September 2022

Volume I, Issue I

ganith

Issued by Department of Mathematics
Ethiraj College for Women
(Autonomous), Chennai- 600 008

On the 125th birth anniversary of Srinivasa Ramanujan, India declared 22nd December, as *"National Mathematics Day"*

The declaration was made by Dr. Manmohan Singh in Chennai on 26 December 2011.

It was also declared that the year 2012 would be celebrated as the *National Mathematics Year.*

From the Editor's Desk

எண்ணென்ப ஏனை எழுத்தென்ப இவ்விரண்டும்
கண்ணென்ப வாழும் உயிர்க்கு. ~ திருக்குறள்

यथा शिखा मयूराणां नागानां मणयो यथा ।
तथा वेढाङ्गशास्त्राणां गणितं मूर्धनि स्थितम ॥ ~ Vedanga Jyotisa
Like the crest of the peacocks, the gems on the hoods of cobra,
Mathematics is at the top of Vedanga Sastras.

The above lines in the two classical languages, reflects beautifully how Mathematics was held in high esteem in ancient and medieval India. 'Ganith' - the Mathematics newsletter from the department of Mathematics is a maiden attempt to share the joy of Mathematics among the students and groom their writing skills. The editorial board enjoyed immensely in bringing out this newsletter and we hope you enjoy as much in reading it.

Read, Reflect and Respond with your comments and suggestions for improvement.

HAPPY READING! *~ The Editorial team*

Nostalgic Reminiscence

Coming from a humble beginning, I was looking for the gates that would open windows of opportunities. Ethiraj college and my professors provided me exactly what I was looking for when I had joined for my bachelor's degree in mathematics in 1993. There are so many good memories about my college. I love all the cultural programs that happened in our auditorium. Ethiraj college was and is full of multi-talented students – whether it is arts or science competitions or fashion shows, or quiz competitions, we are the best!

My love for mathematics began only after joining Ethiraj. The credit goes to my department professors who taught the subjects with a lot of passion and personal touch. It would not be an exaggeration to say they really shaped my career. My heartfelt gratitude to my HOD – Mrs. Nancy Vedanayagam, Class teacher - Dr. Lalitha Subramaniam and other subject professors – Mrs. Nirmala Natarajan, Dr. Varalakshmi, Dr. Nirmala Kumaran, Dr. Amudha and Dr. Jeeva. Each one of them still play a significant role in my professional career. Whenever I entered the department, I felt the warmth and care of a family.

During my second year of study, my classmates and I participated in a Math Model Exhibition where we won the first prize for demonstrating a Kidney Dialysis model. We extended the winning streak by exhibiting the same at a competition held at IIT Madras. This sowed the seed for me to pursue my post graduate studies at IIT Madras. Professor Dr. Lalitha Subramaniam guided me for the IITM's post graduate entrance exam and I can still remember the joy in her face when I joined IIT Madras.

After my post-graduation, I joined my dream Company Tata Consultancy Services and have been successfully working there for about 23 years now. It was nostalgic when I came to the college during the Silver Jubilee Alumni Day in 2019, after 25 years, I was overwhelmed with all the great memories of college life and was emotional. What a journey it was!

From a small-town girl to a Senior Consultant heading the Delivery Excellence of a Unit, the seed was sown in this college! I cherished every minute of my stay at Ethiraj and recently when I was invited to be part of the Board of Studies of the Mathematics department as an Industry expert, I felt so privileged to give something back to my almamatar. I couldn't have asked for more.

My heartiest wishes to Ethiraj College For Women, in its 75th Jubilee year. May it grow from strength to strength in all domains and I wish every Ethiraj-ian a great success!

~ Prabha Ramakrishnan, Senior Consultant
Delivery Excellence Head, TCS, Chennai

ARYABHATA (476 - 550 C)

- Sindhuja A, III B.Sc. Mathematics.

Statue of Aryabhata at the IUCAA, Pune (although there is no historical record of his appearance).

Aryabhata is the Father of Indian Mathematics. He was a great Mathematician and Astronomer of ancient India. He flourished in the Gupta Era and produced works such as the *Āryabhaṭīya* and the *Arya-siddhanta.*

His major work, ***Aryabhatiya***, a compendium of Mathematics and Astronomy, was extensively referred to in the Indian Mathematical Literature and has survived to modern times. The Aryabhatiya presented a number of innovations in Mathematics and Astronomy in verse form, which were influential for centuries to come. The text consists of the 108 verses and 13 introductory verses. Later commentators such as Brahmagupta divided his work into GANITA (Mathematics), KALAKRIYA (Calculations on Time) and GOLAPADA (Spherical Astronomy). His pure Mathematics discusses topics such as determination of square and cube roots, geometrical figures with their properties, quadratic equations, linear and indeterminate equations. The extreme brevity of the text was elaborated in commentaries by his disciple Bhaskara I. He discovered that the apparent westward motion of stars is due to the Earth's spherical rotation about its own axis. Aryabhata also noted that the luminosity of the Moon and other planets is due to reflected sunlight.

PLACE VALUE SYSTEM AND ZERO

The place-value system, first seen in the 3rd-century ***Bakhshali Manuscript***, was clearly mentioned in his work. While he did not use a symbol for zero, the French Mathematician Georges Ifrah argues that knowledge of zero was implicit in Aryabhata's place-value system as a place holder for the powers of ten with null coefficients. Continuing the Sanskritic tradition from Vedic times, he used letters of the alphabet to denote numbers.

APPROXIMATION OF π

Aryabhata worked on the approximation for pi (π), and may have come to the conclusion that π is irrational.

In ***gaṇitapāda*** 10, he wrote as:

"Add four to 100, multiply by eight, and then add 62,000. By this rule the circumference of a circle with a diameter of 20,000 can be approached."

This implies that for a circle whose diameter is 20000, the circumference will be 62832.

i.e., $\pi = ((4 + 100) \times 8 + 62000) / 20000 = 62832 / 20000 = 3.1416$, which is accurate to three significant figures. It is speculated that Aryabhata used the word ***āsanna*** (approaching), to mean that not only it is an approximation but that the value is irrational. If this is true, it is quite a sophisticated insight because the irrationality of pi (π) was proved in Europe only in 1761 by Lambert.

TRIGONOMETRY

In Ganitapada 6, Aryabhata gives the area of a triangle as: "For a triangle, the result of a perpendicular with the half-side is the area."Aryabhata discussed the concept of sine in his work by the name of ***ardha-jya***, which literally means ***"half-chord"***. For simplicity, people started calling it ***jya.*** When Arabic writers translated his works from Sanskrit into Arabic, they referred it as ***jiba.*** Later in the 12th century, when Gherardo of Cremona translated these writings from Arabic into Latin, he replaced the Arabic ***'jaib'*** with its Latin counterpart, 'sinus'; thence comes the English word SINE.

ALGEBRA

In Aryabhatiya, Aryabhata provided elegant results for the summation of series of squares:

$$1^2 + 2^2 + \dots\dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

the summation of series of cubes:

$$1^3 + 2^3 + \dots\dots + n^3 = (1+2+\dots\dots+n)^2$$

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1. https://en.m.wikipedia.org/wiki/Aryabhata
2. https://www.timelineindex.com/content/view/1452

Ramanujan Art(Page 1) by
Selva Swathi.S (III BSc Mathematics)

You don't have to be a Mathematician to have a feel for numbers
- John Forbes Nach.Jr

A BOOK REVIEW ON 'A MIND FOR NUMBERS: HOW TO EXCEL AT MATH AND SCIENCE'

- Fathima N, II B.Sc. Mathematics

Dr Barbara Oakley, an American professor of engineering at Oakland University is the author of the book *'A Mind For Numbers: How to Excel at Math and Science (Even If You Flunked Algebra)'*. This book has proved to be vastly interesting right from the book description!

Oakley hadn't always been great at math. She flunked her way through high school math and science, putting in very minimal effort to learn them. She enlisted in the military right after high school graduation. The book description includes this: "When she saw how her lack of mathematical and technical savvy severely limited her options both to rise in the military and to explore other careers, she returned to school with a newfound determination to re-tool her brain to master the very subjects that had given her so much trouble throughout her entire life."

She holds a B.A. in Slavic languages and literature, a B.S. in Electrical Engineering, an M.S. degree in Electrical and Computer Engineering and a Ph.D. in Systems Engineering. She is also the educator (re: co-creator and teacher) of a MOOC on an online learning platform called Coursera for the course 'Learning How To Learn: Powerful mental tools to help you master tough subjects' which is one of the most popular and sought after online courses in the world!

Book:
A Mind For Numbers: How To Excel at Math and Science (Even If You Flunked Algebra)
Author: Barbara Oakley, Ph.D.
Publication: Jeremy P. Tarcher/Penguin (A member of Penguin Group, USA)
Price: ₹599/-

The key principles or tactics that I would be taking from the book are as follows: diffused mode of thinking (where the brain subconsciously makes connections between already learned concepts and quietly works on organizing those information which happens while we are in a relaxed state) is just as important as focussed mode of thinking (a state of intensely focusing on the work at hand). How procrastinating can ultimately affect our learning pattern and how cramming is ineffective in the long run is well explained. Employing active recall is a lot more efficient than passively reading over notes. The author also speaks about how abstract concepts aren't designed to be grasped in one go and needs time to be understood. The importance of revisiting the concepts we learnt already is essential to be able to commit it into our long-term memory, and the best way to commit information to long-term memory is to get our brain to recall that information over and over again (in a considerably larger time frame) to get our neural networks more strong. Finally, how focusing on the process rather than stressing about the product can help us curb procrastination and, my favourite - how teaching someone else is a great way of making sure we ourselves understand that.

The book 'A Mind For Numbers' is a practical and a research backed guide to help students learn how they learn. This book isn't just a dictation of a few well known facts about the science of studying, no, it is much more than that. It speaks about the process of learning and studying. There are some tips that are repeated throughout the book which greatly helps in internalising them and incorporating them in our study routines!

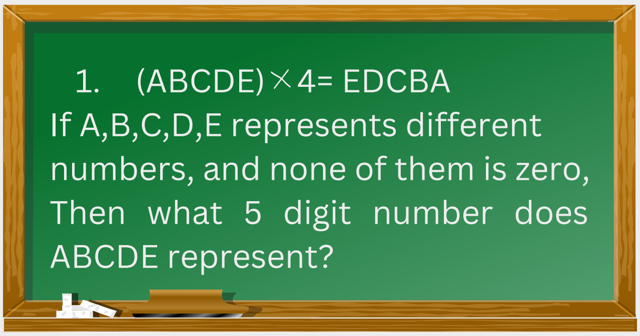
Many a student have claimed that this book finally helped them see the light at the end of the tunnel - struggling students who didn't know how to learn math and science in school took help from this book and went on to pursue careers in math and science. This book helped them discover their passion for the aforementioned subjects. Oakley has also included tips and advice from other professors and feedback she has received from the students she has taught.

Oakley is able to relate to the struggling students as she once was one as well and explains everything in depth to them. This book is also designed to help students take a step back from their current daunting situation and to look at their problem or anxiety around math and science as another entity and learn how to combat them.

This book is great for anyone who has ever struggled with learning and it's not just limited to STEM subjects as the tips and the theories discussed can be applied to any field regardless of their relation to math and science. Since this book is written in a very easy-to-follow manner, anybody be it middle schoolers, high schools, undergraduate and graduate school students, or working professionals hoping to brush up on their math knowledge can benefit off of this book.

The chapters are quite short and packed with valuable information. If a person reads this book patiently, conquers their limiting beliefs, puts the advice and strategies in the book to use in their daily life and are consistent with the practice, they can achieve their goals of succeeding in learning math and science.

To conclude, this is a highly recommended book for anyone who truly wants to learn how to learn, or a struggling student, or someone who is intellectually curious. There is something of value in this book for everyone. It is an exciting, inspiring, motivating and an efficient book.



Mathematics is the most beautiful and most powerful creation of the human spirit. – STEFAN BANACH

MATHEMATICS AND ART

- Harini S, III BSc Mathematics.

Geometry and art, they go hand in hand. When you join a few points to draw patterns on a graph sheet, it is a form of geometry. When you do the same on a piece of blank paper, you give birth to art. Equipped with this information, let us look at a type of art called *'mandala art'*.

In the ancient Sanskrit language of Hinduism and Buddhism, mandala means "circle." Traditionally, a mandala is a geometric design or pattern that represents the cosmos or deities in various heavenly worlds. "It's all about finding peace in the symmetry of the design and the universe," says artist ***Saudamini Madra.*** As described above, it is evident that mandalas help create a bridge between geometry, a mathematical concept, and art. Artist and math professor ***Fernanda Bonafini*** began making mandalas just for the joy of it. "In the process of drawing mandala artwork, you feel much calmer and more peaceful, and your breathing and heartbeat slow down. The sensation in your mind and body, and their connection, is good," Bonafini says. Thus, mandalas are art pieces that play with symmetry. The most intriguing part is that these are known to put the mind at peace, and peace is something we all look for at some point in time, right?

Draw symmetric patterns as you wish. Add doodles as you like. There is no limit as to what can be done. Let your soul do the work and when you are done, you may outline the pencil strokes as you wish. In the simplest form, you may give the outline using a black pen and voila! Your mandala is ready!

Here is a design to stroke the fire that your creativity is. Now let's see how far you can go.

TRANSIRE SVVM PECTVS MVNDOQVE POTIRI

- Deepthy L, III BSc Mathematics.

Why Nobel? The most eminent award "NOBEL PRIZE" was created to recognize an outstanding achievement for existing work and for the promise of future achievement. It was named after an Engineer, Chemist, Industrialist, ***Alfred Nobel*** in 1901.This esteemed prize is being awarded in the fields of Physics, Chemistry, Physiology, Medicine, Literature, Peace and Economics (later added in the year 1958).

But, why are there some fields which have been left out? Is it really due to the lack of practical discoveries? Then, what is equal to Nobel Prize in the field of mathematics?

To the above question, ***FIELDS MEDAL*** is considered to be the most prestigious award for Mathematicians and has been presented every 4 years since 1946 on the occasion of the International Congress of Mathematicians to give recognition and support to younger Mathematical Researchers who have made major contributions. It is by tradition, given to the Mathematicians under the age of 40, rather than to senior scholars. The obverse is designed in with the side view of ***Archimedes*** (father of Mathematics) 287-221 BC which is followed by a quotation attributed to him.

"Transire svvm pectvs mvndoqve potiri"

(Rise above oneself and grasp the world)

The Field Medal was first received by Finnish Mathematician **Lars *Ahlfors*** and the American Mathematician ***Jesse Douglous*** in 1936. In 2014, the Iranian Mathematician Maryam Mirzakhani became the first female Fields Medalist. Totally 64 people have won the medal as of 2022 with the exception of 2 PhD holders in Physics. Therefore, we live in a time of extraordinary and accelerating change i.e., the new phase of development. Knowing mathematics can be personally satisfying and empowering as it provides the vital underpinning of the knowledge of economy. Here, it is no doubt that FIELD MEDAL adds glory to it.

Mandala Art by
Sakthi S, II BSc Mathematics.

● Mathematics is not about numbers, equations, computations or algorithms; it is about understanding. – WILLIAM PAUL THURSTON

CATENARY CURVE

- Anagha, II BSc Mathematics.

Catenary is a curve that an idealized hanging chain or cable assumes under its own weight when supported only at its ends in a uniform gravitational field. the name derives from the Latin word *'catenaria'* ("chain"). A hanging chain will assume a shape of least potential energy which is the catenary.

The equation of a catenary in Cartesian coordinates has the form: $Y=a\cosh(x/a) = a/2(e^{x/a} + e^{-x/a})$, where cosh is the hyperbolic cosine function and x is measured from the lowest point.

An important fact to note in catenary curves is the difference between a catenary curve and a parabola.

Catenary Curve

- The equation of a catenary is $y=a\cosh(x/a)$.
- The catenary is a *funicular shape for an unloaded cable and is solely determined by the self-weight of the cable which is uniformly distributed along its length.

Parabola

- The equation of a parabola is $y=a(x-h)^2 + k$.
- A parabola is a funicular shape of a suspension cable loaded uniformly across its span.

Catenary curves observed in daily life are:

*The term funicular shape is typically considered as the shape taken by a hanging chain for a given set of loads.

This difference is explained with a suspension bridge below:

When the structure is being built and the main cables are attached to the towers, the curve is a catenary. But when the cables are attached to the deck with hangers, it is no longer a catenary. The curve of the cables become the curve of a parabola. Unlike the catenary, which is curving under its own weight, the parabola is curving not just under its own weight, but also curving from holding up the weight of the deck. The cable of a suspension bridge is under tension from holding up the bridge. Therefore, the cables of a suspension bridge is a parabola, because the weight of the deck is equally distributed on the curve.

REFERENCES:

1) https://www.britannica.com/science/catenary
2) https://en.wikipedia.org/wiki/Catenary

Think about it

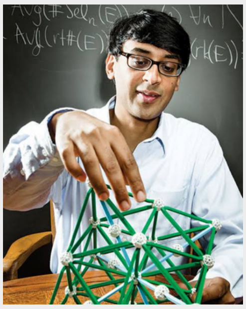
~ Letters 'A' , 'B', 'C', 'D' do not appear anywhere in the spellings of 1 to 99.

~ If you were to spell out numbers from one; you will not find letter 'A' until you reach "One Thousand'.

Neena Gupta

Neena Gupta is the third woman to receive the Ramanujan Prize for young Mathematician, which was first awarded in 2005. She is the fourth Indian to win this prestigious prize. Prior to her, three of the other four winners are also associated with the ISI Kolkata.

Manjul Bhargava



Bhargava was awarded the Fields Medal in 2014. According to the International Mathematical Union citation, he was awarded the prize "for developing powerful new methods in the geometry of numbers", which he applied to count rings of small rank and to bound the average rank of elliptic curves.

Without Mathematics, there's nothing you can do. Everything around you is Mathematics, everything around you is numbers. – SHAKUNTALA DEVI

THE UBIQUITOUS 'SEVEN'

- Harini S & BagyaShree G,
III B.Sc. Mathematics.

We all know that numbers from 1, 2, 3, 4, 5, 6, 7, 8, 9,. . . . . .are called natural numbers. Can you believe that most of the natural numbers probably would have the digit ‘7’ in it?
Let's check that out.

Among the first ten natural numbers, the only natural number that has the digit 7 is the number 7. Therefore, we see that 10% of the first 10 natural numbers have the digit ‘7’. Similarly considering the first 100 natural numbers and so on, we observe equations that support this claim:

1. In the first 10 natural numbers, the number 7 occurs once. We can express that as

$$1=10-9=10^1 - 9^1$$

2. In the first 100 natural numbers, there are 19 numbers that have the digit 7. That can be written as

$$19=100-81=10^2 - 9^2$$

3. In the first 1000 natural numbers, numbers with the digit 7 occur 271 times which can be expressed as

$$271=1000-729=10^3 - 9^3$$

In a similar manner, in the first 10^n natural numbers, the numbers with 7 as a digit can be calculated by using the equation $10^n - 9^n$. Therefore, the percentage of numbers with 7 in them can be expressed as $\left(\frac{10^n-9^n}{10^n} \times 100\right)\%$

$$\Rightarrow \frac{10^n-9^n}{10^n} \times 100 = \left(\frac{10^n}{10^n} - \frac{9^n}{10^n}\right) \times 100$$

$$= \left(1 - \frac{9^n}{10^n}\right) \times 100$$

We know that $\frac{9^n}{10^n} = \left(\frac{9}{10}\right)^n$ and also

$\left(\frac{9}{10}\right) = 0.9$

$\left(\frac{9}{10}\right)^2 = 0.81$

$\left(\frac{9}{10}\right)^3 = 0.729.....$

We can clearly see that the value of $\left(\frac{9}{10}\right)^n$ keeps decreasing as n keeps increasing. Ultimately, $\left(\frac{9}{10}\right)^n$ will tend to 0.

Thus, as $n \to \infty$, $\left(1 - \frac{9^n}{10^n}\right) \times 100\% \to (1-0) \times 100\% = 100\%$

Hence, for 10^n natural numbers, the percentage of numbers that have the digit 7 are 100%.

Therefore, we can clearly see how ubiquitous the number 7 is through a Mathematical approach. But something that we must remember is that this claim will be satisfied only when we consider a very large number of natural numbers. This is yet another proof for how Mathematics is a very mysterious yet satisfying subject.

***A Question to the readers*:**
In the above fact, if we replace the number 7 or take any other single digit number(other than one), does the result we found hold? (i.e.) Do most natural numbers contain the digit 3 or 5? We implore you to think about it more and dig deep.

Facts about the number seven.

1.The number seven is a special number when it comes to memory, too. The amount of numbers in a series that you can recall accurately is called your digit-span. On average, most people can only correctly remember a series of seven digits accurately.

2. 1 divided by 7 gives 0.14285714285714429
2 divided by 7 gives 0.2857142857142857
3 divided by 7 gives 0.42857142857142886
Thus, we see an interesting pattern of 142857 in all the divisions.

3. Seven has the highest probability of occurring as an addition when rolling two dices.

2)Find the missing number in the series:

a. 77, 78, 77, 81, 73, _____, 55.
b. 17, 7, 24, 19, 9, 28,_____, 8, 31, 27, 10, 37.

3)The average age of 24 students in a class is 10. If the teacher’s age is included, the average increases by one. Find the age of the teacher.

PARADOX

- M Kavya , III B.Sc. Mathematics.

WHAT IS A PARADOX?

A paradox in Layman's terms is an allegedly false statement or an argument that run's against one's prior expectation. The word paradox comes from a ancient Greek word "*Parados*" which means "*beyond belief*".

MATHEMATICAL MEANING FOR PARADOX:

A Mathematical paradox is a Mathematical conclusion so unexpected that it is difficult to accept even though every step in the reasoning is valid. Mathematically a paradox is nothing but a statement or a set of statements that seems to be a right due to lack of some essential logic or information or application of logic to the particular situation to prove that it is actually false.

A Mathematical fallacy, on the other hand, is an instance of improper reasoning leading to an unexpected result that is patently false or absurd.

FOR EXAMPLE:

$$25 - 45 = 16 - 36$$
$$5^2 - 2 \cdot 5 \cdot \frac{9}{2} = 4^2 - 2 \cdot 4 \cdot \frac{9}{2}$$
$$5^2 - 2 \cdot 5 \cdot \frac{9}{2} + \frac{81}{4} = 4^2 - 2 \cdot 4 \cdot \frac{9}{2} + \frac{81}{4}$$
$$\left(5 - \frac{9}{2}\right)^2 = \left(4 - \frac{9}{2}\right)^2$$
$$5 - \frac{9}{2} = 4 - \frac{9}{2}$$
$$5 = 4$$

COOL FACTS ABOUT MATHS:

- 'Four' is the only number in English language that is spelt with the same number of letters as the number itself.
- The symbol for division (÷) is called an Obelus.

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

ZENO'S PARADOXES:

Zeno's paradoxes are a set of four paradoxes dealing with counter intuitive aspects of continuous space and time.

Zeno's Paradox explained using convergent series:

Time can be expressed as:

$t = d/v$

So somebody moving at a velocity of 5m/s and a distance of 10m, it will take that 2 seconds to move that distance.

Zeno's paradox, rewritten in the opposite direction states that in order to get to the end destination you must get half way there, and then ¾ of the way there, then 7/8 of the way there and so on and so on. Never quite reaching your goal.

We can rewrite our formula above to match this paradox.

$$t = \frac{d}{2v} + \frac{d}{4v} + \frac{d}{8v} + \frac{d}{16v} + \frac{d}{32v} + \frac{d}{64v} \ldots$$

This goes on for an infinite number of steps.

We can rewrite this as:

$$t = \sum_{k=1}^{x} \frac{d}{2^k v}$$

We then take the limit as x → ∞:

$$t = \lim_{x \to \infty} \sum_{k=1}^{x} \frac{d}{2^k v}$$

So we do the same problem as before. Somebody walking at 5m/s and a distance of 10m:

$$t = \lim_{x \to \infty} \sum_{k=1}^{x} \frac{10}{2^k 5}$$

The answer should be 2 seconds. The time it takes to do those infinitesimally small tasks allows for movement.

REFERENCE:
https://www.reddit.com/r/math/comments/130td0/zenos_paradox_explained_using_convergent_series/

CONNEXIONS

1) 

2) 

3) 

4) 

Life is a math operation, "Add your friends, Subtract your enemies, Multiply your joy, Divide your sorrow" – ALIUL ISLAM

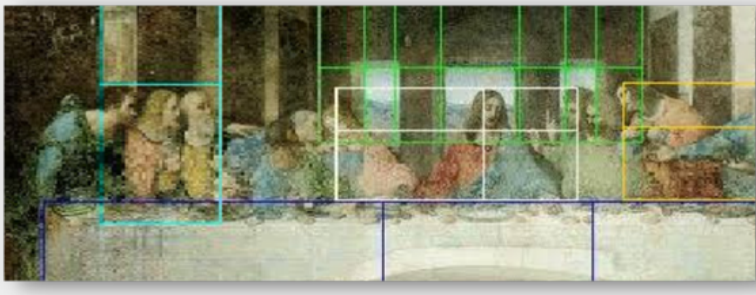
MATH AND DA VINCI

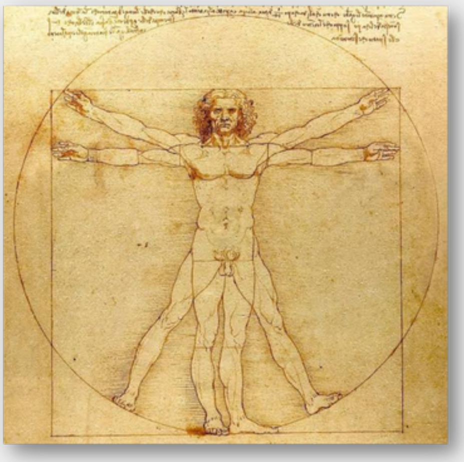
- Harshini D, III B.Sc Mathematics.

Leonardo Da Vinci's association with ***the golden ratio***, known in his time as the divine proportion, runs much longer and deeper. Golden ratio is found by dividing a line into two parts so that the longer part divided by the smaller part equals the whole length divided by the longer part. It is usually denoted by greek letter ***phi*** and roundedto around 1.618…

Da Vinci's use of divine proportion is evident in some of his own works. His famous paintings such as "The annunciation", ***"The last supper"***, ***"La Jaconde"***, ***"Vitruvian man"*** contains golden ratio.
"The last supper" painted between 1494 and 1498 has various design and architectural features which shows very clear golden ratios. Some believe that even the positions of the disciples around the table were placed in divine proportions.
Examination of ***"The vitruvian man"*** created around 1490, shows that the guide lines drawn by Da vinci on the body appear to be based on integer fractions of the height, which is also equal to its width.

One of Da Vinci's most famous painting is ***"la jaconde"*** the Mona Lisa. This painting was begun in about 1503. The width of her face is very close to a golden ratio. The proportions are seen even in her hair and in vertical dimensions.We may not say that all his paintings contain math but we can say that math is everywhere.





'PRAYOG'

- Yuvarani N, Mathumithra M, Shara Princy B, Akshaya M, III B.Sc Mathematics.

A dialogue between Mathematics and Bharatnatyam!
The '***Shringar***' to the invocation of the gods, rhythms of nature,dance of peacock,rain, journey of light, drawing of water from the river etc., are the noteable themes in bharatnatyam, but every motion uses cardinal numbers 3,4,5,7and 9 to arrive at a figure of 32, which is the basic numeral structure of bharatnatyam body postures and compositions.

Most of the postures are characterized by 3 angular nodes, linear formations like straight lines and circular patterns. The Hindu God Narayana is a straight line. Goddess Parvati Devi signifies 3 in Bharatnatyam, which is originally comprised of 108 karnas or Temple postures. Yet the dancers kept choreographies to the basic 32 postures and confined the geometric patterns made by dancers to triangles, circles, rhombus, pentagons, etc. In Alarippu, Mallari, Jathi Swara, Tillanna, which are the important parts of a Margam, the dancer's body is broken into sharp triangles at hands, knee and legs. Even the main Talam that is Natuvangam needs Mathematics for peculiar beats at sharp times.

DO YOU KNOW?

A Palindrome number is a number that reads the same backward and forward. Eg: 12421.
Multiplying ones always gives you palindromic numbers.
Eg: 111,111×111,111=12,345,654,321

4.What do you call a flat image that can be easily displayed in 3D image ?
5. Using only the process of addition, how to add eight 8's to get the final sum to be 1000 ?

● Mathematics is not only real, but it is the only reality. – MARTIN GARDENER

THE VALUE OF π

- Subalakshmi P, III B.Sc. Mathematics.

Does the word Pi (Pie) ring a bell to you? Hey, if your mouth is watering stop right there. It's about the Mathematical Version of π.

The earliest written approximations of π are 3.125 in Babylon (1900-1600 B.C.) and 3.1605 in ancient Egypt (1650 B.C.). Both approximations start with 3.1—pretty close to the actual value of its for your Math Exam that you didn't prepare for but still relatively far off if it's usage is in Rocket Science where it is extensively used. The Ancient ***Jainas*** were aware that there is a fixed ratio between the diameter and the circumference and that the circumference multiplied by one-fourth the diameter is the area of a circle . Aryabhata I had a value for Pi that is the probable origin of the value .

The following quotation unveils the in-depth discovery of π.

ARYABHATA'S VALUE OF π

चतुरधिकं शतमष्टगुणं द्वाषष्टिस्तथा सहस्राणाम् ।
अयुतद्वयविष्कम्भस्यासन्नो वृत्तपरिणाहः ॥

A.B.Ganitapada 10

Aryabhata used 2 methods to calculate the value of Pi.

The mode of arriving at this value was substantially the same as that for getting the value √10 but instead of stopping with the inscribed polygon of 12 sides, the number of sides was doubled till 384 was reached.

Ganesa suggested that a 384 sides-polygon inscribed in a circle of diameter 100 was calculated by repeated application of the formula.

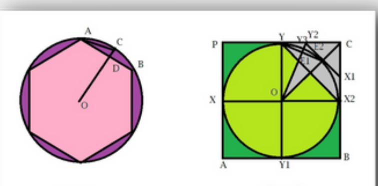


Figure A Figure B

From Figure A,

$$S_{2n} = \sqrt{\frac{S_n^2}{4} + \left(r - \sqrt{\frac{4r^2 - S_n^2}{4}}\right)^2}$$

here S_n and S_{2n} are the sides of the polygon of n sides and 2n sides respectively.

From Figure B, through a intense study and proof, it is concluded that

Side of the polygon of 16 sides = 2(Y)(Y1) - 2(Y2)(Y1)

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Using the above two figures, the number of sides of the polygon can be doubled and the corresponding side calculated till the number of vertices is very large and the polygon becomes a circle.

The measure of the circumference in a circle of diameter 900,000,000,000 is 2,827,433,388,233.

$$\pi = \frac{2,827,433,388,233}{900,000,000,000}$$

π=3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211706 79...

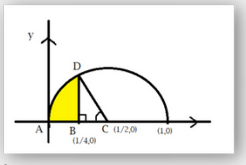
I'm sure you didn't read all the numbers. That's fine neither did I!

Thus the relation between circumference and diameter of any size gives the same ratio value that is . In the case of proof, it was previously chosen to consider a huge number of sides of a polygon to attain a large circle. Thus the relation between circumference and diameter of any size gives the same ratio value that is . In the case of proof, it was previously chosen to consider a huge number of sides of a polygon to attain a large circle.

$\frac{22}{7}$, $\frac{333}{106}$, $\frac{355}{113}$, $\frac{67783}{21576}$, $\frac{68138}{21689}$, $\frac{408473}{130021}$, etc.

Aryabhata had followed the above method to find the value of Pi.

ISSAC NEWTON VALUE OF π



Isaac Newton used the semicircle, and the proof involved the area of the triangle within the semicircle where he came to a conclusion of the following series, which also gave the same value of as that as of Aryabhata.

$$\pi = \frac{3\sqrt{3}}{4} + 24\left(\frac{2}{3 X 2^3} - \frac{1}{5 X 2^5} - \frac{1}{28 X 2^7} - \frac{1}{72 X 2^9} - \frac{5}{704 X 2^{11}} - \ldots\right)$$

It is fascinating to see that 2 Great geniuses worked for a long time on this value and came up with proof to support their hypotheses. This shows how Important and significant this number is to Mathematics. The beauty is that Ganitapada was established around 510 CE while Isaac Newton came front with his discovery in the year 1665. Geometry in Sanskrit and Prakrit literature is right from the vedic times to the early part of the seventeenth century A.D. The contributions in the field of geometry made by Sulba Sutras, Hindu Siddants, Jaina Canonical works, Bakshali manuscripts are also as eminent as the contributions made by Mathematicians Aryabhata I & II, Bhaskaracharya I & II, Mahavira and a few more. These have been dealt critically after knowing the significance of their ancient findings.

●Math is the only place where truth and beauty mean the same thing.
– DANICA MCKELLER

MATHEMATICS AND ARTIFICIAL INTELLIGENCE

- Subiksha I U, II M.Sc. Mathematics.

Artificial intelligence is the imitation of human intelligence processes by machines. Artificial intelligence requires a foundation of specialised hardware and software for writing and training machine learning algorithm. AI applications were at the heart of the foremost commercially successful areas of computing and have become a ubiquitous feature of existence. AI is employed in search engines such as Google Search, targeting online advertisements, for instance the recommendation systems offered by Netflix, YouTube or Amazon, virtual assistants like Siri or Alexa, autonomous vehicles, image labeling and spam filtering.

There are thousands of successful AI applications used to solve problems for specific industries or institutions. A few examples are energy storage, medical diagnosing, military logistics, or supply chain management.Mathematical concepts gives the real solution of hypothetical or virtual problems. It's about structure, developing principles that remain true even if you make any alterations in the components. But have we ever thought of how mathematics is used in artificial intelligence? Now let us see a few of the mathematical concepts involved in artificial intelligence.

Linear algebra: Linear algebra plays a vital role and key foundation in machine learning and it enables machine learning algorithms to run on a huge number of datasets. The concepts of linear algebra are widely used in developing algorithms in machine learning . We need to understand four mathematical objects and their properties. Scalars, Vectors, Matrices which could be a 2-D array of numbers where each number is identified with 2 indices and Tensors which is an N-D array of numbers arranged on an everyday grid with N axes.
The most important concepts in calculus are derivatives, vector and matrix calculus, which deals with different derivative operators such as gradient, Jacobin, Hessian and Laplacian.

Calculus: Calculus is a branch of mathematics that analyses every little thing and that's why it plays a major role in AI. Calculus is all about conceptualizing things and formally presenting them. With the help of calculus we study the rate of change of quantities like area, volume and length of the object. Calculus deals with changes in parameters, functions, errors and approximations. Working knowledge of multidimensional calculus is imperative in artificial intelligence. Also, we need to know about gradient algorithms which includes local maxima and minima, saddle points, convex functions and stochastic gradient descents.

Statistics: Statistics serve as a foundation for analysis and dealing with data in data science. Statistics further help in the visual representation of data and performance algorithms used on it for better understanding. Statistics helps to identify specific trivial patterns, outliers in the data, and metric summaries like median, mean, standard deviation, and so on. The statistical concepts such as Baye's theorem, maximum likelihood estimation and distribution concepts such as binomial, Poisson, Gaussian and exponential are employed in artificial intelligence.

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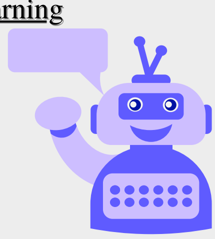
3. https://www.javatpoint.com/linear-algebra-for-machine-learning



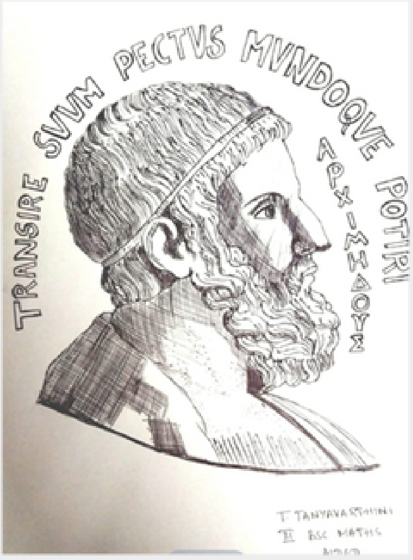
Highlights of the Department

The Department of Mathematics and Mathematics with Computer Applications, Ethiraj College for Women conducted "Two day International Workshop on Optimization Techniques " on 11th and 12th August 2022. Dr. Sung Hoon Chung, Assistant Professor, Department of Systems Science and Industrial Engineering, Binghamton University was the resource person.

S.A. Gowri Parameswari (II BSc Mathematics) secured first place (Gold Medal) in SNJ TamilNadu State Youth Volley Ball Championship 2022-2023

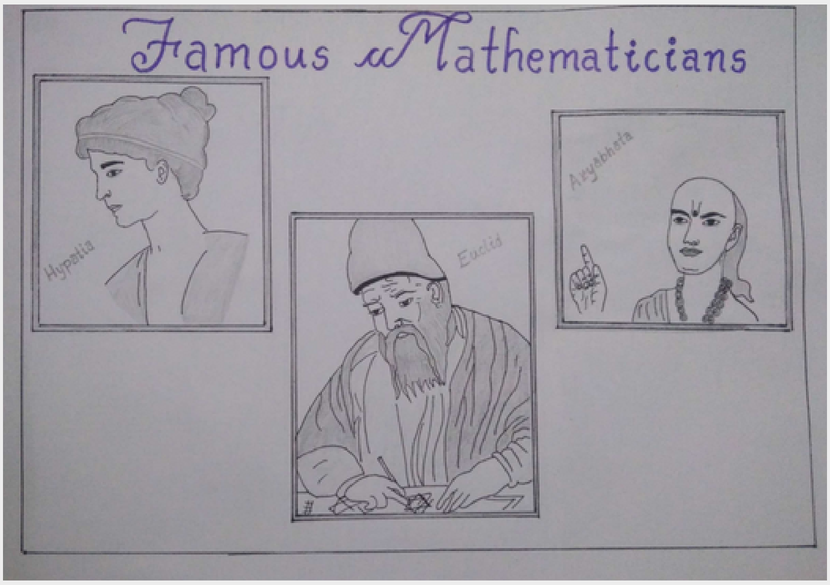
Mathematics reveals its secrets only to those who approach it with pure love, for its own beauty. ~ ARCHEMEDES.

Kalaakrti



~Tanyavarthini T (III BSc Maths)

~Roshini T (II MSc Maths))



~ Anbukodi (II BSc Maths)

Not only 12+1=11+2,but the letters "twelve plus one" rearrange to give you "eleven plus two". If you count the number of letters per phrase, you get the number of letters that phrase describes!

Sudoku

		3	5		9		4	
4	6							
5			1	8				
							9	
			4		3		8	1
					7			6
		9					3	
	4					7	1	
8				7				

MATH POEM

Life is so **undefined**
with **hypothesis** and **differentiation**
People being **separated** by EGO
Followed by a **series** of **problems.**

But no worries,
Just a **combination** of **Analysis** and **Understanding**
Makes your way a **Superset.**
With a glimpse of faith and **positivity**
It's **trivial** we can come over people of different **walks** and **faces.**

When the **mode** of your thinking is **divergent**
All you see is the **sequence** of success.
May there be some **tests** and **curves;**
Without which life won't be **complete** and **compact.**

Stay focused on the **direction (vector),**
Keep an **'i'** (eye) on your progress,
Hardwork is the single **local determinant,**
Witness the **maximization** of true **identity!**

What I **mean** here is
Life is **Complex** with **Real blocks**
But, Never forget
We ain't **regular.**

~ Saradha P
Alumna
M.Sc. Maths

LEGENDS OF THE DEPARTMENT

Left to Right

1) Mrs. Nancy Vedanayagam
2) Dr. Lalitha Subramanian
3) Mrs. Nirmala Natarajan
4) Dr. Amutha Nagaraj
5) Dr. V. Varalakshmi
6) Dr. P. Nirmala
7) Dr. M. Jeeva
8) Dr. M. Mullai

Teacher's day celebration:

"Teachers are the backbone of any country, the pillar upon which all aspirations are converted into realities" ~ A. P. J. Abdul Kalam.

The students of the Department of Mathematics celebrated the Teacher's day in a heartfelt way, expressing their gratitude and respect on 5th September 2022

Answers: Quiz:

1. There is a number in mathematics that when multiplied by 4, the opposite will appear and it is 21978.
2. a. Series increases and decreases alternatively with a difference of +(1)^2, -(1)^3, +(2)^2, -(2)^3, +(3)^2, -(3)^3. i.e., +1, -1, +4, -8, +9, -27 & the answer is 82.
   b. 23.
3. Age of the teacher = (25x11-24x10) years =35 years.
4. A hologram.
5. 888+88+8+8+8=1000.

~Badhmalochani D, III B.Sc Mathematics

Connexions:

1.Mathematics 2. Combination 3. Hypotenuse 4. Symmetry

~ Hevanthika G , III B.Sc Mathematics

Sudoku:

7	8	3	5	6	9	1	4	2
4	6	1	7	3	2	9	5	8
5	9	2	1	8	4	6	7	3
3	1	8	6	2	5	4	9	7
6	2	7	4	9	3	5	8	1
9	5	4	8	1	7	3	2	6
1	7	9	2	4	6	8	3	5
2	4	6	3	5	8	7	1	9
8	3	5	9	7	1	2	6	4

~ Supraja SV , III B.Sc Mathematics

V	E	H	W	R	A	E	D	I	V	S	D	G	E	R	O	K	E
A	M	J	H	E	R	O	M	A	R	D	A	E	Z	F	H	H	F
R	U	V	M	N	S	U	B	T	R	A	C	T	I	O	N	O	S
S	L	I	G	O	W	R	I	K	R	I	T	H	I	N	A	P	U
H	T	V	S	F	R	A	C	T	I	O	N	R	U	P	A	E	G
I	I	E	P	R	A	V	E	E	N	A	V	I	J	A	Y	N	A
N	P	K	S	A	R	A	S	W	A	T	H	I	L	V	E	T	N
I	L	A	C	A	P	A	D	D	I	T	I	O	N	I	X	A	Y
A	I	V	S	N	E	H	A	P	R	I	Y	A	J	C	A	G	A
B	C	A	D	I	V	I	S	I	O	N	T	P	N	K	M	O	G
I	A	R	G	I	N	G	U	V	I	N	E	O	L	I	E	N	H
N	T	S	N	G	O	N	S	I	H	N	E	L	O	G	I	S	O
A	I	H	I	R	S	I	E	A	E	E	A	Y	I	R	S	U	S
Y	O	I	K	A	Q	T	E	M	X	L	P	G	P	A	W	D	I
A	N	N	I	C	U	H	N	M	A	A	P	O	U	J	E	H	T
P	T	I	T	E	A	I	A	A	G	N	A	N	V	N	T	A	U
R	A	D	H	M	R	Y	W	E	O	G	O	U	I	A	H	V	P
I	B	E	A	K	E	A	Q	I	N	B	A	N	W	M	A	R	S
Y	L	V	A	N	D	H	A	N	A	T	Q	S	N	I	K	I	N
A	E	I	Q	M	U	L	T	I	P	L	I	C	A	T	I	O	N

1. It is the process of finding the total (or) sum by combining two or more numbers.

2. It is a shape that has five straight and equal sides.

3. It is the process of calculating the result when a number is taken times.

4. It is a number expressed as a quotient, in which a numerator is divided by a denominator.

5. It is the mathematical process of finding out how many times one number is contained in others.

6. It is a shape that has four sides of equal lengths and four angles of 90 degrees.

7. It is a list that shows the result of multiplying certain numbers with each other.

8. It is a closed shape with straight sides.

9. It is a shape with six sides.

10. It is the process of finding the difference between two numbers.

Answers:

1. Addition 2. Pentagon
3. Multiplication 4. Fraction
5. Division 6.Square
7. Multiplication table8. Polygon
9. Hexagon 10. Subtraction

By Praveena V, II B.Sc Mathematics

UPCOMING EVENTS OF THE DEPARTMENT:
Two day International Conference on Indian Contribution to Mathematics - Ancient & Modern (ICICM2022) on 13th and 14th October 2022.