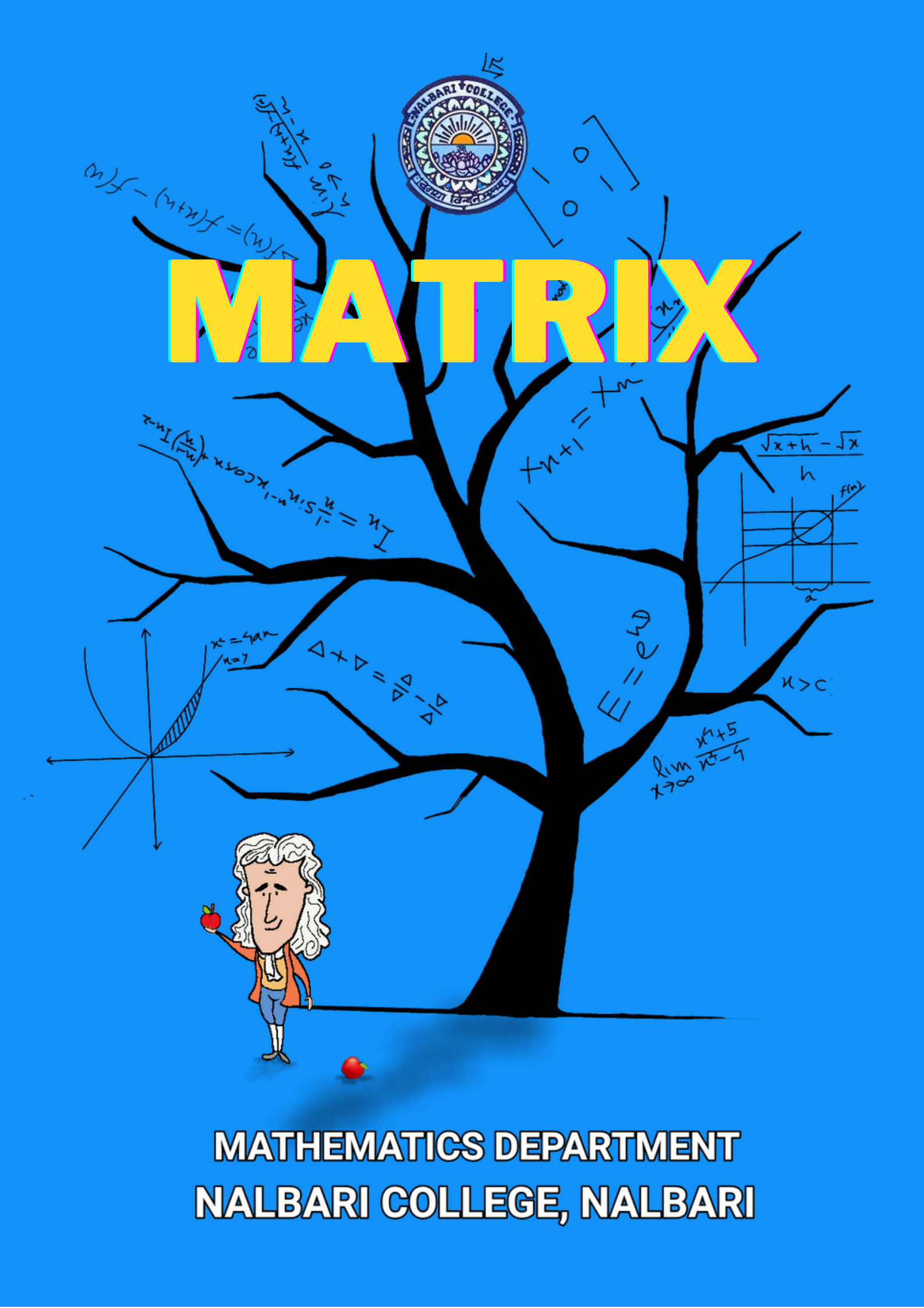

NALBARI COLLEGE
MATRIX
MATHEMATICS DEPARTMENT
NALBARI COLLEGE, NALBARI

MATRIX

First Edition

YEARLY E-MAGAZINE

2022-23

Matrix

First Edition : 2022-23

Editorial Board

Publisher

Mathematics study circle, Nalbari college

Special Thanks : Dr. Kamal Nayan Patowary, Principal, Nalbari College.
Thanks : All present and former students of Mathematics department, staff of TNG library and all the well wishers of Nalbari college.

N.B. : For any objectionable elements, the writer will responsibile.

- Editorial Board

Dr. Kamal Nayan Patowary
Principal
Nalbari College,Nalbari

Principal's Pen

It gives me immense pleasure to know that the students of mathematics department of Nalbari College is going to publish an online journal MATRIX from this year. This is a bold initiative. A person busy with numbers always has a flagship idea in his or her mind. The flagship ideas are the real need of the hour. Science creates many things, but these are always in our nature or around us. Simply, we start recognizing those things with new scientific inventions. But numbers are the creation of human imagination. These are not in nature. The human mind creates numbers, and that is why it becomes the main force behind every scientific discoveries. So the efforts that the young Mathematical mind of our college put in arrenging the words in pages of MATRIX certainly be remarkable one. I hope this venture will remain as a guiding spirit of innovation in years to come.

Dr. Kamal Nayan Patowary

Dr. Piroja Begum
HOD, Department of mathematics,
Nalbari College, Nalbari

HoD's Pen

The Department of Mathematics in Nalbari College – a glimpse

The development of mathematics is closely linked to the development of human civilization. The progress of civilization requires social order and coherent thinking. This coherent thinking can be developed by mathematical thinking or mathematical mindset. Coherent thought was expressed through the creation of mathematics at the dawn of human civilization. People used mathematics even before formal education began. Mathematics was used orally.

` With the introduction of secondary education in Assam in 1838, mathematics education became more disciplined. In 1887, the Mine School was established in Nalbari. In 1917, the mine school was renamed Gordon High School. With that, formal mathematics education expanded in Nalbari. The Department of Mathematics at Nalbari College was established in July 1945 through the founding efforts of Late Kamakhya Kamal Pandit, who rendered his services in this college for one year. Then Mathematics classes were managed by Late Radha Sarma, a teacher of Govt. Gurdon High School for a period of eight months. Two-year degree classes with subjects English, Assamese, History, Philosophy, Sanskrit and Economics were started in the year 1949. Intermediate science classes with subjects English, Assamese, Mathematics, Physics and Chemistry were started in the year 1958.

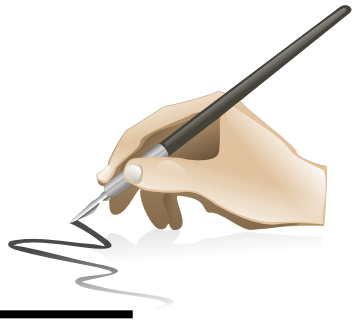
Gauhati University introduced one-year P.U. in both Arts and Science classes in lieu of intermediate Arts and Science in 1961. These courses were started in Nalbari College. In 1962, G.U. introduced three-year degree courses in both arts and science. This year was the beginning year of degree course of Mathematics as well as Science in our college. For greater interest of local students, commercial Arithmetic subject was started in H.S. Arts class in 1971 for two years.

Mathematics (Major) classes were started from the year 1972. In 1974, Assam Higher Secondary Education Council introduced two-year H.S. course in Arts and Science and in 1976, two-year degree course in both Arts and Science was introduced. H.S. and two-year degree classes were started in Nalbari College. In the year 1985, the 10+2+3 course was introduced and new syllabus of degree as well as Higher Secondary classes was improved. Recently CBCS course is introduced . Nalbari college followed this course timely.

To improve and popularize mathematics education, the department of mathematics has done various activities time to time. In 1986, the Assam Academy of Mathematics was born. Assam Academy of Mathematics, Nalbari Branch has been playing a leading role in the promotion and dissemination of mathematics since its inception. An organization named as 'Mathematics Study Circle' was started in 1991. Each student of mathematics department is a member of this organization. This organisation continues to try in making mathematics more interesting by dispelling phobia of mathematics through various seminars, popular lectures and publications. A book on collection of research paper on mathematics “Matrix” was published by the Mathematics Department in 2017 through offline mode. This magazine is our first attempt through online mode. I hope readers will accept our e-magazine and encourage us.

Dr. Piroja Begum

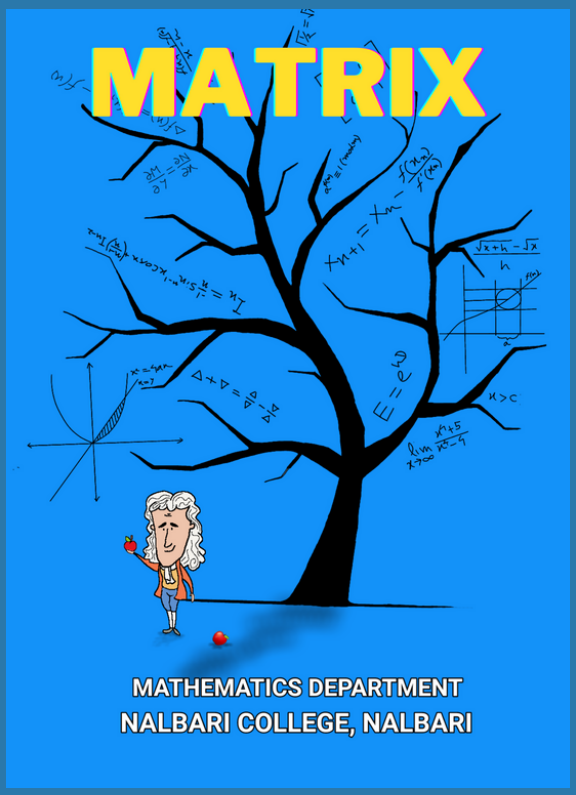
EDITORIAL



Mathematics for everyone

Mathematics is a subject that is often feared and avoided by many individuals. This fear is largely due to the perception that mathematics is a difficult and abstract subject that is only suitable for individuals with a natural inclination towards numbers. However, this perception is far from the truth, as mathematics is a subject that is fundamental to our everyday lives and is accessible to everyone with a willingness to learn. It is essential that we recognize the importance of mathematics in our daily lives. From calculating our grocery bills to understanding the principles of investments and savings, mathematics is a vital tool that can help us make informed decisions in all areas of life. By improving our mathematical abilities, we can gain a better understanding of the world around us and become more capable of solving complex problems. Furthermore, the idea that mathematics is only for the intellectually gifted is a myth that must be dispelled. Anyone can become proficient in mathematics with the right mindset and approach. In fact, many studies have shown that individuals who struggle with mathematics can improve their abilities with practice and perseverance. Therefore, it is crucial that we work towards making mathematics accessible to everyone. This can be achieved by promoting a positive attitude towards mathematics and providing adequate resources and support to individuals who need it. Schools and educational institutions must also play a significant role in promoting the importance of mathematics and providing a strong foundation in the subject to their students.

In conclusion, mathematics is a subject that is essential for everyone to learn and understand. By recognizing its importance and promoting a positive attitude towards the subject, we can create a society that is more capable of solving complex problems and making informed decisions. Let us work towards making mathematics accessible to everyone and dispelling the myth that it is only for the intellectually gifted. □



First Edition

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Assamese section

Prime Gaps and Twin Primes

"Mattia thought that he and Alice were like that, twin primes, alone and lost, close but not close enough to really touch each other."

–The Solitude of Prime Numbers,
Pablo Giordano

SOmeone might ask the real life applications of prime numbers or is there any practical use of primes at all? The answer is yes. Number theory enables us to apply the encryption algorithms used millions of time each day to secure online transactions with military strength secret communication. These encryption algorithms are difficult to break as the decryption requires decomposition of an enormous number into its prime factor.

But the reason of the obsession with primes is not only its practical applications. Prime numbers are the fundamental building blocks of Arithmetic. The fundamental theorem of arithmetic states that any number can be factored into primes in a unique way. We can compare it with atoms. Just as everything is made of atoms, every number is composed of primes. But the main problem is its mysterious behavior that is yet to be generalized. Unlike atoms, they refuse to follow any simple pattern or a structured categorization akin to periodic table. The anomaly is evident in the first 10 primes- 2, 3 5, 7, 11, 13, 17, 19, 23, 29.

It starts with 2, the only even prime. The first, smallest, and only odd prime gap is the gap of size one between 2, the only even prime number, and 3, the first odd prime. All other prime gaps are even. Apart from 2 the rest of the primes are all odd. Sometimes they are two spaces apart (11 and 13), sometimes four (13 and 17) and sometimes six spaces apart (23 and 29). This gap between two successive primes is called prime gap.

As we march towards infinity on the number line, primes become rarer. We get ten primes in the first thirty numbers which implies that near the beginning of the number line one third of the whole numbers are primes. But among the first hundred numbers, only twenty-five are prime. Their ranks have dwindled to one in four, a worrisome 25 percent. And among the first billion numbers, a mere 5 percent are prime. Primes never die out completely but they fade into near oblivion.

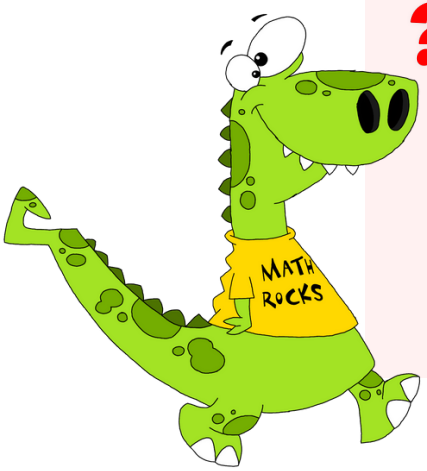
Number theorists have quantified how desolate the prime numbers truly are, as expressed by a formula for the typical spacing between them. If N is a large number, the average gap between the primes near N is approximately equal to lnN, the natural logarithm of N. Although the lnN formula for the average spacing between primes doesn't work too well when N is small, it improves in the sense that its percentage error goes to zero as N approaches infinity.

For example we take N = 1,000. It turns out there are 168 prime numbers less than 1,000, so the average gap between them in this part of the number line is 1,000/168, or about 5.9. For comparison, the formula predicts an average gap of ln(1,000) ≈ 6.9, which is too high by about 17 percent. But when we go much farther out, say to N = 1,000,000,000, the actual and predicted gaps become 19.7 and 20.7, respectively, an overestimate of only about 5 percent.
The validity of the lnN formula as N tends to infinity is now known as the prime number theorem. It was first noticed (but not published) by Carl Friedrich Gauss in 1792 when he was fifteen years old.

There's another confounding aspect of primes- the existence of twins primes. A twin prime has a prime gap of two. For example 11 and 13, 41 and 43 etc. Twin primes become increasingly rare as one examines larger ranges, in keeping with the general tendency of gaps between adjacent primes to become larger as the numbers themselves get larger. However, it is unknown whether there are infinitely many twin primes or if there is a largest pair. The problem known as twin prime conjecture says couples like this will turn up forever. . Computers have found twin primes at unbelievably remote parts of the number line. The largest known pair consists of two numbers with 100,355 decimal digits each. The breakthrough work of Yitang Zhang in 2013, as well as work by James Maynard, Terence Tao and others, has made substantial progress towards proving that there are infinitely many twin primes, but at present this remains unsolved.

- Manjima sarma
Department of mathematics (2019-22)

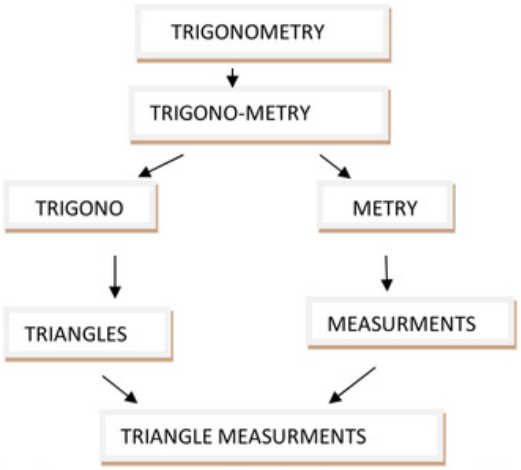
DO YOU KNOW ?



The **largest known prime number** is $2^{82589933} - 1$, a number which has 24,862,048 digits when written in base 10. It was found via a computer volunteered by Patrick Laroche of the Great Internet Mersenne Prime Search (GIMPS) in 2018.

REAL LIFE SCENARIO OF TRIGONOMETRY

"TRIGONOMETRY" is a combination of two Greek words "TRIGONO" AND "METRY". As below in the figure:-



Thus the trigonometry means the triangle measurments.Now we know that a triangle has six parts; three angles and three sides. Therefore, the triangle measurments is actually the measurements of its sides and angles.

REAL LIFE APPLICATIONS:-

IN MEASURING THE HEIGHT OF BUILDING AND MOUNTAINS:-

In measuring the height of building and mountains it is considered that building or mountains as the perpendicular and the base of the building is on the plane road. Now this building or mountain baseline is considered as the base of the triangle.At last,the line of sight is considered as the hypotenuse of the right-angled triangle.Then,this situation is considered as the application of a right-angled triangle.Hence we can use the trigonometric functions as sine, cosine, tangent etc to find the height and distance of the buiding or the mountain . Therefore the measurement of the height and distance of the mountain or building is the real life application of trigonometry.

IN AVIATION OR FLIGHT ENGINEERING:-

When an Airopalne flies in the sky then it gets more affected by the wind. Thus, wind plays an important role in aviation technology.The wind of flight direction is considered as the two perpendicular sights of a right angled triangle in which the speed of wind and speed of the flight is measured in their direction.Thus by using the definition of trigonometrical ratios,we can easily calculate the direction of the destination.Therefore, flight engineering is the real life application of trigonometry.

IN INVESTIGATION OF CRIME SCENE OR CRIMINOLOGY:-

To investigate a crime,we need to identify the causes of any accidents,how the objects fall or what the angle is shot by the gun.All of these crimes are related to the angles and sides of the trajectory or triangle.Hence,this criminology is also considered as the real life application of trigonometry.

IN MARINE BIOLOGY:-In marine biology,the biologist studies the marine life,that means it is the education of plants.animals and other organism that lives in the saltwater in the sea.Thus marine life means sea life or ocean life.Now, when biologist studies about marine life it always observes the animals and other organism etc in the water and their behaviour, depth from water level etc.All the sunlight and phtosynthesis effects are studied.Now, to measure the depth of the animal from the water level,it is considered as perpendicular to the right-angled triangle and sea level is considered as base of the right-angled triangle.Hence we can conclude the exact location of animals or another organism in the water from the surface of the water level by using the properties of a right-angled triangle or we can also use the concept of trigonometric ratios and function.Thus this marine biology is also considered as the real life application of trigonometry.

IN NAVIGATION:-

In navigation,we study about the process of monitoring and controlling the movement of craft or vehicle from a fixed location.It means,it is the process of determining the position and the direction of any moving bodieson or above the earth.Thus,the navigation can be any type of marine navigation,land navigation,aeronotic navigation and space navigation,Now to measure the exact location of these moving bodies,the compass and pinpoint poles are used that is based concept of trigonometric function.Hence navigation is also the real life application of trigonometry.

IN VIDEO GAMES:-

In gaming industries,a very popular video game known as MARIO game,where the mario smoothly glide over the road blocks and and uses a curve path or parabolic path to cross the obstacle.This jump of mario developed by using the trigonometric function.Hence,the video game developed is also the real life application of trigonometry.

IN SOUND WAVES OR LIGHT WAVES:-

Sound waves travels in a repeating waves pattern and it is graphically represented by the sine and cosine curve of trigonometric function.Hence,the trigonometric function is very helpful for the study of sound waves and hence it is the real life application of trigonometry.

IN ROOF INCLINATION:-

In some buildings specially in bungalows,the roof of the house is inclined.This inclination of roof is measured by using the application of triginometry

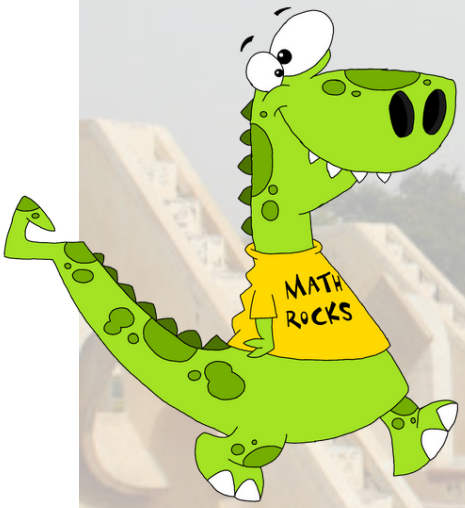
function.Trigonometry defines the relationship between the sides of roofs and inclination of the roofs.Thus,the roof inclination in the buildings is also considered as the real life application of trigonometry.

IN SATELLITE:-

In the satellite system,we need to study the location and its postion.Its location and postion is measured by using the trigonometric function.Hence it is also considered as the real life application of trigonometry.

- Rupjyoti sarma
Department of mathematics (2019-22)

DO YOU KNOW ?



Jantar Mantar in Jaipur has the world's biggest stone sundial called as Brihat Samrat Yantra. This instrument gives the local time at the accuracy of two seconds. The structure is over 27m high. The reason behind the enormous Samrat Yantra is the accuracy.

The words Jantar and Mantar derive from Sanskrit words Jantra and Mantra that mean 'instrument' and 'calculate' respectively, which makes the meaning of Jantar Mantar as "a calculating instrument".

Jantar Mantar was built to study time and space. The structure in Jaipur is a complex of nineteen architectural astronomical instruments, and is still running and being used for calculations and teaching. It is used to observe and study the orbits around the Sun.

Zeno's Dichotomy Paradox

A paradox is a logically self-contradictory statement or a statement that runs contrary to one's expectation. A paradox usually involves contradictory-yet-interrelated elements that exist simultaneously and persist over time. One very famous paradox is that everyone has heard is "Chicken or Egg: Who comes first?". Another one is barber's paradox "Once a barber states that he shaves all those who don't shave themselves". Now the question is "Does the barber shave himself?"

Mathematics- a large system of logic, a kind of universal language also contains hundreds of beautiful and interesting paradoxes and unsolved conjectures. These paradoxes have puzzled and fascinated the mind of mathematicians from ancient Greeks, Hindus, Chinese, and other civilizations to the quantum theory of 20th century. Some are false paradoxes: they don't present actual contradictions, and merely superficial logic tricks. However, many other conjectures and open problems have shaken the very foundations of mathematics-requiring brilliant, creative thinking to resolve. And some others remain unresolved to this day.

Zeno of Elea, Greek philosopher and mathematician is well known for his paradoxes that contributed to the development of logical and mathematical rigour and that were unsolvable until the development of precise concepts of continuity and infinity. Zeno came up with a list of paradoxes but in this article we only look at Zeno's most famous paradox "The Dichotomy Paradox" that not just interest to mathematicians but also interest to physicists and philosophers.

This paradox is known as the 'dichotomy' because it involves repeated division into two. Let us grasp this paradox with the help of following illustration- Zeno proposes that in order to travel any arbitrary distance, one must travel 1/2 way of the destination, but before one can reach the halfway point, one must first travel half way there, to the 1/4 point etc. One can keep dividing this initial required distance forever, therefore, according to his reasoning, one can never reach the goal. Let us make it more clear to understand with an example: Suppose a person needs to run for the bus. Clearly before he reaches the bus stop he must run half-way. Supposing a constant motion it will take his 1/2 the time to run the half-way there and 1/2 the time to run the rest of way.Now she must also run half-way to the half-way point-i.e., a 1/4 of the total distance-before he reaches the half-way point, but again he is left with a finite number of finite lengths to run, and plenty of time to do it. And before he reaches 1/4 of the way he must reach 1/2 of 1/4 =1/8 of the way; and before that a 1/16; and so on. By continually halving the remaining distance, the person will walk an infinite interval of distances and still remain slightly away from his final destination. So this means that travelling between any two points will take an infinite amount of time or in other words, it says that all motion is impossible as Zeno's point of view, which is totally absurd. Then where is the flaw in the logic? Let's supposed that the distance is 1 km to the

bus stop and the person walks at 1km/hr. Common sense tells us that the time for the journey should be 1 hr. To resolve the paradox we need to convert it into a math problem.

To get the total distance we need to add up the infinitely many finite-sized terms.

Let, S (total distance) = 1/2 + 1/4 + 1/8 + 1/16 + 1/32 + ----------∞

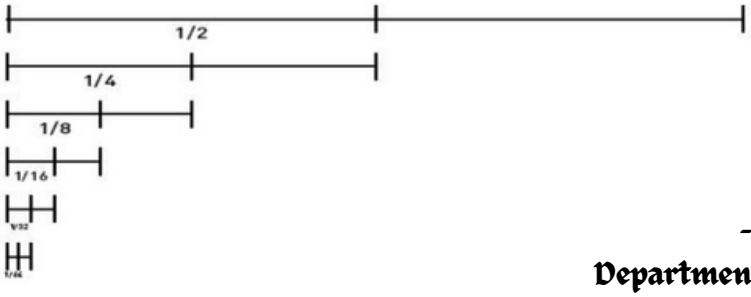
2 S = 1 + 1/2 + 1/4 + 1/8 + 1/16 +----------∞

2 S = 1 + S

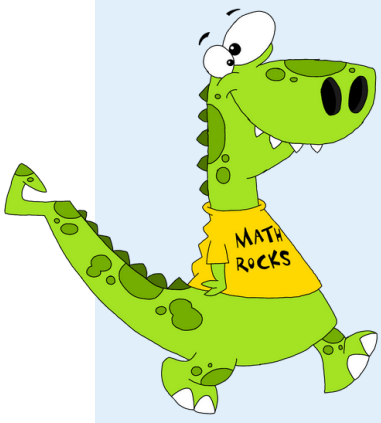
S = 1

So, now we can see that the paradox is resolved. Not only does the infinite series sum to a finite answer, but that answer is the same one that common sense tells us is true i.e., sum of an infinite series don't always diverge.

Zeno's Dichotomy Paradox is a great example showing how an infinite amount
of numbers don't always sums up to infinity. Zeno's paradoxes are not remotely paradoxical to modern mathematics. Taking the limit as n tends to infinity it can be easily resolved.



- Dipinti barman
Departmentof mathematics (2019-22)



DO YOU KNOW ?

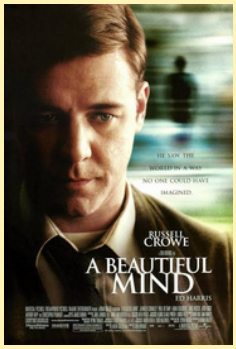
Pierre de Fermat (1607-1665) wasn't a professional mathematician or scientist. He was a lawyer and an official in his local government who only did mathematics as a hobby. Even so, the letters he wrote to intellectuals all over Europe paved the way for a number of major discoveries, and his theorems and conjectures have challenged amateurs and professionals alike for centuries. His famous "Last Theorem" holds the record for the most wrong proofs ever published. It wasn't correctly proved until 1994.

6 MOVIES YOU MUST WATCH

1.The Imitation Game (2014) :

It is based on the real life story of legendary cryptanalyst Alan Turing. The film portrays the nail-biting race against time by Turing and his brilliant team of code-breakers at Britain's top-secret Government Code and Cypher School at Bletchley Park, during the darkest days of World War II.

2. A Beautiful Mind (2001) :



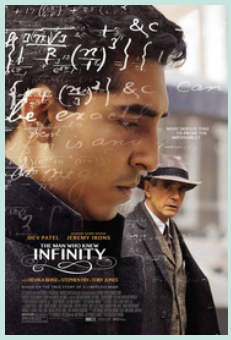
A Beautiful Mind, American biographical film, released in 2001, that told the story of American Nobel Prize winner John Nash, whose innovative work on game theory in mathematics was in many ways overshadowed by decades of mental illness.

3.Good Will Hunting (1997) :

The movie is about Will Hunting, a janitor at M.I.T., has a gift for mathematics, but needs help from a psychologist to find direction in his life.

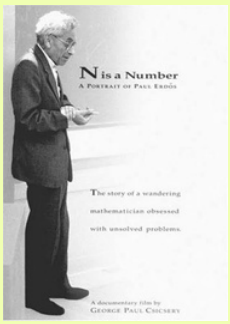
4. The Man Who Knew Infinity (2015) :

The story of the life and academic career of the pioneer Indian mathematician, Srinivasa Ramanujan, and his friendship with his mentor, Professor G.H. Hardy.

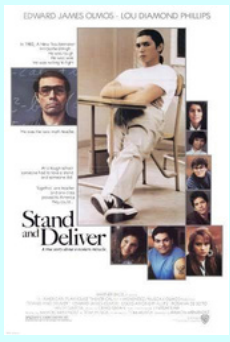


5. N Is a Number: A Portrait of Paul Erdös (1993) :

N Is a Number: A Portrait of Paul Erdos is a 1993 biographical documentary about the life of mathematician Paul Erdos, directed by George Paul Csicsery.



6. Stand and Deliver (1988) :



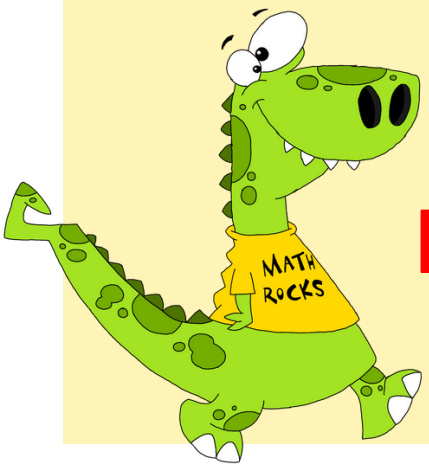
The story of Jaime Escalante, a high school teacher who successfully inspired his dropout-prone students to learn calculus.

INTERESTING AND AMEZING FACTS OF MATHEMATICS

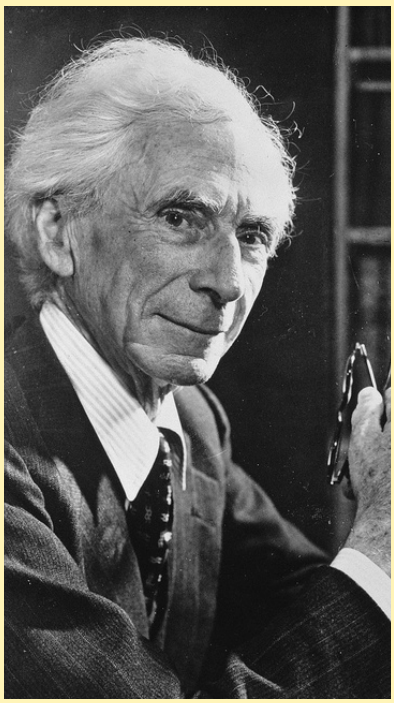
- Nature loves Fibonacci sequences.
- If you multiply 111,111,111 × 111,111,111 you get 12,345,678,987,654,321 – a palindrome number that reads the same forwards or backwards and that works all the way back down 11 × 11 (121) or just 1 × 1 (1).
- From 0 to 1000 the letter “a” only appears in 1000 (one thousand).
- -40 ˚C is equal to -40 ˚F .
- Zero is the only one number that can’t be represented in Roman Numerals.
- Pi and Pizzas are linked.
- The symbol for division (i.e. ÷) is called an obelus.
- The golden ratio or golden mean, represented by the Greek letter phi (φ), is an irrational number that approximately equals 1.618.
- One of the most important numbers in our universe is the number Pi or π .
- A baseball field is of the perfect shape of a rhombus.

~Kuldeep Sarma
Departmentof mathematics (2021-24)

- **Bertrand Russell is the only Mathematician Who Won the Nobel Prize for Literature in 1950.**



DO YOU KNOW ??



INDIAN HISTORY OF MATHEMATICS

The history of mathematics deals with the origin ascertain of mathematic and mathematical methods. Before the modern age , Only in a few locales written examples of new mathematical developments have come to light.

The Indusvally civilization(2600BC—1900BC) is the earliest civilization on the Indian subcontinent that thrive on the basin of Indus river. Their cities were laid out with geomatrical regularity, But on known mathematical documents is survive from the Indus vally civilization.

The sulba sutras (between 8th century BC and the 2th century AD) are the oldest extant mathematical records from India, appendices to religious texts. Which give simple rules for constructing altars of various shapes, such as squares, rectangles, parallelograms and others. The sulba sutras give methods for constration circle with approximately the same area as given square, which imply several different approximation of the value of pie. In addition, they compute the square root of 2 to several decimal places, list Pythagorean triples and give a statement of pythagorean theorem. All these result present in Babylonian mathematics, indicating Mesopotamian influence.

Panini was a Sanskrit philologist, grammarian and revered scholar in ancient India, variously dated between the 6th and 4th century BCE. His notation was the similar to modern mathematical notation and used metarules, transformation and recursion. Pingala (3rd – 2nd century BCE, was an
ancient Indian poet and mathematician) in his treatise of prosody uses device corresponding to a binary numeral system. His discussion of the combinatorics of meters corresponds to an elementary version of the binomial theorem Pingala's work also contains the basic ideas.

The next significant mathematical documents from India after the sulba sutras are the siddhants (During Gupta period) they are significant in that they contain the first instance of trigonometric relation based on half-chords, as was the case in Ptolemaic trigonometry.

In the 7th century, Brahmagupta identified the Brahmagupta theorem, Brahmagupta's indentity and Brahmagupta's formula and for the first time in Brahma-Sphuta-siddhanta, He lucidly explained the use of zero and explained Hindu-Arabic numerals system. In the 10th century, Halayudha's commentary on Pingala's work contains a study of the fibonacci sequence and Pascal's triangle, and describes the formation of a matrix.In the 12th century, Bhakara II lived in southern India and wrote extensively on all then known branches of mathematics.

His work contains mathematical objects equivalent or approximately equivalent to infinitesimals, derivatives, the mean value theorem and the derivative of the sine function. To what extent he anticipated the invention of calculus is a controversial subject among historians of mathematics.

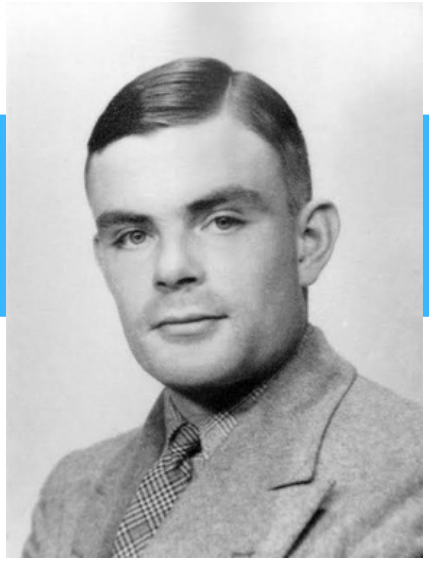
In the 14th century, Madhava of Sangamagrama, the founder of the Kerala school of mathematics, found the Madhava-Leibniz series and obtained from it a transformed series, whose first 21 terms he used to compute the value of pie as 3.14159265359. Madhava also found the Madhava-Gregory series to determine the arctangent and more.

- Hrishikesh barman
Department of mathematics (2021-24)

DO YOU KNOW ?

- Aryabhata calculated calculated that the circumference of the earth as being 39968.05 km, which is very close to the modern-day scientific calculation of 40072.66 km.
- He also calculated the time for one sidereal rotation of the earth as 23 hours 56 minutes 4.1 seconds.
- One of Aryabhata's most important contributions is his approximation of the value of 'pi', or π.
- Aryabhata devised Calendric calculations and these calculation have been in continuous use in India for the practical purposes of fixing the Panchangam (the Hindu calendar).
- In the Islamic world, the group of astronomers including Omar Khayyam introduced Jalali calendar in 1073 CE based on Aryabhata's calculation

Alan Turing: An overview on his work and his life



On the morning of 8th June, 1954, the housekeeper found her master, a reader at Manchester University, dead. He was found lying neatly on his bed and beside his bedside was a half-eaten apple. It was speculated that the apple was laced with cyanide and the master had taken a fatal dose. At that time he was consulting a psychiatrist. He had been convicted of “gross indecency”- that is to say homosexuality back in 1952 and was forced to take hormonal conversion therapy. From a general perspective it seemed like an act of self –annihilation from shame and the chemical castration he had gone through but for the few people who knew this private man, the news of his sudden death came as a shock. For them he was simply ‘not the type’ for suicide. He had a good health and free of financial trouble. For them he exhibited no signs of depression and was hopeful about the future. Again he took his homosexuality as a normal inclination rather than a shameful tendency and never tried to hide the fact.
His mother countered the verdict- she declared it an accident. Her son cared little about cleanliness and on the fateful night he was engrossed in a chemical experiment that required the use of cyanide. She argued that her son had got cyanide on to his hands by accident and then into his mouth.
But nonetheless it was declared a suicide due to an instable state of mind.
For the next 40 years he remained an anonymous semi successful professor who died a criminal, his name. It was only in 1990s when the full story of Bletchley Park was revealed when Alan Turing became an overnight hero and was declared the Father of modern computer science.

Early Life : Alan Turing was born in Maida Vale on 23th June, 1912. His father was an ICS (Indian Civil Service) officer and his mother Ethel Sara Turing was from an eminent family of engineers. He had an elder brother John Turing.
From his early days at Sherborne School he showed natural inclination towards Science and Mathematics. But the most Impactful incident of his early life that influenced him to dive deep into the world of Mathematics and inspired his future endeavours was the death of his fellow student Christopher Morcom.
Christopher Morcom himself was a prodigy at science and mathematics. He was one year older than Alan and a year ahead of him in school. But lonely Alan quickly formed a friendship with popular and charismatic Christopher on their mutual interest of Mathematics and started to share their thoughts and ideas. Slowly Alan fall in love with him. But the relationship was not destined to last for long.
Just 3 years after their first meeting at Sherborne school library, Christopher Morcom died from complications of bovine tuberculosis in February 19, 1930. The

news came as a great shock to Alan who was unaware of his illness. In a letter to Christopher's mother Alan wrote "I am sure I could not have found anywhere another companion so brilliant and yet so charming and unconceited. I regarded my interest in my work, and in such things as astronomy (to which he introduced me) as something to be shared with him and I think he felt a little the same about me ... I know I must put as much energy if not as much interest into my work as if he were alive, because that is what he would like me to do."
Christopher's early demise is speculated to be the cause of his atheism and his materialistic outlook on life.
Alan took his undergraduate degree from King's College, Cambridge University. At the age of 22 he was elected a Fellow of King's College on the strength of a dissertation in which he proved a version of the central limit theorem.

On computable Numbers : In January 1937 Alan published one of his most significat work with the title "On Computable Numbers, with an Application to the Entscheidungsproblem". In this paper he first introduced the concept of Turing machines and Universal Machine.
The Entscheidungsproblem or the decision problem was a challenge posed by David Hilbert and Wilhelm Ackermann in 1928. The problem demanded of an algorithm that would take a statement as input and would answer in terms of "Yes" or "No" after evaluating it through a set of axioms. Turing reduced the question of the existence of an 'algorithm' or 'general method' able to solve the Entscheidungsproblem to the question of the existence of a 'general method' which decides whether any given Turing machine halts or not. The halting problem is the problem of determining, from a description of an arbitrary computer program and an input, whether the program will finish running, or continue to run forever. Alan Turing proved in 1937 that a general algorithm to solve the halting problem for all possible program-input pairs cannot exist and thus an algorithm for the Entscheidungsproblem or the decision problem doesn't exist. It was a simple, elegant and extremely intuitive approach to the problem compared to that of Alonzo Church's equivalent proof using his lambda calculus. The paper is often regarded as the most influential paper in the history of mathematics. Legendary computer scientist and mathematician John von Neumann acknowledged that the central concept of the modern computer was due to Turing's paper. To this day, Turing machines are a central object of study in theory of computation.
In June 1938, he obtained his PhD from the Department of Mathematics at Princeton. His dissertation titled Systems of Logic Based on Ordinals introduced the concept of ordinal logic and the notion of relative computing.

World War II : During Second World War Turing was recruited by Government Code and Cypher School, the British government codebreaking organisation. During these years he was totally engaged in the mastery of the German enciphering machine, Enigma, and other cryptological investigations at now-famous Bletchley Park, the British government's wartime communications

headquarters. Turing made a unique logical contribution to the decryption of the Enigma and became the chief scientific figure, with a particular responsibility for reading the U-boat communications. As such he became a top-level figure in Anglo-American liaison, and also gained exposure to the most advanced electronic technology of the day.
Combining his ideas from mathematical logic, his experience in cryptology, and some practical electronic knowledge, his ambition, at the end of the war in Europe, was to create an electronic computer in the full modern sense. His plans, commissioned by the National Physical Laboratory, London, were overshadowed by the more powerfully supported American projects. Turing also laboured under the disadvantage that his wartime achievements remained totally secret. He was required to sign the Official Secrets Act, in which he agreed not to disclose anything about his work at Bletchley, with severe legal penalties for violating the Act. His ideas led the field in 1946, but this was little recognised. By using statistical techniques to optimise the trial of different possibilities in the code breaking process, Turing made an innovative contribution to Cryptanalysis. He wrote two papers discussing mathematical approaches, titled The Applications of Probability to Cryptography and Paper on Statistics of Repetitions, which were of such value to GC&CS and its successor GCHQ that they were not released to the UK National Archives until April 2012.
The work of Bletchley Park – and Turing's role there in cracking the Enigma code – was kept completely secret until the 1970s, and the full story was not known until the 1990s. It has been estimated that the efforts of Turing and his fellow code-breakers shortened the war by several years.

The Imitation Game : His next ground-breaking idea was published in 1950. In his paper titled "Computing Machinery and Intelligence" Turing made pioneering development on Artificial Intelligence. Turing proposed that a computer would deserve to be called intelligent if it could deceive a human into believing that it was human and introduced his famous “Turing Test” to define a standard of an intelligent machine. In the paper, Turing suggested that rather than building a program to simulate the adult mind, it would be better to produce a simpler one to simulate a child's mind and then to subject it to a course of education. A reversed form of the Turing test is widely used on the Internet; the CAPTCHA test is intended to determine whether the user is a human or a computer.
The paper “Computing Machinery and Intelligence” is one of the most frequently cited paper in modern philosophical literature. It gave a fresh approach to the traditional mind-body problem, by relating it to the mathematical concept of computability he himself had introduced in his 1936–7 paper “On computable numbers, with an application to the Entscheidungsproblem.” His work can be regarded as the foundation of computer science and of the artificial intelligence program.
In 1951 Alan shifted his attention to Mathematical biology and produced another masterpiece "The Chemical Basis of Morphogenesis". Although published before the structure and role of DNA was understood, Turing's work on morphogenesis

remains relevant today and is considered a seminal piece of work in mathematical biology.

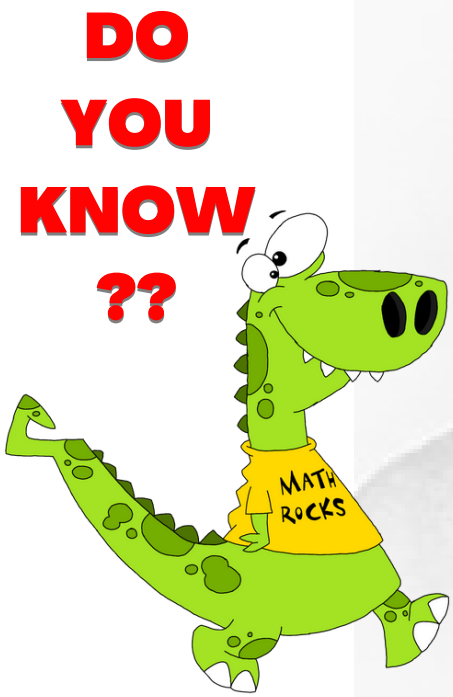
The fateful event : But an incident in 1952 changed his life forever. His home was burgled. As the investigation went on, Turing's homosexual relationship with a man named Arnold Murray came to light. Alan was convicted of "gross indecency" and was ordered to choose between imprisonment and probation in form of "chemical castration". He chose the latter and was forced to undergo hormonal therapy for one year. Although things are not so clear, it is suspected that the therapy messed up the stability of his mind.
In 1954, he was found dead at his house.

The man through the lens of other people : Alan Turing wasn't considered as a very social person. People didn't get a second chance with him. If they were able to keep up with is rather fast thought process, If they tuned into a Turing wavelength, they would receive hours of attention at full blast, with an almost embarrassing intensity. But with a wobble of frequency, a hint of being judged by conventional or second hand standards, the door of conversation closed unapologetically.
in case of dealing with society he had the same approach as his theoretical Universal machine- in terms of "yes" and "no."
'Boyish' or 'schoolboyish' was the word that still came to many lips to describe the immediacy of his presence, his shaggy, dog-eared, larger-than-life appearance. Writer Lyn Irvine, the wife of scientist Max Newman was struck by Alan, with 'his off-hand manners and his long silences – silences finally torn up by his shrill stammer and the crowing laugh which told upon the nerves even of his friends'; there was his 'strange way of not meeting the eye' and of 'sidling out of the door with a brusque and off hand word of thanks.' She saw him as 'a very strange man, one who never fitted in anywhere quite successfully. His scattered efforts to appear at home in the upper-middle class circles into which he was born stand out as particularly unsuccessful. He did adopt a few conventions, apparently at random, but he discarded the majority of their ways and ideas without hesitation or apology. Unfortunately the ways of the academic world which might have proved his refuge, puzzled and bored him . . .'
During WWII days, his trivial examples of 'eccentricity' circulated in Bletchley circles. Near the beginning of June he would suffer from hay fever, which blinded him as he cycled to work, so he would use a gas mask to keep the pollen out, regardless of how he looked. The bicycle itself was unique, since it required the counting of revolutions until a certain bent spoke touched a certain link (rather like a cipher machine), when action would have to be taken to prevent the chain coming off. There was his voice, liable to stall in mid-sentence with a tense, high-pitched 'Ah-ah-ah-ah-ah' while he fished, his brain almost visibly labouring away, for the right expression, meanwhile preventing interruption. The word, when it came, might be an unexpected one, a homely analogy, slang expression, pun or wild scheme or rude suggestion accompanied with his machine-like laugh. He cared little for appearances, least of all for his own, generally looking as though he

had just got up.
He had a very small social circle. Once he told one of his friends-“I have more relation to this bed than the outside world.” He was particularly fond of his mother and often explained her his ideas and tried to make her more literate about his work. He was also a big admirer of George B. Shaw and often enjoyed his plays in theatre.
As a world class marathon runner, in 1949 he almost represented UK in the Olympics but pulled out due to injury.
Biographer Andrew Hodges writes that “It is a pity that Turing did not write more about his ethical philosophy and world outlook. As a student he was an admirer of Bernard Shaw's plays of ideas, and to friends would openly voice both the hilarities and frustrations of his many difficult situations.”
‘The Imitation Game’, a movie loosely based on his life was released in 2015.
Turing has also emerged as an LGBTQA+ icon in modern times. A statue of Turing was unveiled in Manchester on 23 June 2001 in Sackville Park, between the University of Manchester building on Whitworth Street and Canal Street.
A plaque at the statue's feet reads 'Father of computer science, mathematician, logician, wartime codebreaker, victim of prejudice', which sums up his whole life in a single sentence.

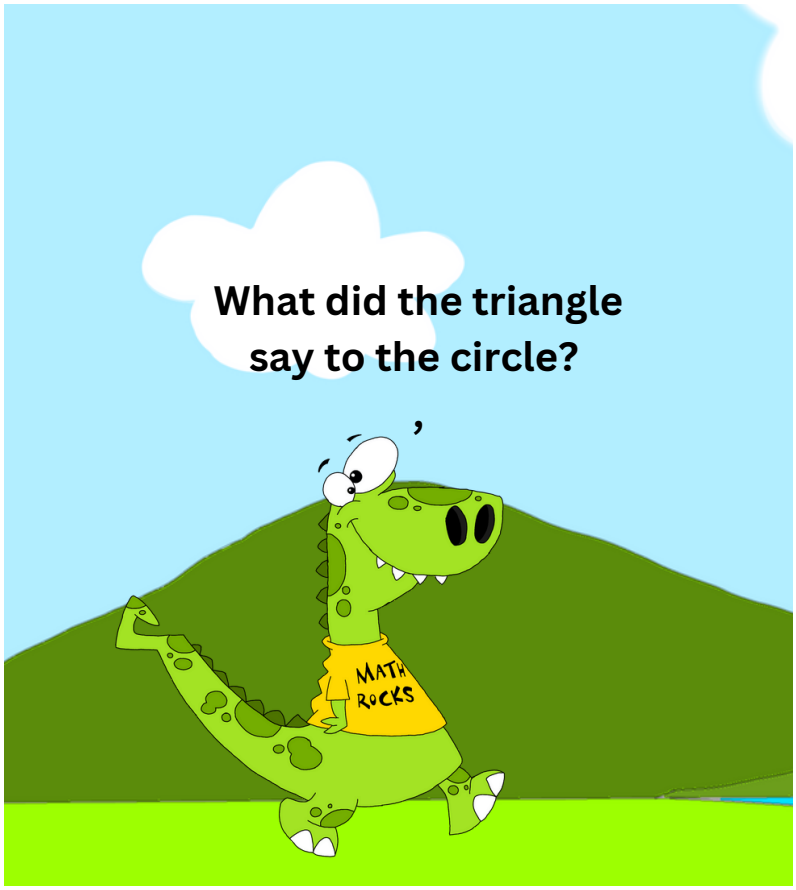
- Manjima sarma
Department of mathematics (2019-22)

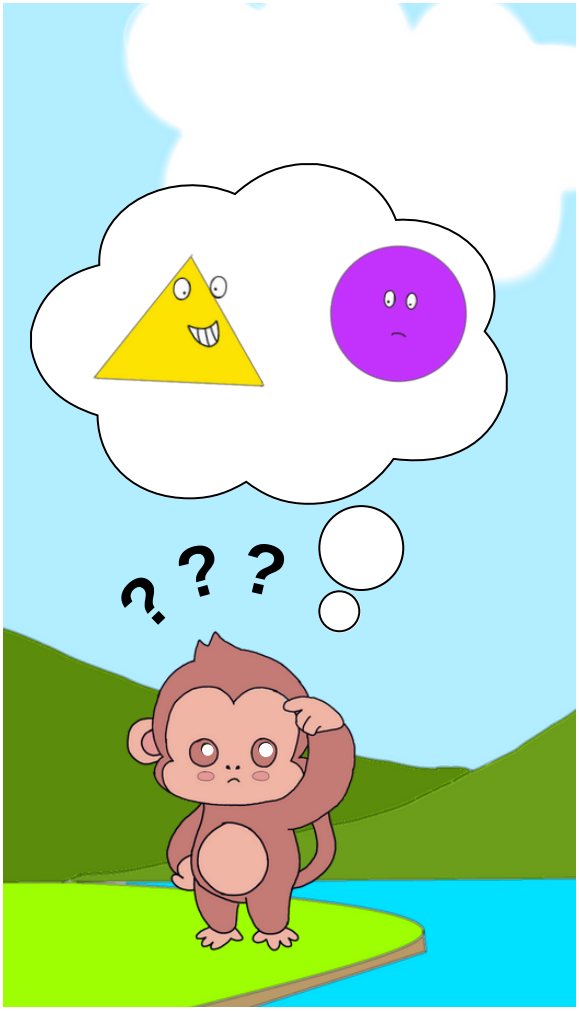
Taxicab numbers



In a famous anecdote, Hardy took a cab to visit Ramanujan. When he got there, he told Ramanujan that the cab’s number, 1729, was “rather a dull one.” Ramanujan said, “No, it is a very interesting number. It is the smallest number expressible as a sum of two cubes in two different ways. That is,
1729 = 1^3 + 12^3 = 9^3 + 10^3. This number is now called the Hardy-Ramanujan number, and the smallest numbers that can be expressed as the sum of two cubes in n different ways have been dubbed taxicab numbers. The next number in the sequence, the smallest number that can be expressed as the sum of two cubes in three different ways, is 87,539,319.


MATH ROCKS
Mr. Dino


What did the triangle say to the circle?
MATH ROCKS


? ? ?


“You’re pointless.”
MATH ROCKS

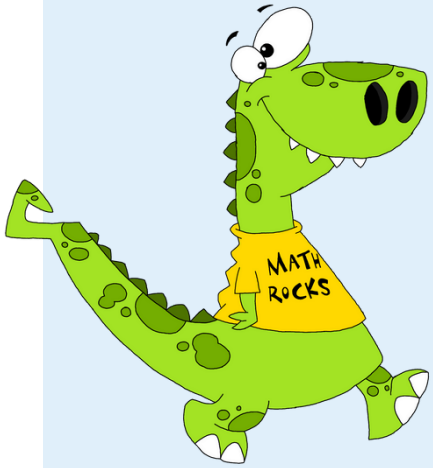
What is zero?

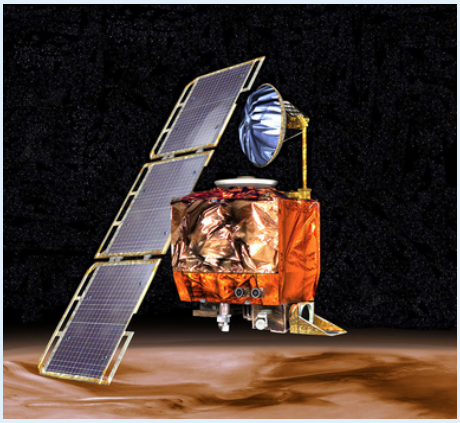
Zero is a stranger number and one of the greatest paradoxes of human thought. It means both everything and nothing. It is both a number and a numerical digit used to represent that numbers in numerals. It fulfils a central role in mathematics as the additive identity of the integers, real numbers and many other algebraic structures. Without zero, not just mathematics but all branches of science would have struggled for proper definitions. As a digit, 0 is used as a placeholder in place value system. The value of zero is well known today as it holds the highest value today. Without the invention of 0, the binary system and computer are not possible. It is the greatest invention on which every calculation depends. Zero is a tiny number but it can never be ignored.

- Dhritisman Dutta
Department of mathematics (2020-23)

DO YOU KNOW ??

The Mars Climate Orbiter was a robotic space probe launched by NASA in 1998 to study the Martian climate, atmosphere and surface changes. Communication with the orbiter was permanently lost as it went into orbital insertion. The reason behind the orbital insertion failure is the Measurement mismatch between two software systems- one using metric and the other using imperial units.





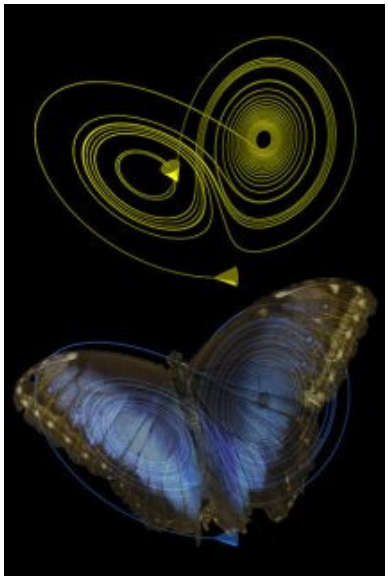
The Butterfly Effect

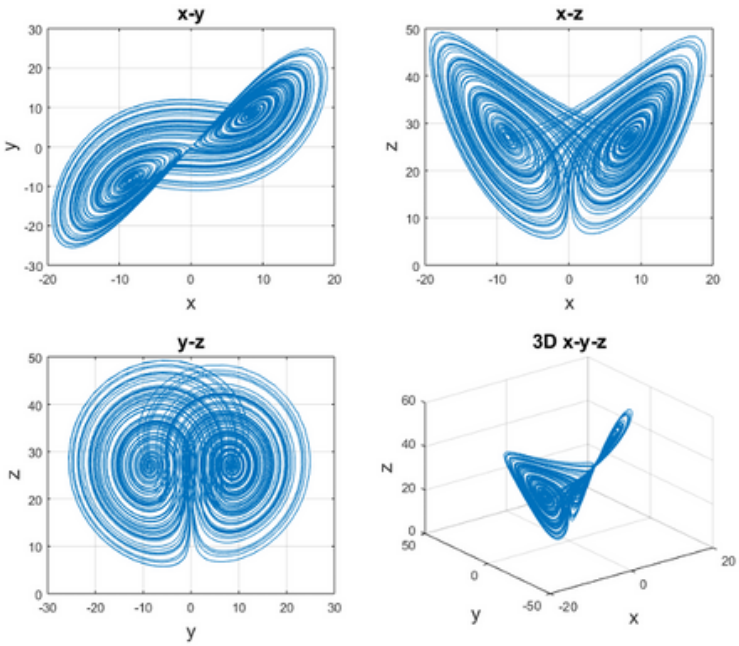
Nearly 45 years ago, during the 139th meeting of the American Association for the Advancement of Science, Edward Lorenz posed a question: “Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?”

Lorenz was a mild-mannered Massachusetts Institute of Technology meteorology professor.The purpose of his provocative question was to illustrate the idea that some complex dynamical systems Exhibit unpredictable behaviours such that small variances in the initial conditions could have profound and Widely divergent effects on the system’s outcomes. Because of the sensitivity of these systems, outcomes Are unpredictable. This idea became the basis for a branch of mathematics known as chaos theory, which has Been applied in countless scenarios since its introduction. This idea was later named “the butterfly effect”. Lorenz’s insight called into question laws introduced as early as 1687 by Sir Isaac Newton suggesting that Nature is a probabilistic mechanical system, “a clockwork universe.” Similarly, Lorenz challenged Pierre-Simon Laplace, who argued that unpredictability has no place in the universe, asserting that if we knew all the Physical laws of nature, then “nothing would be uncertain and the future, as the past, would be present to our Eyes.”

Lorenz discovered the butterfly effect when he observed that runs of his weather model with initial Condition data that were rounded in a seemingly inconsequential manner. He noted that the weather model Would fail to reproduce the results of runs with the unrounded initial condition data. A very small change in Initial conditions had created a significantly different outcome. The phrase “the flap of a butterfly’s wings in Brazil set off a tornado in Texas” refers to the idea that a Butterfly’s wings might create tiny changes in the atmosphere that may ultimately alter the path of a Tornado or delay, accelerate or even prevent the occurrence of a tornado in another location. The Butterfly does not power or directly create the tornado, but the term is intended to imply that the flap Of the butterfly’s wings can cause the tornado: in the sense that the flap of the wings is a part of the Initial conditions of an inter-connected complex web; one set of conditions leads to a tornado while The other set of conditions doesn’t. The flapping wing represents a small change in the initial condition Of the system, which cascades to large-scale alterations of events. Had the butterfly not flapped its Wings, the trajectory of the system might have been vastly different but it’s also equally possible that The set of conditions without the butterfly flapping its wings is the set that leads to a tornado.Here are some examples of how the butterfly effect has shaped our lives.

•The bombing of Nagasaki. The US initially intended to bomb the Japanese city of Kuroko, with the Munition’s factory as a target. On the day the US planned to





attack, cloudy weather conditions Prevented the factory from being seen by military personnel as they flew overhead. The airplane Passed over the city three times before the pilots gave up. Locals huddled in shelters heard the hum of The airplane preparing to drop the nuclear bomb and prepared for their destruction.Except Kuroko was never bombed. Military personnel decided on Nagasaki as the target due to Improved visibility. The implications of that split-second decision were monumental. We cannot even Begin to comprehend how different history might have been if that day had not been cloudy. Kuroko is Sometimes referred to as the luckiest city in Japan, and those who lived there during the war are still Shaken by the near-miss.

•The Academy of Fine Arts in Vienna rejecting Adolf Hitler's application, twice. In the early 1900s, a Young Hitler applied for art school and was rejected, possibly by a Jewish professor. By his own Estimation and that of scholars, this rejection went on to shape his metamorphosis from an aspiring Bohemian artist into the human manifestation of evil. We can only speculate as to how history would Have been different. But it is safe to assume that a great deal of tragedy could have been avoided if Hitler had applied himself to water colours, not to genocide.From these examples it is clear how fragile the world is, and how dire the effects of tiny events can be On starting conditions.We like to think we can predict the future and exercise a degree of control over powerful systems Such as the weather and the economy. Yet the butterfly effect shows that we cannot. The systems Around us are chaotic and entropic, prone to sudden change. For some kinds of systems, we can try to Create favourable starting conditions and be mindful of the kinds of catalysts that might act on those Conditions but that's as far as our power extends. If we think that we can identify every catalyst and Control or predict outcomes, we are only deluding ourselves.

~ Bidisha dutta
Department of mathematics (2019-22)

No Nobel for Mathematics

Alfred Nobel's last will stated that his fortune is used to create a series of prizes for those whose contributions in the fields of physics, chemistry, physiology or medicine, literature, and peace were the "greatest benefit to mankind." However, no Nobel Prize was designated for Mathematics. There are various speculations on the possible reasons for this exclusion. Some of them are worth going through.
It is often discussed that Nobel found Maths too theoretical. Since he believed that only practical invention or discoveries could benefit mankind, he might have disregarded this subject whose practical applications are often obscure. The other (and the more dramatic) theory is an unfounded one. Rumours have it that Nobel disliked a contemporary Mathematician, Gosta Mittag-Leffler, with whom his partner allegedly cheated him. This made him detest the subject too and moreover, he didn't wish Leffler to win this prize (and the probability of this happening was quite high). The other reason can be linked with an already existing Math award. King Oscar II of Sweden and Norway had already established a prestigious award for Mathematicians and Nobel felt that instead of duplicating it, other fields should be given their due.
Whatever the reason be, there is no Nobel Prize in Mathematics. However, there is another prestigious award which is considered a parallel to the Nobel. It is the Abel Prize. It was proposed by a Norwegian Mathematician Sophus Lie when he learned that Noble had omitted Mathematics in his series of awards.

~ Jyotirmoy Baishya
Department of mathematics (2019-22)

'Pure Mathematics is, in its way, the poetry of logical ideas'

-Albert Einstein.

Zero Factorial

The value of 0 factorial (0!) and 1 factorial (1!) equal to 1, But why?? First, we need to understand what does n! means.

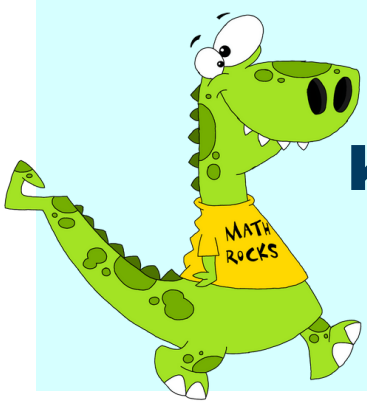
Logical aspect :-

n! gives number of ways of a possible arrangement of n different things(things must be different than only factorial is applicable)Now, 1! tells number of ways in which, we can represent one object.It should be one only. We can't represent one object by different arrangement but one.Coming on 0!:- If we don't have any thing(object) then in how many ways we can represent it to another person. obviously, one way that we have none that's it.

Mathematical aspect:-

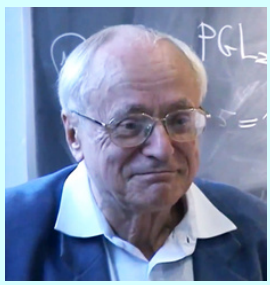
n! is defined as n! = n (n-1)(n-2)(n-3).....2.1
It can be written as,n! = n(n-1)!
=>n! /n = (n-1)!
putting n=1 both side.
we get, 1!/1= 0! .
hence, 0! = 1.
The same way if we put n=2 both side.
2!/2=(2−1)! .
hence, 1! =1
For these reasons the value of 0 factorial (0!) and 1 factorial (1!) equal to 1

~Abhijit haloi
Department of mathematics (2020-23)



Do you know ?

Jean-Pierre Serre is a French mathematician who has made contributions to algebraic topology, algebraic geometry, and algebraic number theory. He was awarded the Fields Medal in 1954, the Wolf Prize in 2000 and the inaugural Abel Prize in 2003.



Jean-Pierre Serre

The Man Who Knew Infinity

This is the story of a mathematical prodigy and his productivity towards the subject despite having a life of poverty and neglect . His amazing ability to understand messages and meaning lying in numbers and his genius and extraordinary brilliance in number theory and pattern of the number brought the focus of entire world towards India .

The effect that words have on a poet and emotions on a lyricist, was the same that the Principles of Mathematics had on Srinivasa Ramanujan . According to him-

"Mathematics is not about numbers, equations, computation or algorithms: it is about understanding."

Let's begin the life story of this legendary being Srinivasa Ramanujan was a largely self-taught pure Mathematician hindered by poverty and ill-health. His highly original work has considerable enrichnumber theory . December 22nd iscelebrated as National MathematicsDay as he was born on that day in 1887. He lived a short life of only 32 years as he died on 26 April 1920.

We can't control everything that happens to us. But we can control how we respond to things that we can't control. He is recognized as one of the greatest Mathematicians of his time. However, Srinivasa Ramanujan had no formal training in Maths. He used to always write on a slate with chalk and when one of his friends asked him to write on paper.

He replied-

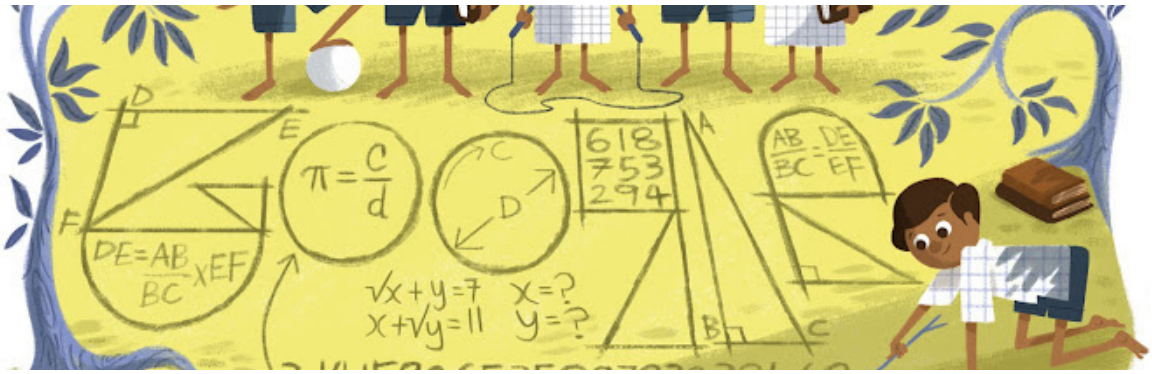
"When food is the problem, how can I find money for papers? I may require four reams of paper every month."

He was the second Indian to be induced as a fellow of the royal society, which is a fellowship of some of the world's most eminent scientist. For him education was not just a preparation of life,education is life itself.

It is said that the numbers 1-10,000 were his best "personal friends". He could effortlessly tell their factors, divisors, how the number can be split & each part of number can be squared /cubed etc. to produce interesting numbers, and much more.

One time, G.H. Hardy(professor of Mathematics at Cambridge University) was paying a visit to Ramanujan, who was ill and undergoing treatment. Hardy mentioned to him that he rode a taxi cab, whose number was 1729. Hardy said to Ramanujan,"the number seems to me rather a dull one". Ramanujan on this comment replied,"No Sir, this is the smallest number expressible as the sum of two cubes in two cubes in two different ways-

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



Later, 1729 came to be known as RAMANUJAN NUMBER. He discovered many other interesting facts, viz a viz, a solution of infinite root equations and the sum of positive numbers is a negative number-
1+2+3+4+5+.....=-1/12
It was his insight into algebraic formulae, the transformation of infinite series and so forth, that was amazing. In his short lifetime, he prepared almost 4000 proofs, identities, conjectures and equations in pure Mathematics. His theta function lies at the heart of string theory in physics. He used to say-
“An equation for me has no meaning unless it represents a thought of GOD”
One more interesting thing about Ramanujan is-he discovered so much, and yet he left so much in his garden for other people to discover.
“SUCCESS IS NOT JUST A MEASURE OF HOW BIG YOU CAN DREAM. IT IS ALSO A MEASURE OF HOW MUCH YOU CAN DO.”

~Kangkan Baishya
Department of mathematics (2020-23)

Some real life applications of set theory

Database Management:

Set theory is widely used in database management systems to organize and retrieve data efficiently. For instance, relational databases rely heavily on set theory concepts like union, intersection, and difference to combine, filter, and extract data from tables.

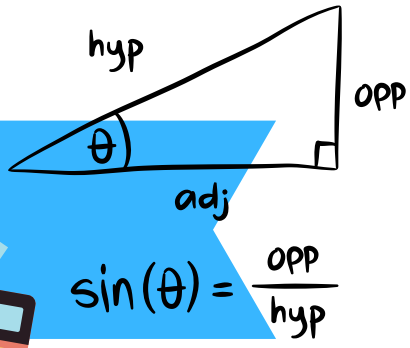
Social Networks:

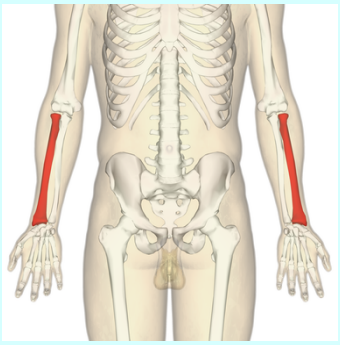
Social networks such as Facebook and LinkedIn use set theory to recommend friends or connections. The algorithm uses sets of people who have similar interests or connections to suggest new people who might be interesting to add to the user's network.

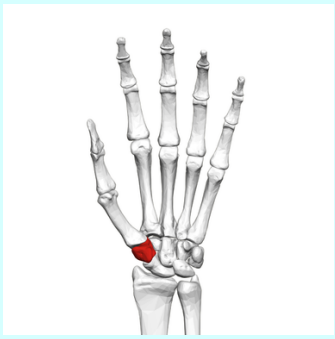
Genetics: :

Set theory is also used in genetics to study the relationship between genes and traits. In this field, sets of genes are studied to determine which ones are responsible for specific traits or diseases. By using set theory, researchers can identify which genes are related to specific diseases and use this information to develop new treatments or cures.

Mathematics Quiz







Q1. What are the names of the two bones (highlighted in red) ?

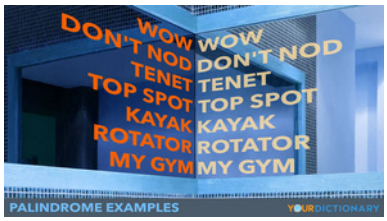
Q2. Name of the artwork and Painter ?

Q3. ____,
87539319,
6963472309248,
48988659276962496,
24153319581254312065344.
Give me the preceding blank as well as a means of transport .

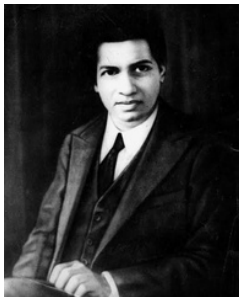
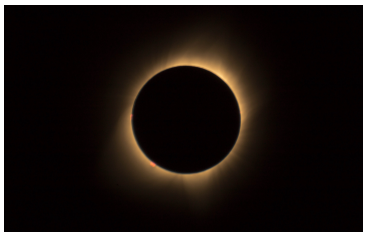
Q4. Who is this tabla player ?








Q5. Connected all the 17 pictures.

Q6. Daniel Kehlmann‘s novel Measuring the World is a beautiful fictional double biography of two famous German contemporary scientists in the late18th and early 19th century- Alexander von Humboldt and X. X was a prolific mathematician who made significant contributions to many fields in mathematics and science. Can you guess who is X?

Q7. In the foreword of his book "A Brief History of Time", Stephen Hawking mentions that to keep things simple, the book doesn't contain any mathematical equations, bar one. Which mathematical equation?

Q8. Identify the person. For her work in "the dynamics and geometry of Riemann surfaces and their moduli spaces" she received the Fields medal. She is the first woman to have received the Fields medal. She hailed from Iran and died of breast cancer at the age of 40.

Q9. He is the only person to have won the Nobel as well as Abel Prizes. Who am I talking about? An Academy award winning movie was made on his life in 2001. Strictly speaking, the proper terminology for the Nobel Prize is Nobel Memorial Prize in Economic Sciences.

Q10. The abbreviated name of the institute founded by this gentleman may remind people of something infamous from a nearby country. What was founded by him in Baranagar and formally registered on 28 April, 1932?

Q11. Who is this gentleman?

ANSWERS

1 : Radius, Trapezium.
2 : Newton, By William Blake.
3 : 1729, Taxicab (numbers).
4 : Manjul Bhargava, Fields medallist 2014.
5 : Types of Primes
Balanced Primes, Bell Primes, Cullen Primes,
Cuban Primes, Cousin Primes,
Home Primes, Happy Primes, Lucky Primes,
Leyland Primes, Partition Primes, Palindrome Primes,
Twin Primes, Good Primes, Eisenstein Primes,
Ramanujan Primes, Circular Primes, Euclid Primes.
6 : Carl Friedrich Gauss.
7 : E=mc2.
8 : Maryam Mirzakhani.
9 : Jhon Forbes Nash, Jr.
10 : Indian Statistical Institutes, He is P C Mahalanobis.
11 : C R Rao.

The Great Astronomer and Mathematician "Arya Bhata"

Arya Bhata (476-550 CE) an Indian mathematician, physicist and Astronomer of classical age of Indian mathematics and Indian astronomy. He lived during the Gupta period and produced works such as the Aryabhatiya (Which mentions that in 3600 kaliyuga, 499 CE) and Arya-Siddhanta.

Arya Bhata was the first to explain how the Lunar Eclipse and the Solar Eclipse happened. Arya Bhata also gave close approximation for pi. In the Aryabhatiya, he wrote -Add 4 to 100, multiply by 8, then add 62000 and then divided by 20000. The result is approximately the circumference of a circle of diameter twenty thousand. By this rule the relation of the circumference of the circle of diameter is given." In other words, p~62832/20000 =3.1416, correct to four rounded off decimal places. Arya Bhata astronomers to make an attempt at measuring the earth's circumference. He accurately calculated the earth's circumference as 24835 miles, Which was only 0.2% smaller than the actual value of 24902 miles. This approximation remained the most accurate for over a thousand years. Before going to Arya Bhata's invention The Great Astronomer and Mathematician "Arya Bhata"of "0". Let know a little bit about the Indian history of Number "0".

Acharya Pingala a sanskrit scholar and an Indian Mathematician first used the Sanskrit word "Sunya" referred to as "0". The word "Sunya" means void or empty. It is believed that the first text to use the decimal place value. System(include 0) was first used in Jain text or cosmology named "Lokavibhaga". This is where the term 'Sunya' was used. "Bakshali Manuscript " an arithmetic manual on merchants records the symbol of '0' which is a dot like structure having a hollow structure signifying void or nothing. These manuscripts were brought up by radio carbon dating in 2017. The ages were recorded to come from 224-383 AD, 680-779 AD and 885-993 AD. This marks the world's oldest record of the application of the symbol of '0'

In Mathematics there is a term called the decimal place value system also called positional notation. This means that the value of number is determined by the position of the digit that the value of a number is actually the product of the digit by a factor which is determined by the position of the digit.

This concept of the place value system, although was first used in 'Bakshali' manuscripts held a very important place in Arya Bhata's work. But the symbol for "0" was not used by Arya Bhata. The use of '0' as a digit was first used in India during the Gupta period.

"0" was not used by Arya Bhata. The use of '0' as a digit was first used in India during the Gupta period.

~Arindam Sarma
Department of mathematics (2022-25)

Fields Medal 2022

The Fields Medal is awarded to recognize outstanding mathematical achievement for existing work and for the promise of future achievement.

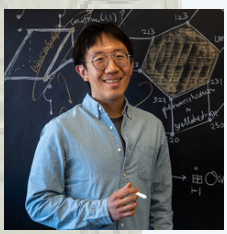
□ James Maynard

For contributions to analytic number theory, which have led to major advances in the understanding of the structure of prime numbers and in Diophantine approximation.

□ Hugo Duminil-Copin

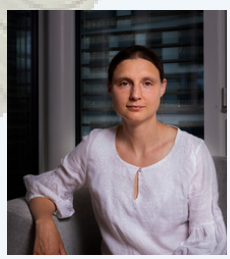
For solving longstanding problems in the probabilistic theory of phase transitions in statistical physics, especially in dimensions three and four.

□ June Huh



For bringing the ideas of Hodge theory to combinatorics, the proof of the Dowling–Wilson conjecture for geometric lattices, the proof of the Heron–Rota–Welsh conjecture for matroids, the development of the theory of Lorentzian polynomials, and the proof of the strong Mason conjecture.

□ Maryna Viazovska



For the proof that the E8 lattice provides the densest packing of identical spheres in 8 dimensions, and further contributions to related extremal problems and interpolation problems in Fourier analysis.

Feminism in the field of Mathematics

"I think it is a duty I owe to my profession and to my sex to show that a woman has a right to the practice of her profession and cannot be condemned to abandon it merely because she marries."

~ Emmy Noether

Before the 21st century, female representation in the field of mathematics was very limited. Women were often excluded from formal education and higher learning opportunities, particularly in the fields of science, technology, engineering, and mathematics (STEM). Despite these barriers, there were some notable women mathematicians who made significant contributions to the field. when we talk of feminism in the field of mathematics, many names come to our mind. They are EMMY Noether, Hypatia, sophie germain, ada lovelace, Florence Nightingale etc. Those who had proved their mettle in the sea of mathematics by breaking all the barriers. Maybe the definition of feminism is different for everyone but it has nothing to do with our topic. Let us discuss about some of them.

- **Hypatia**

Hypatia of Alexandria was a renowned scholar and mathematician who lived in the fourth century CE. She was born in Alexandria, Egypt, around 370 CE and was the daughter of Theon, a famous mathematician and philosopher. Hypatia was highly educated and studied mathematics, astronomy, philosophy, and other subjects at the Library of Alexandria.
Hypatia was well-respected in her time and attracted many students who came to learn from her. She was known for her exceptional intellect and her contributions to mathematics, including her work on conic sections and the invention of the hydrometer.
However, Hypatia's life was cut short when she was brutally murdered in 415 CE by a group of Christian zealots who accused her of heresy. Her death was a great loss to the intellectual community, and her legacy has been celebrated in many works of literature and art.
Hypatia is remembered today as a symbol of intellectual curiosity and the pursuit of knowledge. Her life and death serve as a reminder of the dangers of fanaticism and the importance of defending freedom of thought and expression.

● **Sophie Germain (1776-1831)**

Sophie Germain was a French mathematician and physicist who lived in the late 18th and early 19th centuries. Born in Paris in 1776, Germain was interested in mathematics from a young age, despite her parents' objections to her pursuing such a "unwomanly" field. She taught herself mathematics from her father's textbooks and later gained admission to the École Polytechnique in Paris, although she was not allowed to attend lectures or receive a degree due to her gender. Germain's most significant contribution to mathematics was her work on number theory, specifically on Fermat's Last Theorem, which she attempted to solve using innovative new methods. She also made important contributions to elasticity theory, proving a theorem that bears her name.

Despite facing discrimination and being excluded from the academic community, Germain persisted in her work and became the first woman to win a prize from the Paris Academy of Sciences in 1816. She continued to work in mathematics and physics until her death in 1831, leaving behind a legacy of perseverance and intellectual curiosity that continues to inspire women in STEM fields to this day. There is an interesting story about Sophie Germain. When Germainwrote to Gauss about her work in number theory but used the pseudonym Monsieur LeBlanc because she feared that Gauss would not take seriously the efforts of a woman. Gauss gave Germain's results high praise and a few years later, upon learning her true identity, wrote to her:

"But how to describe to you my admiration and astonishment at seeing my esteemed correspondent Mr. LeBlanc metamorphose himself into this illustrious personage who gives such a brilliant example of what I would find it difficult to believe. A taste for the abstract sciences in general and above all the mysteries of numbers is excessively rare: it is not a subject which strikes everyone; the enchanting charms of this sublime science reveal themselves only to those who have the courage to go deeply into it. But when a person of the sex which, according to our customs and prejudices, must encounter infinitely more difficulties than men to familiarize herself with these thorny researches, succeeds nevertheless in surmounting these obstacles and penetrating the most obscure parts of them, then without doubt she must have the noblest courage, quite extraordinary talents, and a superior genius."

● **Ada Lovelace (1815-1852)**

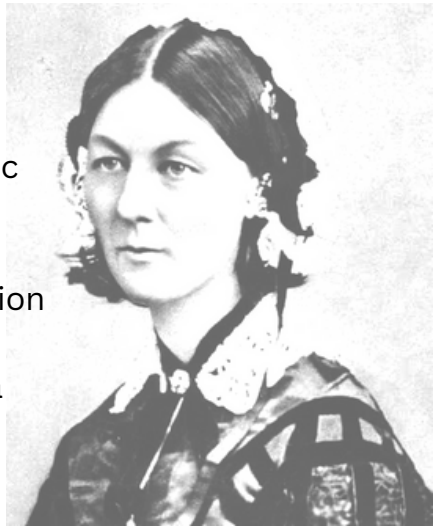
Ada Lovelace (1815-1852) was an English mathematician and writer who is best known for her pioneering work on Charles Babbage's proposed mechanical general-purpose computer, the Analytical Engine. She was the only legitimate

child of poet Lord Byron and his wife, Annabella Milbanke. Lovelace was fascinated by mathematics from an early age and was tutored by leading mathematicians of the time, including Augustus De Morgan. Lovelace's most significant contribution to computing was her translation and extensive annotations of an article on the Analytical Engine by Italian mathematician Luigi Menabrea. Her notes, which were three times longer than the original article, contained what is now considered to be the first algorithm intended to be processed by a machine. Lovelace's work was groundbreaking in that she recognized the potential of computers to go beyond mere calculation and become a tool for creative expression.

Despite her relatively short life, Lovelace's legacy has endured. She has been recognized as a pioneer of computer science and a symbol of women's achievement in STEM fields. The Ada programming language, used extensively in scientific and engineering applications, is named after her.

- **Florence Nightingale (1820-1910)**

Florence Nightingale, known as the "Lady with the Lamp" for her pioneering work in nursing during the Crimean War, was also a skilled statistician and mathematician. In fact, Nightingale's use of statistics and mathematical analysis was crucial in shaping public health policy in the 19th century.



One of Nightingale's most significant contributions to the field of public health was her use of data visualization to demonstrate the impact of sanitation on mortality rates. In her famous "rose diagram," Nightingale used a circular graph to illustrate the causes of death in military hospitals during the Crimean War. This visualization showed that the majority of deaths were due to preventable diseases, rather than injuries sustained in battle, and helped to convince policymakers of the need for improved sanitation measures.

Nightingale also used statistical analysis to demonstrate the effectiveness of her nursing methods. In her book "Notes on Nursing," Nightingale argued that by improving the physical and emotional environment in which patients were treated, nurses could have a significant impact on patient outcomes. She supported this claim with statistical evidence, demonstrating that patients treated under her methods had significantly lower mortality rates than those treated under traditional methods.

Overall, Nightingale's mathematical and statistical contributions to public health

were groundbreaking, and helped to establish the importance of data analysis in shaping healthcare policy. Her legacy continues to inspire healthcare professionals and researchers to this day.

- **Emmy Amalie Noether (1882-1935)**

"In the judgment of the most competent living mathematicians, Fräulein Noether was the most significant creative mathematical genius thus far produced since the higher education of women began. In the realm of algebra, in which the most gifted mathematicians have been busy for centuries, she discovered methods which have proved of enormous importance in the development of the present -day younger generation of mathematicians."

~ ALBERT EINSTEIN, The New York Times

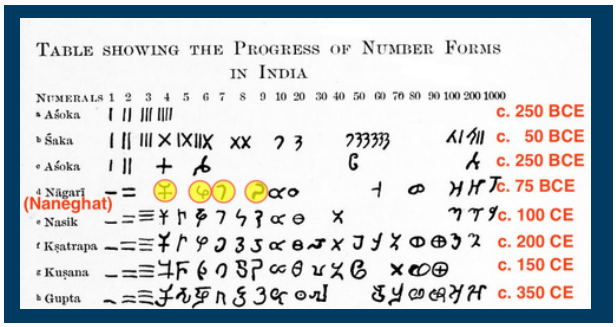
Emmy Noether was a groundbreaking mathematician who made significant contributions to the fields of algebra and theoretical physics in the early 20th century. Born in Germany in 1882, Noether faced significant obstacles to her academic career due to her gender, but she persisted in pursuing her passion for mathematics.
Noether's most significant contribution to mathematics is known as "Noether's Theorem," which is a fundamental result in the field of physics. The theorem connects symmetries in physical systems to conserved quantities, such as energy and momentum. This work was revolutionary at the time and had a profound impact on the development of modern physics.
Noether also made important contributions to abstract algebra, particularly in the study of group theory. She developed a concept called "Noetherian rings," which has since become a fundamental concept in algebraic geometry and commutative algebra.
Despite facing significant discrimination and obstacles in her career, Noether continued to work and inspire others in the field of mathematics. She taught at the University of Göttingen in Germany, where she mentored many students who would go on to become leaders in mathematics and physics.
Noether's legacy continues to inspire mathematicians and scientists around the world, and she is recognized as one of the most important and influential mathematicians of the 20th century. Her work has had a profound impact on the development of modern physics and mathematics, and she is remembered as a pioneering figure in the field who broke down barriers and paved the way for future generations of women in mathematics and science.

~ Gitartha kalita
Mathematics Department (2019-22)

গণিতৰ ক্ৰমবিকাশৰ চমু পৰ্যালোচনা

"কলা মানসিকতাৰ বাবে গণিত মানসিকতাৰ পৰিপুষ্টি সাধন হৈছে আৰু তাৰেই ফলত মানৱ সভ্যতাৰ অগ্ৰগতি সাধন হৈছে।" — (উৎসঃ গণিতৰ ক্ৰমবিকাশৰ ইতিহাস)

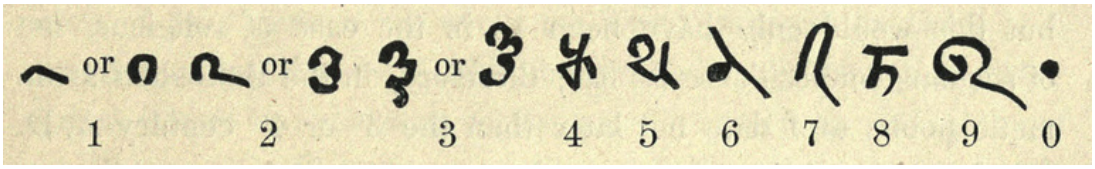
দৈনন্দিন জীৱনত গণিতক আমাৰ সকলোৰে পৰা আঁতৰাত ৰাখি কেৱল পাঠ্যপুথিৰ মাজতে সীমাবদ্ধ ৰাখিলে গণিতৰ মূল ৰহস্য কেতিয়াও উদঘাটন কৰিব পৰা নাযায়। কাৰণ গণিত বিষয়টো অত্যন্ত জটিল ৰূপত দেখা পাইছে যে তাৰ মাজত লুকাই থকা আমোদ আজিৰ ছাত্ৰ-ছাত্ৰীয়ে লাভ কৰিব পৰা নাই। আজিৰ দিনত গণিত জনা মানে আচলতে কেইটামান সূত্ৰৰ উপযুক্ত প্ৰয়োগ তথা কম সময়ত বিভিন্ন অংকৰ সমাধান সাধনকে বুজায়। কিন্তু গণিত কেৱল প্ৰায়োগিক ক্ষেত্ৰতে সীমাবদ্ধ নহয়।



বৰ্তমান যুগত চাকৰিমূখী প্ৰতিযোগিতাবোৰে কেৱল গণিতৰ প্ৰায়োগিক দিশটোৰহে উন্নতি ঘটাইছে। কিন্তু গণিতৰ আচল যুক্তিক বুজি পোৱাৰ এটা উপযুক্ত পৰিৱেশ তথা মানসিকতা গঢ় দিব পৰা নাই। এই ক্ষেত্ৰত শৈক্ষিক সমাজ সচেতন হোৱাটো অত্যন্ত দৰকাৰ। গণিতৰ বিকাশ সম্ভৱ হ'বলৈ ইয়াৰ গৱেষণাৰ স্থল বৃদ্ধি কৰাটো বাঞ্ছনীয়। কাৰণ গৱেষণালব্ধ ব্যক্তিয়েহে গণিতৰ আঁৰৰ যুক্তিক খণ্ডিত কৰিব পাৰে আৰু তেনে লোকেহে গণিত মানসিকতা বৃদ্ধি কৰিব পাৰে । গণিতক বিজ্ঞানৰ মাতৃস্বৰূপ বুলি বিবেচনা কৰা হয়। কাৰণ গণিত অবিহনে বিজ্ঞানৰ বিভিন্ন শাখা যেনে জীৱবিজ্ঞান, ৰসায়ন বিজ্ঞান, পদাৰ্থ বিজ্ঞান আদি সকলোবোৰ অংশ অচল। তাৰোপৰি মহাজাগতিক ঘটনাবোৰৰ উপযুক্ত বিচাৰ বিশ্লেষণৰ মাপকাঠি হ'ল গণিত। যদি গণিতক মানুহৰ দৈনন্দিন ক্ৰিয়া-কলাপ যেনে জোখ-মাখ, হিচাপ-নিকাচ, খেল-ধেমালি আদিৰ মাজেৰে বৰ্ণনা কৰা যায় তেন্তে ই আমোদজনক হৈ পৰে আৰু মানুহক চিন্তাশীল কৰি তোলে। গণিত জীৱজগতৰ সকলো বস্তুৰ মাজতে বিদ্যমান। দৈনন্দিন জীৱনত দেখি থকা চৰাই-চিৰিকটি, কীট-পতঙ্গ, জীৱ-জন্তু সকলোৱে গণিত ব্যৱহাৰ কৰি আহিছে। মকৰাজাল, মৌচাক, পিপৰাই কৰা সৰলৰৈখিক গতি, চৰাইৰ জাকৰ উৰণ আদি সকলোতে গণিতৰ উপস্থিতি ধৰা পৰে। তদুপৰি মানুহৰ দেহৰ বিভিন্ন অংগ বা গছ-গণিৰ ফুলৰ পাহি আদিত সোণালী অনুপাত (Golden Ratio) ৰ উমান পোৱা যায়। কিন্তু তাৰ মাজৰে কিছুমান পৰিঘটনা যেনে – সূৰ্য গ্ৰহণ, চন্দ্ৰ গ্ৰহণ বা ঋতু পৰিৱৰ্তন আদিক দৈৱিক পৰিঘটনা বুলি ভাবিছিল। কিন্তু পিছত সময় নিৰূপণৰ জৰিয়তে এনে অন্ধবিশ্বাস বোৰ আঁতৰ কৰা হ'ল।

গণিতৰ ক্ৰমবিকাশৰ আৰম্ভণি খ্ৰীষ্টপূৰ্ব ৩০০০ বুলিয়েই ধৰা হয়। তেতিয়াৰ পৰা খ্ৰীষ্টপূৰ্ব ১০০০ মানলৈকে বিভিন্ন নথি-পত্ৰ, প্ৰাচীন বুৰঞ্জী আদিৰ ওপৰত ভিত্তি কৰি গণিতৰ ক্ৰমবিকাশ সম্পৰ্কে অনুমান কৰা হয়। তেতিয়াৰ বিকাশৰ গভীৰতা কিমান তাক ঠাৱৰ কৰাটো কঠিন। এই সময়ছোৱাক গণিতৰ ঐতিহাসিক যুগ বুলি কোৱা হয়। গণিতৰ ইতিহাসত থেলছে অৱতাৰণা কৰা দুটা প্ৰশ্ন — কি? আৰু কিয়, কেনেকৈ? এই প্ৰশ্ন দুটাৰ সমাধান বিচাৰিবলৈ যাওঁতে গণিতৰ বিকাশ অভাৱনীয় ভাৱে বৃদ্ধি পাইছে। তদুপৰি থেলছকে প্ৰথমজন গণিতজ্ঞ ৰূপে জনা যায়। থেলছৰ এই মৌলিক প্ৰশ্ন দুটাই গণিতক যুক্তিৰ দৃষ্টিৰে নিৰীক্ষণ কৰিব শিকাইছে। আৰম্ভণি সময়ত পৃথিৱীৰ চাৰিখন ঠাই – চীন, ভাৰতবৰ্ষ, বেবিলন আৰু মিছৰত গণিত চৰ্চা হৈছিল । কিন্তু ত্ৰয়োদশ শতিকাৰ পিছত এইবোৰ অঞ্চলত গণিত চৰ্চা একেবাৰে নোহোৱাৰ দৰে হৈ পৰিছিল। ত্ৰয়োদশ শতিকাৰ পৰা ঊনবিংশ শতিকাৰ শেষ ভাগলৈকে গণিতৰ বিকাশ

হৈছিল মূলতঃ ইউৰোপত। গণিতৰ ইতিহাসত সপ্তদশ শতিকা সদায় স্মৰণীয় হৈ ৰ'ব। কাৰণ সেই সময়ছোৱাত গণিতৰ জগতত কেতবোৰ অভাৱনীয় নতুন ধাৰণাৰ সৃষ্টি হৈছিল। পিছত ঊনবিংশ শতিকাৰ আৰম্ভণিত গণিতৰ এক নতুন যুগৰ সৃষ্টি হয় যিয়ে বিংশ শতিকাৰ গণিত তথা ইয়াৰ ক্ষেত্রখন আশাতীত ভাৱে বৃদ্ধি কৰে। গণিত আৰু কলা এটা আনটোৰ পৰিপূৰক। যিদৰে এজন চিত্রকৰে নিজৰ চিত্রত এক অজানিত তৃপ্তি লাভ কৰে বা এজন কবিয়ে নিজৰ কবিতা ৰচনাত মুগ্ধ হৈ থাকে ঠিক তেনেদৰে এজন গণিতজ্ঞই নিজৰ গণিত সৃষ্টিৰ আনন্দত নিজকে বিলীন কৰি দিয়ে। এই আটাইবোৰ কলাই যিদৰে যুক্তিৰ বার্তা দিয়ে ঠিক তেনেদৰে গণিতেওঁ কোনো অদৃষ্টই দেখুওৱা বাটত যধে - মধে আগ নাবাঢ়ি এক যুক্তিবাদী চিন্তাৰে মানুহক আকর্ষণ কৰিব পাৰিছে। কিন্তু য'ত সৃষ্টিয়ে পোহৰ দিব বিচাৰে তেনে সময়ত ধ্বংসই বাৰে বাৰে অন্ধকাৰ নমাই আনিব বিচাৰে। সেইবাবে আর্কিমিডিছক ৰোমান সৈন্যই হত্যা কৰিছিল। প্রাচীন কালত অন্যান্য অঞ্চলৰ লোকৰ তুলনাত চীনদেশৰ মানুহৰ গণিত মানসিকতা বেছি আছিল। সেই সময়তে দ্বিআধাৰী পদ্ধতি (Binary System), যাদুবর্গ (Magic Square) তথা পাইথাগোৰীয় উপপাদ্যৰ বর্ণনামূলক চিত্র আদিৰ প্রাৰম্ভিক বিকাশ চীনতেই হৈছিল। তদুপৰি গণিতৰ বহুতো বিষয় সামৰি লোৱা প্রশ্ন সংকলন এখনো ইয়াতেই ৰচনা হৈছিল। সেইবাবে গণিতৰ ক্রমবিকাশৰ আৰম্ভণিতে চীন দেশৰ ভূমিকা আছিল অত্যন্ত গুৰুত্বপূর্ণ। ভাৰতবর্ষতো সিন্ধু সভ্যতাৰ সময়ত উচ্চ খাপৰ জ্যামিতিক জ্ঞান তথা পৰিমিতিৰ উপযুক্ত প্রয়োগৰ সন্ধেদ পোৱা যায়। সেই সময়ৰ ৰাস্তা-ঘাট, পকী ঘৰ, নলা-নর্দমা, টাইল লগোৱা গা-ধুৱা ঘৰৰ আর্হি তথা কৌশল গাণিতিক জ্ঞান অবিহনে অসম্ভৱ। একেদৰে বেবিলন তথা মিছৰতো গণিতৰ বিকাশৰ ভালেখিনি চিন দেখা যায়।



খ্রীষ্টপূর্ব তৃতীয় শতাব্দীত প্রণয়ন কৰা ইউক্লিডৰ বিখ্যাত "এলিমেণ্টছ্" (Elements) গ্রন্থই পৰৱর্তী কালত এক দিক নির্ণায়ক, সুস্পষ্ট তথা সুদূৰ প্রসাৰী প্রভাৱ পেলাইছিল। গণিতৰ প্রথম সোণালী যুগ অর্থাৎ খ্রীষ্টপূর্ব ৩০০ ৰ পৰা খ্রীষ্টপূর্ব ৫০০ ৰ ভিতৰত ইউক্লিড, আর্কিমিডিছ, টোলেমী, হিৰণ, বৰাহমিহিৰ আদি গণিতজ্ঞই ইয়াৰ বিকাশৰ পথ প্রশস্ত কৰিছিল। একেদৰে প্রাচ্য আৰু মধ্য প্রাচ্যৰ গণিতৰ বিকাশৰ সময়ছোৱাত অর্থাৎ ৫০০ খ্রীষ্টাব্দৰ পৰা ১০০০ খ্রীষ্টাব্দলৈ বিজ্ঞান আৰু গণিত চর্চাৰ প্রাণকেন্দ্র আছিল বাগদাদ চহৰ। সেই সময়ছোৱাত জাপানত গণিত চর্চাৰ ভেঁটি সুদৃঢ় হৈ উঠিছিল। একে সময়তে ভাৰতীয় গণিতত আর্যভট্টই "আর্যভট্টীয়" নামৰ এখন পুথি ৰচনা কৰে য'ত জ্যোতির্বিজ্ঞান, পৰিমিতি আৰু পাটীগণিতৰ বিভিন্ন সমস্যা সমাধানৰ কেতবোৰ নিয়ম বা ফর্মূলা বিনা প্রমাণে উল্লেখ কৰিছে। তদুপৰি তেওঁ পাই (Pie) ৰ মান ৩.১৪১৬ বুলি উল্লেখ কৰিছিল। এই মান তেওঁ কেনেদৰে গণনা কৰিছিল তাৰ কোনো উল্লেখ নাই। খ্রীষ্টাব্দ ১০০০ ৰ পৰা ১৬০০ লৈ ইউৰোপীয় নৱজাগৰণৰ সময়ত দীর্ঘদিন জোৰা স্থবিৰতা তথা নিষ্ক্রিয়তা ভংগ কৰি গণিত চর্চাৰ ক্ষেত্রত এক নৱজাগৰণৰ সূচনা কৰিব পাৰিছিল। এই সময়ছোৱাত পৃথিৱীৰ বিখ্যাত গণিতৰ পুথিসমূহ লেটিন ভাষালৈ অনুবাদ হৈছিল যাৰ ফলত ইউৰোপত উচ্চ পর্যায়ৰ গণিত চর্চাৰ পথ সুগম হৈছিল। সেই সময়ত বহুতো বিশ্ববিদ্যালয় স্থাপন কৰি শিক্ষাৰ প্রসাৰত গুৰুত্বপূর্ণ ভূমিকা লৈছিল যদিও গণিতৰ পাঠ্যক্রম বৰ উচ্চ পর্যায়ৰ নাছিল। পোন্ধৰ শতিকাত বাণিজ্যিক প্রসাৰৰ লগে লগে গণিত চর্চাও ব্যাপক হৈ পৰিছিল। পোন্ধৰ শতিকাৰ এটা উল্লেখযোগ্য ঘটনা হ'ল গণিতৰ পুথি ছপা হৈ ওলোৱাটো। ইটালীত এখন পাটি গণিতৰ পুথি আৰু ইউক্লিডৰ 'এলিমেণ্টছ' ছপোৱা হয়। কিন্তু কিছুমান গৱেষকৰ মতে ১১১৫ খ্রীষ্টাব্দত চীন দেশত হুৱাং-টি-কিউ-চাঙ (হালধীয়া সম্রাটৰ নটা অধ্যায়) নামৰ এখন পুথি ছপা হৈ ওলাইছিল বুলি ক'ব খোজে।

সেই সময়ত ফিব'নাকিয়ে ইউৰোপীয় গণিত সৃষ্টিত মৌলিকতাৰ লগতে আধুনিকতা আনিছিল। তেওঁৰ সৃষ্টি 'ফিব'নাকি অনুক্রম' পত্র বিন্যাস, শহাপহুৰ বংশ বৃদ্ধি আদিত পৰিলক্ষিত হয়। তেওঁ ত্রিঘাত সমীকৰণৰ সম্পূর্ণ সমাধান নির্ণয়ত সহায় কৰিছিল। এনেদৰে আগবাঢ়ি গৈ সপ্তদশ শতিকাৰ গণিতৰ ক্রমবিকাশৰ জগত খনত প্রৱেশ কৰিছিল এদল ইউৰোপীয় গণিতজ্ঞই যাৰ আৱিষ্কাৰে গণিতৰ বিকাশ ত্বৰান্বিত কৰিছিল আৰু আনিছিল অভাৱনীয় পৰিপক্কতা। এই শতিকাতে আধুনিক গণিতৰ ভেঁটি স্থাপন

হৈছিল। নেপিয়াৰৰ ঘাতাংক তত্ত্ব, গেলিলিওৰ গতিবিজ্ঞান, কেপলাৰৰ গ্ৰহ সম্বন্ধীয় গতি সূত্ৰ, পাস্কেলৰ মৌলিক জ্যামিতি, ডেকার্টৰ আধুনিক বিশ্লেষণাত্মক জ্যামিতি, ফার্মাৰ আধুনিক সংখ্যা তত্ত্ব তথা হাইগেন্সৰ সম্ভাৱিতা তত্ত্বৰ আৱিষ্কাৰে গণিতৰ জগতত তোলে পাৰ লগাই। পিছত নিউটন আৰু লেবনিজে সৃষ্টি কৰা যুগান্তকাৰী 'কলন গণিতে' সপ্তদশ শতিকাক চিৰস্মৰণীয় কৰি ৰাখিলে। প্ৰামাণিক তথা গাণিতিক বিশ্লেষণৰ ক্ষেত্ৰত নিউটনৰ 'প্ৰিন্সিপিয়া' গ্ৰন্থৰ অৱদান অতুলনীয়। ওঠৰ-ঊনৈশ শতিকাৰ গণিতত শক্তিশালী যুক্তি পদ্ধতিৰ বিস্ময়কৰ প্ৰায়োগিকতা পৰিলক্ষিত হয় যাৰ ফলত বহু কঠিন অমিমাংসিত গাণিতিক প্ৰশ্নৰ উত্তৰ সহজে দিব পৰা হ'ল। গণিতজ্ঞ সকলৰ বহু প্ৰচেষ্টাৰ ফলত ঊনৈশ শতিকাৰ শেষৰ ফালে গণিতৰ ভেঁটি অধিক সুদৃঢ়, যুক্তি-যুক্ত আৰু দোষ মুক্ত হয় পৰে। এই ভেঁটিৰ ওপৰতে কুৰি শতিকাৰ গণিতজ্ঞই ৰচনা কৰিলে গণিতৰ বিশালতম ভাণ্ডাৰ যিয়ে গণিতক এক অভিনৱ ৰূপ দিলে। কিন্তু গণিতৰ বিকাশ যে কেৱল সময়ে সময়ে গণিতজ্ঞইহে কৰিছে তেনে নহয় । গণিতৰ বিকাশৰ ক্ষেত্ৰত বিভিন্ন গাণিতিক সংস্থা তথা গৱেষণা আলোচনীৰ ভূমিকাও অতুলনীয়। কাৰণ এনে আলোচনীয়ে গণিতৰ প্ৰচাৰ তথা প্ৰসাৰৰ ক্ষেত্ৰখন বহুগুণে বঢ়াই দিছিল।

কুৰি শতিকাৰ জটিল তথা সীমাহীন গণিতৰ ভাণ্ডাৰক উপস্থাপন কৰাটো সহজ নহয়। সেই সময়ছোৱাত ভাৰতীয় গণিতজ্ঞ শ্ৰী নিবাস ৰামানুজনৰ প্ৰতিভাই ভাৰতৰ নাম গণিতৰ জগতত সোণালী আখৰেৰে লিখি থৈ গ'ল যাক কেতিয়াও মচিব নোৱাৰিব। আনুষ্ঠানিক শিক্ষা অবিহনে উৎকৎ দাৰিদ্ৰ্য আৰু চৰম দুৰ্দশাৰ মাজত সৃজনী শক্তিৰ এনে নিদৰ্শন গণিতৰ ইতিহাসত বিৰল । পিছত হার্ডিৰ লগ লাগি বহু উচ্চ পৰ্যায়ৰ গণিত সৃষ্টি কৰিছিল যাৰ ফলত Fellow of the Royal Society আৰু Fellow of the Trinity College উপাধিৰে সন্মানিত কৰা হয়। ১৯৩১ চনত Indian Statistical Institute ৰ জন্মৰ লগে লগে ভাৰতত পৰিসংখ্যা বিজ্ঞানৰ জনপ্ৰিয়তা বাঢ়ে। পিছত IIT কেইখন স্থাপন হোৱাৰে পৰা ভাৰতবৰ্ষত প্ৰায়োগিক গণিতৰ গৱেষণা খৰতকীয়া গতিত আগবাঢ়িবলৈ ধৰে। গণিতৰ গৱেষণাৰ ক্ষেত্ৰত মুম্বাইৰ Tata Institute of Fundamental Research আৰু Institute of Mathematical Science ৰ গুৰুত্বও উল্লেখযোগ্য। তথাপিও ভাৰতীয় গৱেষকৰ মাজত গণিতৰ গুৰুত্বপূৰ্ণ বিষয় কিছুমান এতিয়াও জনপ্ৰিয় হৈ উঠা নাই যাৰ ফলত নতুন গণিতৰ গৱেষণাৰ ক্ষেত্ৰত অন্যান্য উন্নত দেশৰ তুলনাত আমাৰ দেশ এতিয়াও যথেষ্ট পিছ পৰি আছে। এই প্ৰবন্ধটোত ভালেমান মহান গণিতজ্ঞ তথা কালৰ সোঁতত বিলীন হোৱা সৰু বৰ গণিতজ্ঞৰ অৱদানৰ বিষয়ে আলোকপাত কৰিব নোৱাৰাৰ বাবে মই দুখিত। প্ৰবন্ধটি যুগুতোৱাৰ ক্ষেত্ৰত ড° বুদ্ধ প্ৰসাদ চেতিয়াদেৱৰ 'গণিতৰ ক্ৰমবিকাশৰ ইতিহাস' গ্ৰন্থখন বিশেষকৈ হাতৰ সাৰথি কৰিছোঁ। প্ৰবন্ধটোত যদি অজানিতে কিবা ভুল তথ্য উত্থাপিত হৈছে তাৰবাবে মই ক্ষমাপ্ৰাৰ্থী ।

~ চন্দন দাস
গণিত বিভাগ (২০১৯-২২)