam, a Persian Mathematician, poet, and philosopher, is known for his work on the theory of quadratic equations.

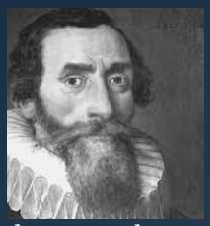
Early Modern Mathematics 1500 CE - 1800 CE



Principia Mathematica

During this time period, Mathematical knowledge underwent a period of rapid expansion and development in Europe.

The discovery of the laws of planetary motion by Johannes Kepler, and the development of analytic geometry by René Descartes


Johannes Kepler

Significant discoveries and concepts during this time period include the development of calculus by Isaac Newton and Gottfried Leibniz


Issac Newton

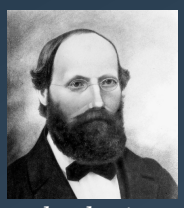

Rene Descartes

These discoveries formed the foundations for many branches of Mathematics and laid the groundwork for future advancements.

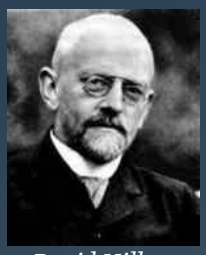
Modern Mathematics I 1800 CE - 1930 CE

During this time period, Mathematics continued to grow and expand, with major developments in areas such as algebraic geometry, group theory, number theory, and topology. Significant contributions were made by Mathematicians such as Carl Friedrich Gauss, Évariste Galois, Bernhard Riemann, Henri Poincaré, Georg Cantor, David Hilbert, and Kurt Gödel.


Carl F . Gauss


Bernhard Reimann

Their work led to the development of abstract algebra and the formulation of axiomatic systems, which revolutionized the field of Mathematics.


David Hilbert


Henri Poincaré

Modern Mathematics II 1930 CE - Present

Significant contributions were made by Mathematicians such as John von Neumann, André Weil, Simone Weil, Samuel Eilenberg, Saunders Mac Lane, Andrew Wiles, Grigori Perelman, John Tate, Maryam Mirzakhani, Claude Shannon.

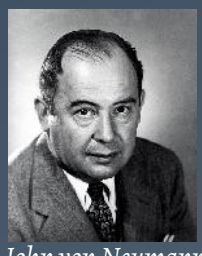
For integers $n > 2$ the equation

$$a^n + b^n = c^n$$

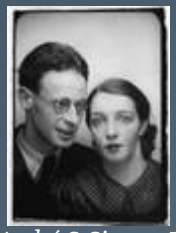
cannot be solved with positive integers a, b, c.

Fermat's Last Theorem

During this time period, there were major developments in the fields of topology, algebra, and logic, including the development of game theory and category theory.


John von Neumann

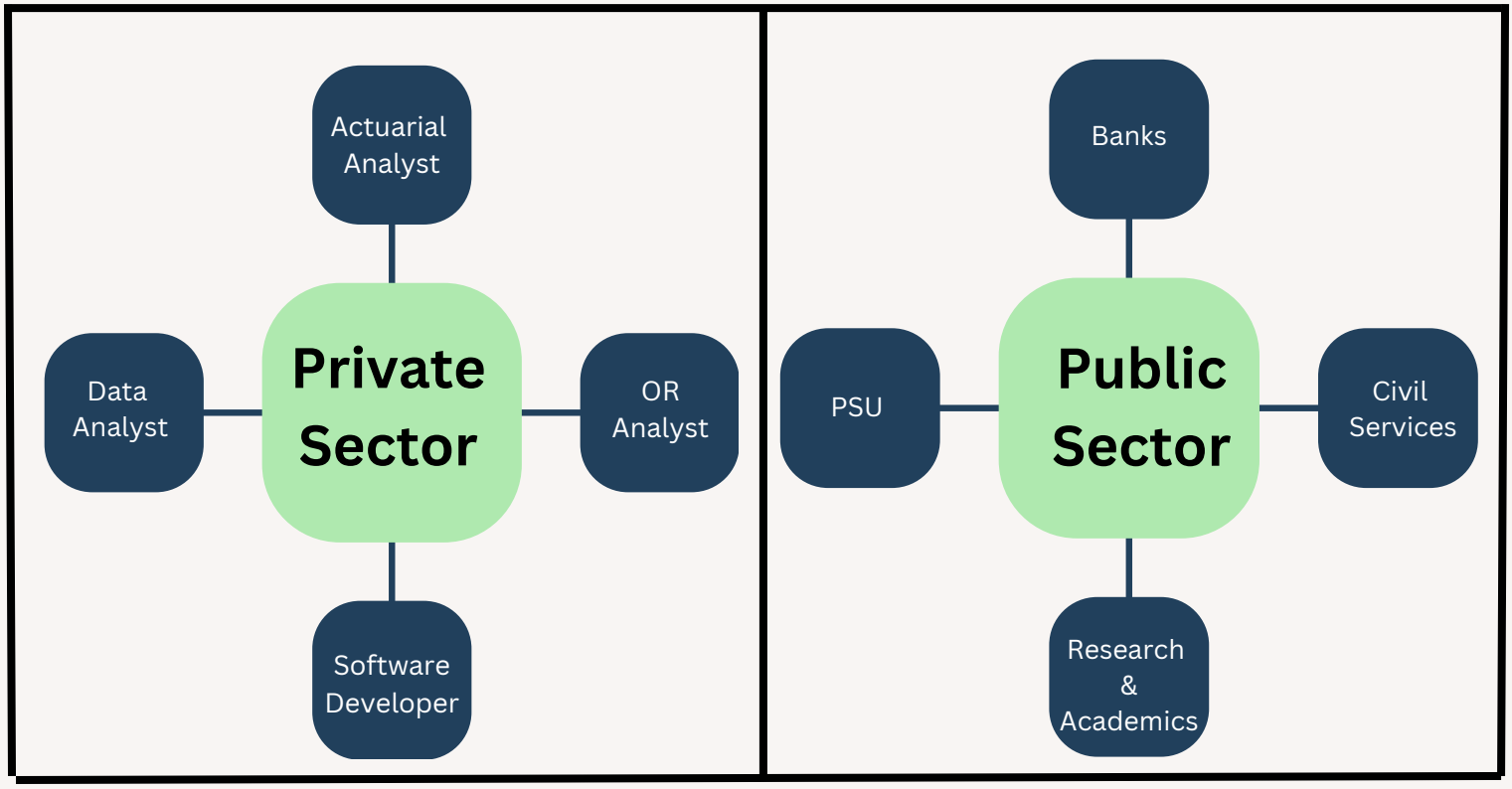
There were also major breakthroughs in number theory and algebraic geometry, including the proofs of Fermat's Last Theorem and the Poincaré Conjecture.


André & Simone Weil

CAREER OPPORTUNITIES

Choosing a career path can be a daunting task, especially when you have a major in Mathematics. With so many options available, it's easy to feel overwhelmed and unsure of where to start. However, fear not! This quick guide is designed to help you navigate through the vast array of opportunities available to those with a Mathematics background. So, if you're struggling to identify a suitable career path that aligns with your interests, we're here to help!

SOME OF THE POPULAR JOB OPTIONS INCLUDE



CAREER OPPORTUNITIES

Data Analyst

Data analysts analyze vast data using Mathematical and statistical techniques to facilitate informed organizational decisions. They use data visualization tools and software to present their findings to stakeholders. Data analysts usually require a bachelor's degree in Math, stats or a related field, proficiency in programming languages like SQL, Python, or R, and familiarity with data analysis tools and techniques. Strong analytical and problem-solving skills, attention to detail, and effective communication skills are also essential for this role.

Actuarial Analyst

Actuarial analysts use Mathematical models to assess the likelihood of future events and manage risks in insurance companies, banks, and financial institutions. They analyze and evaluate the likelihood of future events, such as natural disasters or financial crises, and use statistical and Mathematical data to make informed predictions and recommendations. There are several exams for actuarial analysts in India, offered by the Institute of Actuaries of India (IAI).

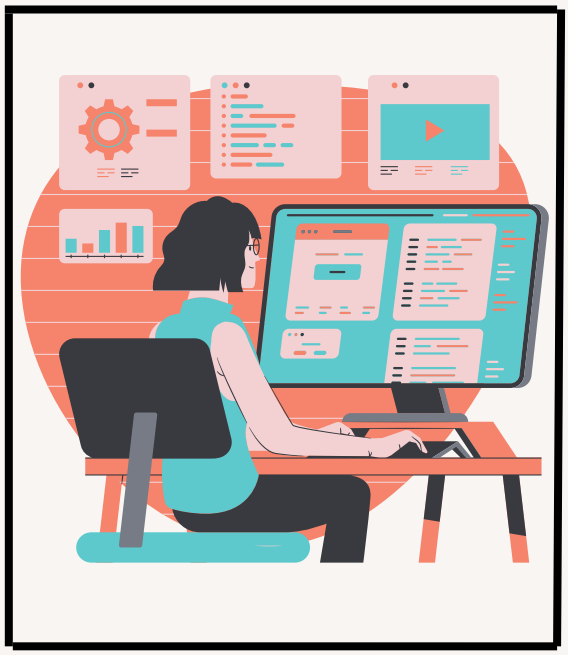
CAREER OPPORTUNITIES

OR Analyst

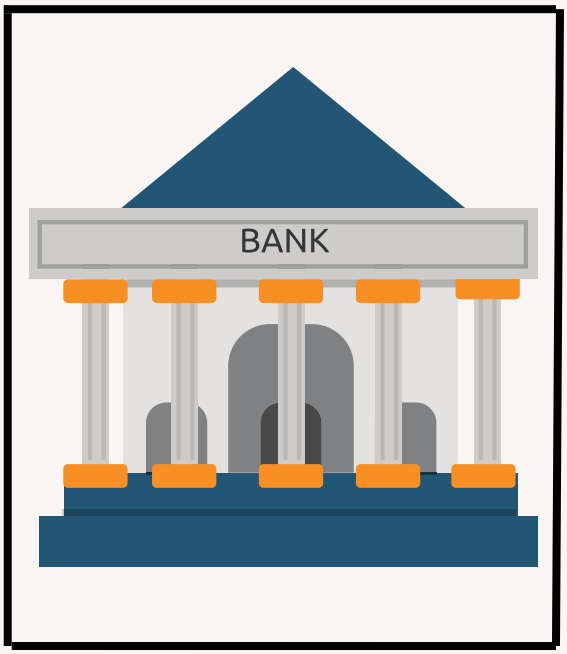
Operational research analysts apply Mathematical and analytical skills to resolve complicated business issues. They work across multiple industries such as manufacturing, transportation, and healthcare. They help businesses increase efficiency and reduce costs by creating models to optimize resource allocation, logistics, and inventory management. An operational research analyst often requires a degree in Mathematics, statistics, or a related field, along with strong problem-solving, analytical, and critical thinking skills. They should also be proficient in programming and data analysis tools to create Mathematical models for decision-making processes.

Software Developer

Actuarial analysts use Mathematical models to assess the likelihood of future events and manage risks in insurance companies, banks, and financial institutions. They analyze and evaluate the likelihood of future events, such as natural disasters or financial crises, and use statistical and Mathematical data to make informed predictions and recommendations. There are several exams for actuarial analysts in India, offered by the Institute of Actuaries of India (IAI).



CAREER OPPORTUNITIES

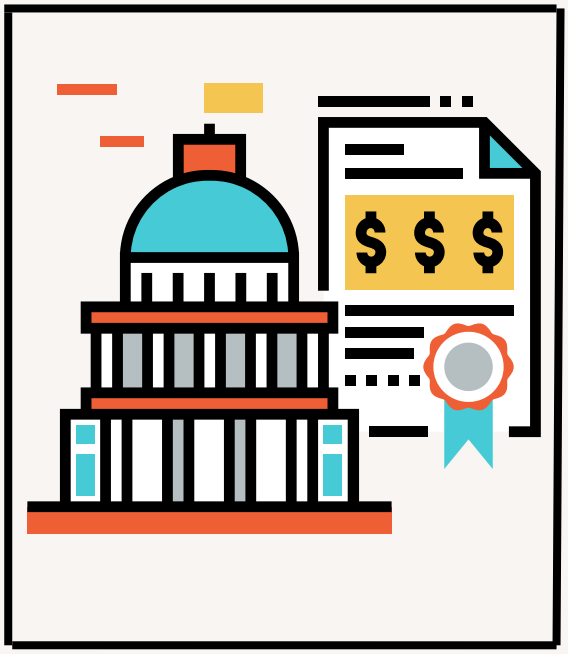


Public sector banks

Graduates in Mathematics can pursue banking and finance jobs in government organizations such as the Reserve Bank of India (RBI), State Bank of India (SBI), and other nationalized banks. They can apply for job roles like Probationary Officer (PO), Clerk, Specialist Officer, and others. Graduates with a degree in Mathematics can make a significant contribution to the banking and finance industry by applying their Mathematical skills to financial modelling and analysis.

PSU

BSc Maths graduates can also apply for various Public Sector Undertaking (PSU) jobs such as management trainee, assistant manager, and executive trainee. PSUs such as ONGC, BHEL, SAIL, GAIL, and NTPC offer various entry-level positions for BSc Maths graduates. The selection process for these jobs involves a written test followed by a personal interview. The roles could include analyzing data, performing research, designing models, and more. The PSUs offer competitive salaries, job security, and other benefits.



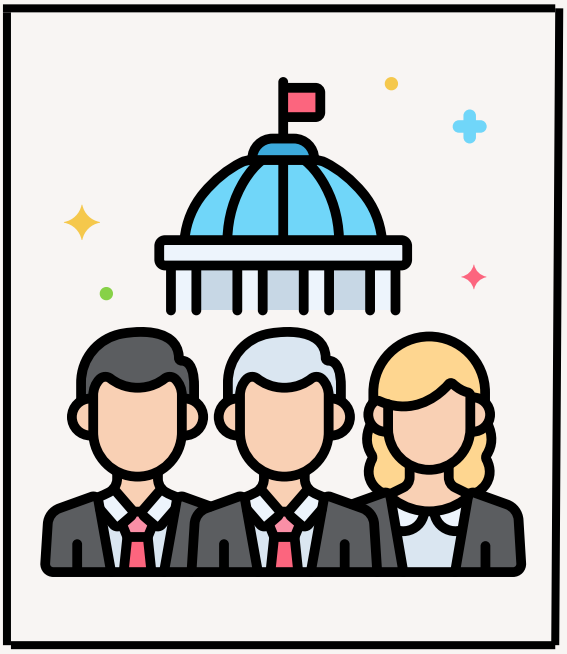
CAREER OPPORTUNITIES

Research & Academics

After completing BSc in Mathematics, one can pursue a career in research and academics. Basic qualifications for such jobs include a Master's or PhD in Mathematics or a related field. Research jobs can include working in government universities, or other research institutions. Academic jobs include positions such as professor, lecturer, and research scholar in universities and colleges. These positions involve conducting research, teaching, and publishing research papers in reputed journals.

Civil Services

BSc Maths graduates can opt for a career in civil services by taking the civil services examination, which offers the Indian Administrative Service (IAS), Indian Police Service (IPS), and Indian Revenue Service (IRS), among others. The selection process involves a preliminary exam, a main exam, and an interview. Civil services jobs offer excellent growth opportunities, a competitive salary, and a chance to serve the country.



Srijan

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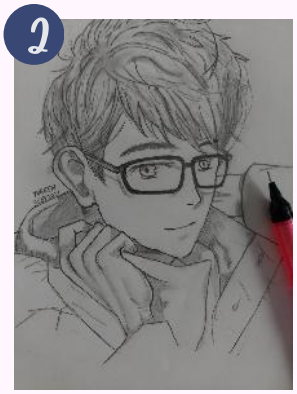

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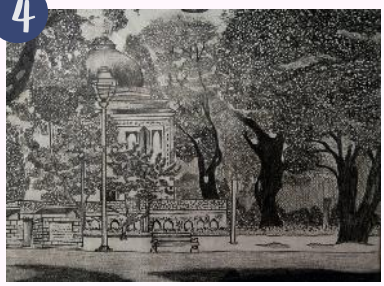

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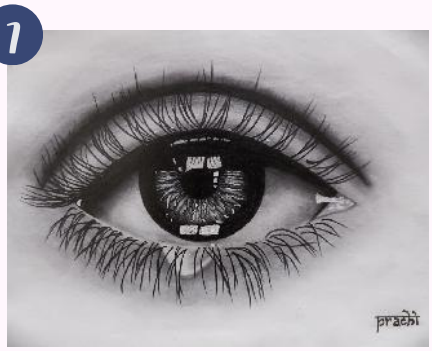

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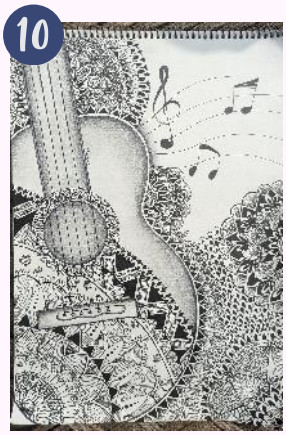

11


2,11 - Yogesh (1st year)
3,4 - Yashdev(1st year)
9 - Yash Anuj Gupta(1st year)
1,6,8 - Sneha Gupta (2nd year)
5,7 - Prachi Bohra (2nd year)
10 - Tanya Malik (2nd year)

PHOTO Strike

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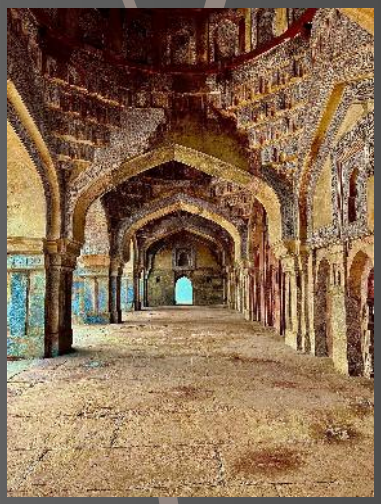

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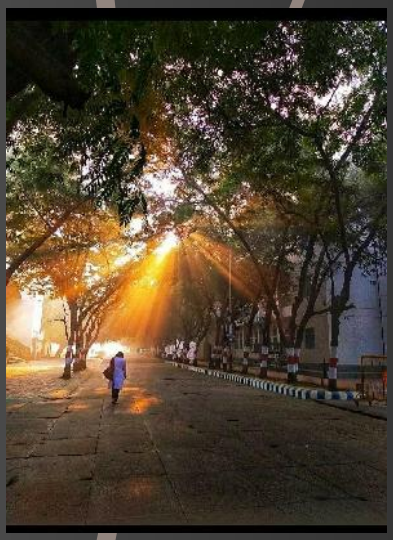

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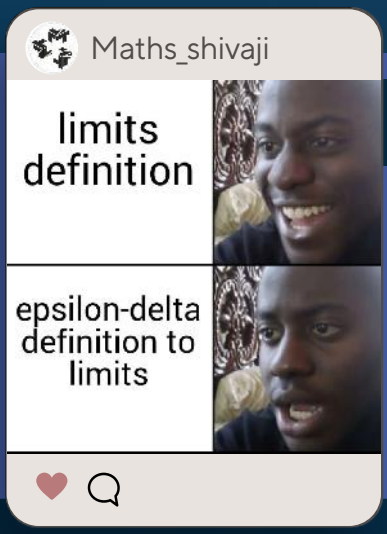
1 - Yash Gupta (1st year)

3,5,6 - Vishwesh Tiwari (2nd year)

2,4 - Adeeba Vaseem(1st year)

SOCIAL BUZZ 2022-23

@Maths_shivaji

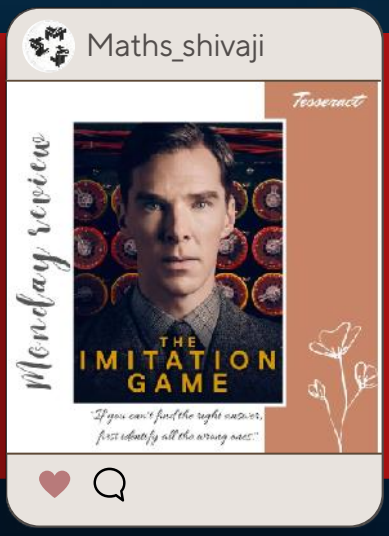


TRENDING MEMES FT. MATHEMATICS

"Math doesn't have to be dry and boring! Our Instagram page injects some levity into the world of equations and formulas by curating the most popular and hilarious Math memes around. From puns to parodies, we've got it all. Come for the laughs, stay for the learning!"

BLOCKBUSTER OR BUST: MOVIE REVIEWS

Get ready for some reel Math! Our Instagram page combines the love of movies with a passion for numbers by reviewing films that involve Mathematics. From A Beautiful Mind to The Imitation Game, we break down the arithmetic angles that make these movies so captivating.



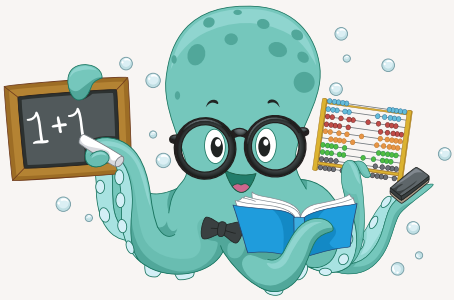
FUN REELS!!

"Math is all around us! We hit the college campus to ask random Math questions to random people and the answers may surprise you! From geometry to algebra, see how much people know about general formulas and basic trivia. Tune in for a fun and informative Math adventure! Don't miss out!

Fact-O-Mania

There's not enough space in the known universe to write out a googolplex on paper.

There Are More Ways to Arrange a Deck of Cards Than There Are Atoms on Earth.



Most Mathematical symbols weren't invented until the 16th century. Before that, equations were written in words.

Seven is the most significant number across religions and cultures. For example, seven colours in a rainbow, seven days in a week, seven notes on musical skill, etc.

Boolean Pythagorean Triples is a problem whose solution would take 10 billion years to read.

From 0 to 1000, the only number that has the letter "a" in it is "one thousand".

The oldest surviving Mathematical proof is the Pythagorean Theorem, first proved by the ancient Greeks in the 6th century BC.

Mathematical Jokes

Who was the roundest knight at King Arthur's table?
Sir Cumference.
How did he get so round?
He ate too many π's.

When I was at school, I put invisible ink in the printer before printing a Maths question. I couldn't see what the problem was.

Why was six scared of seven?
Because seven eight(ate) nine

Why did the (x^2+2) tree fall over?Because it had no real roots.

Why did the Mathematician spill all of his food in the oven?
The instructions said, 'Put it in the oven at 180'.

What do you call a man who spent all summer at the beach?
A tan-gent.

Why do Mathematicians always get a cab home from a party?
Because you can't drink and derive.

What did one Math book say to the other?
Don't bother me. I've got my own problems!

Math Mania

The Ultimate Math Challenge Game

Crossword Fun

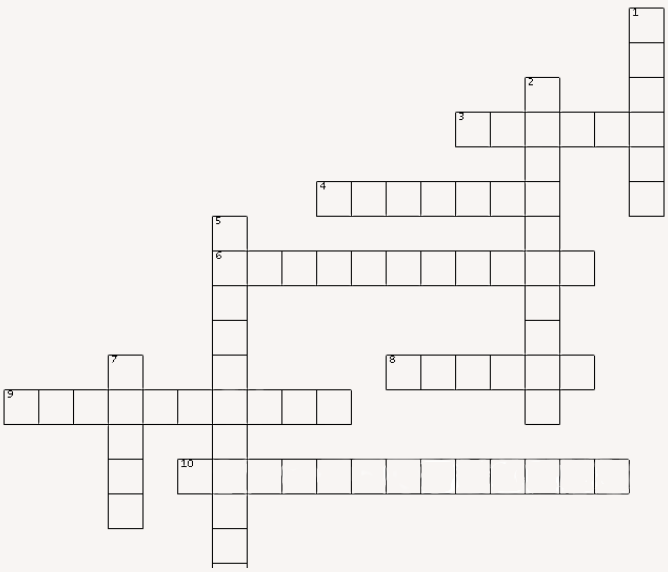
Challenge yourself with Words and Clues

Down

1. Name of the symbol used in division(÷) is called?
2. Who discovered logarithms and decimal points?
5. Name of the first Math book ever written.
7. Abacus was invented in which country?

Across

3. 1 Followed by a 100 zeroes is called?
7. Number system with base 16 called?
4. Prefix 'giga' represents what?
8. Zero was initially called as?
9. Father of Mathematics?
10. Who developed the Cartesian axes?



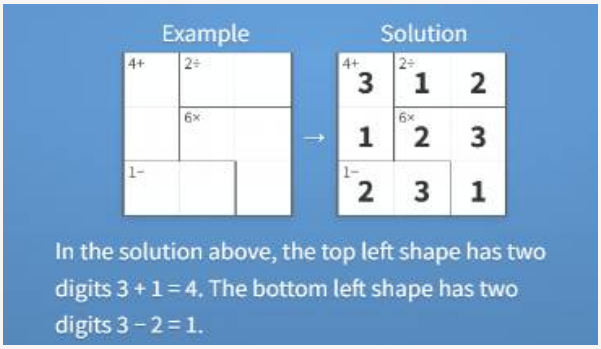
Math Madness:

Test your Brain with Calcudoku

3÷	12+		24×	10+	3-	5+	2-	
	16+	5+					9+	7-
3			6÷	3÷	13+	2-		
8÷		9					28×	
17+	10+		2-		126×		3÷	
	1-	5×	20×		54×		6	24+
4			21+			96×		
17+				1-	9×			8+
4-						2÷		

Help!

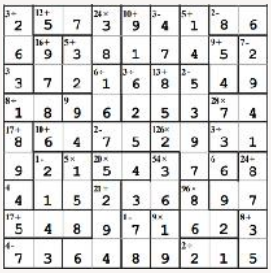
Every Calcudoku has a single solution that can be reached logically. Fill in the grid such that no two digits repeat in any column or row. Use the shapes in the grid as your guide. Each shape contains a number equaling the product of the shapes' digits.



Answers:

Across:
3. Googol
4. Billion
6. Hexadecimal
8. Cipher

Down:
1. Obelus
2. John Napier
5. The elements
7. China
9. Archimedes
10. Renedescartes



Let's hear from our Seniors!

Apurv Dagar (2019-2022)

Shivaji college's Mathematical department is one of the best institutes to provide a better platform to learn. The faculty members are very supportive and create a wonderful environment to enhance the student's skills and help in developing great personalities. The curriculum is balanced with theoretical and practical knowledge letting the students advance their skills in the best way possible. Along with this, the college organizes many activities that allow students to socialize and have fun in the stressful environment of studies. The days I have spent here are one of the best as they gave me a decent circle of friends, a lot of treasurable memories, and an immense amount of knowledge.

Priya Beniwal (2019-2022)

My time at the Mathematics department was incredible. It is a single location where we can study and grow as people. The department allows an individual to interact with alumni and receive guidance on internships and careers.
Apart from academics, the department has its own Mathematics society, and joining it allows you to connect with everyone as a single family, where students from all years come together, brainstorm ideas, and organise events that prepare an individual to instill management, leadership qualities, time management, and so on.

And, in terms of professors, the Department of Mathematics has one of the greatest. From your orientation until after college, they will be there as one of the best.
Finally, I'd want to thank the entire Tesseract team for continuing with the 'READ-O-MATH' newsletter series and wish them all the best in their future pursuits.

Anushka Aggarwal (2019-2022)

It's a pleasure for me to appear here. I just know that I was the most absent girl in first semester, no one ever knew me and then online mode made me so comfortable with reaching out to some of my classmates most of my juniors and to teachers. People had good times offline and I had it online. Teachers made so much efforts to make our online classes as much efficient and interactive as offline ones could have been. I was not the same girl who entered this college. I found my guides who trusted me who mentored me, found a friend whom I can confide in. Best part was the juniors who loved me so much that I felt like I knew them since ages. It's rightly said, if not all, there's a little bit good in every chapter of the story.

Himanshi Shadeja(2019-2022)

Shivaji College has been a valuable contributor to the development of my personality.
The entire faculty members of the Mathematics Department are the pillars of the learning one can gain about the subject. They're very supportive, having an attitude of being ever ready to help.
I've been able to establish my leadership and team skills by leading the Editorial Team at Women's Development Cell. The college societies provide a great exposure to all the students who come from different places.
I'm grateful to all the professors, mentors, and the life long memories I created.

Samridhi Kaushik (2019-2022)

It gives me great pleasure to say that I have complete my graduate degree in Mathematics (hons) from Shivaji college.
My experience with all the faculty members have been amazing, they make sure that you are provided with opportunities and exposure in your field of interest. Also they never fail to be a wonderful supporters whenever you need them. I am so thankful to this Shivaji college for providing me everything to excel in my field.


SHIVAJI COLLEGE