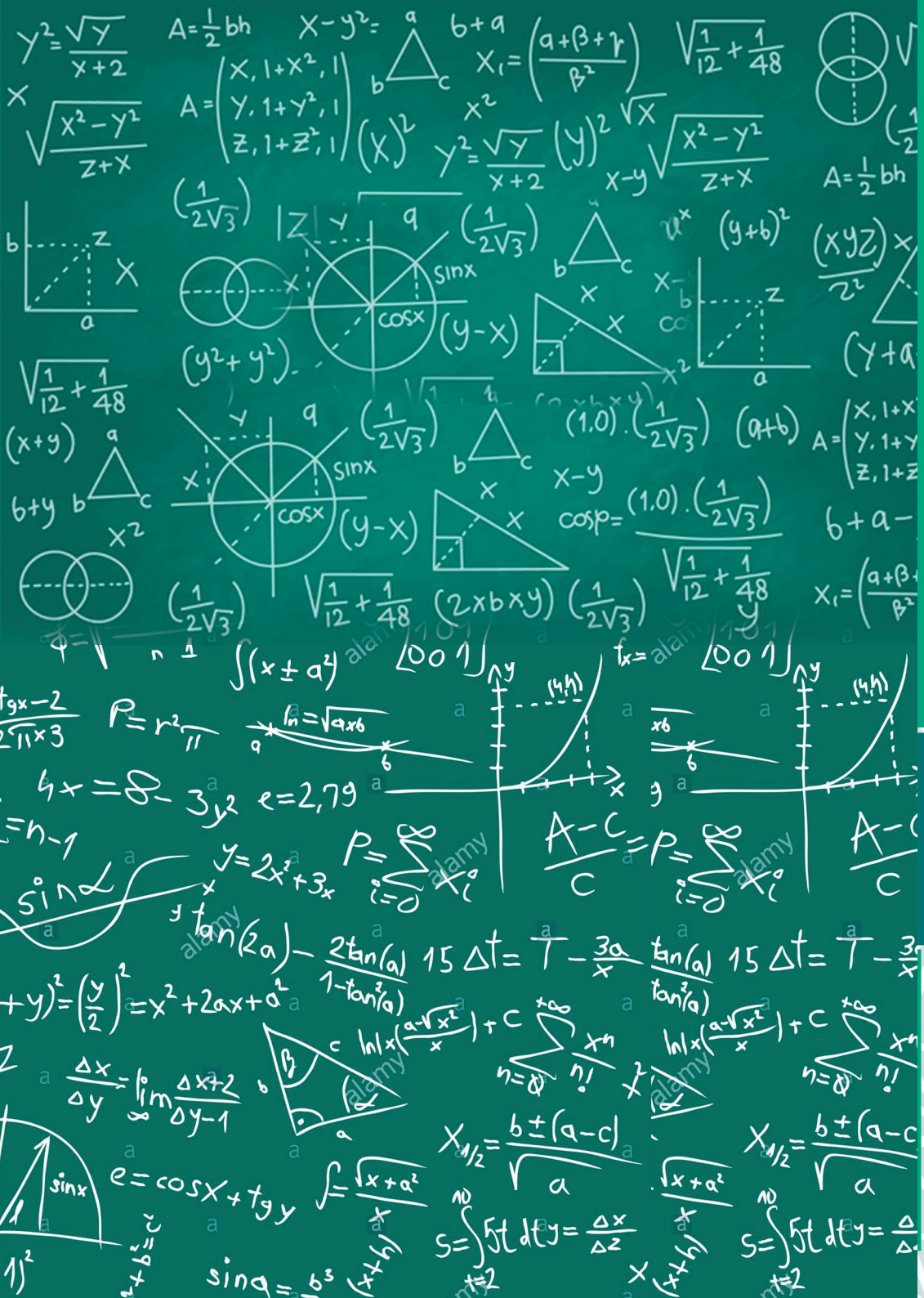


ABSTRACT BOOK

Association for International Mathematics Education and Research
(AIMER)

5th International Conference on Mathematics Education

19th - 22nd December, 2019

Venue : Indore Marriott Hotel
Vijay Nagar - Indore - India

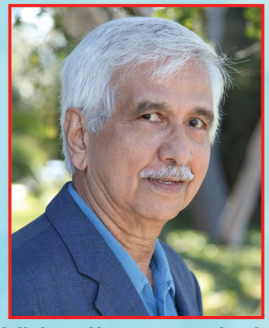
Sponsor:
Sri Prakash Educational Institutions
Andhra Pradesh - India

AIMER

5th International Conference on Mathematics Education

4th International Conference on Mathematics Education

Workshops and Special lectures conducted and delivered by

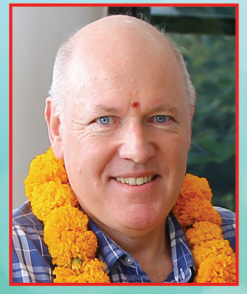


Dr Vidyadhar mandrekar
Michigan State University,
USA

Dr Miriam Amit
Bengurion University,
Israel

Dr Damjan Kobal
University of Ljubljana,
Slovenia

Dr S C Agarkar
Retired Senior Scientist,
Homibaba Centre for Science Education



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Founder, School of Vedic Maths
Maharastra

AIMER

FIFTH INTERNATIONAL CONFERENCE ON MATHEMATICS EDUCATION

Dates: 19th – 22nd December 2019. Indore Marriott Hotel, Indore - India

PROGRAM

19th - December - Thursday

1: 15 pm to 3:00 pm	Registration
3:00 pm to 3:30 pm	Inauguration and Felicitations
3:30 pm to 4:15 pm	Written Test leading to quiz program
4:15 pm to 4:45 pm	High Tea
4:45 pm to 5:30 pm	Presidential Address
5:30 pm to 6:00 pm	Special Lecture I

20th - December - Friday

9:00 am to 10:00 am	**Students Presentations - 1**
10:00 am to 10:30 am	Adult Presentation - 1
10:30 am to 11:00 am	Special Lecture – II
11:00 am to 11:30 am	Tea Break
11:30 am to 12:00 noon	**Students Presentations - 2**
12:00 noon to 12:30 pm	Adult Presentation - 2
12:30 pm to 1:00 pm	Special Lecture – III
1:00 pm to 2:00 pm	Lunch Break
2:00 pm to 2:30 pm	**Students Presentations - 3**
2:30 pm to 3:30 pm	Workshop: (1)
3:30 pm to 4:00 pm	Adult Presentation - 3
4:00 pm to 4:30 pm	Tea Break
4:30 pm to 5:30 pm	**Students Presentations -4**

21st – December - Saturday

9:00 am to 9:30 am	**Students Presentations - 5**
9:30 am to 10:00 am	Special Lecture – IV
10:00 am to 11:00 am	Adult Presentation - 4
11:00 am to 11:30 am	Tea Break
11:30 am to 12:30 pm	Quiz Program
12:30 pm to 1:00 pm	Special Lecture – V
1:00 pm to 2:00 pm	Lunch Break
2:00 pm to 3:30 pm	Debate (Is an Entrance Examination Necessary to enter a Professional course after schooling? Chair person Dr SC Agarkar)
3:30 pm to 4:00 pm	**Students Presentations - 6**
4:00 pm to 4:30 pm	Tea Break
4:30 pm to 5:30 pm	Adult Presentation - 5

22nd – December - Sunday

9:00 am to 9:30 am	**Students Presentations – 7**
9:30 am to 10:00 am	Celebrations of Ramanujan's 132nd Birthday
10:00 am to 11:00 am	Workshop – (2)
11:00 am to 11:30 am	Tea Break
11:30 am to 12:30 pm	**Students Presentations – 8**
12:30 pm to 1:30 pm	Lunch Break
1:30 pm to 2:00 pm	**Students Presentations – 9**
2:00 pm to 3:00 pm	Open session
3:00 pm to 4:00 pm	Valedictory Function
4:00 pm to 4:30 pm	Tea Break and dispersal

* * * * *

Non-Routine Geometry

Authors: Siddhant Baiswar, Adwai Krishna

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Abstract

Usually by geometry we imagine triangles, squares, angles, etc. But what if the page which we draw this figure on was not what we call a page in our daily life. What if the plane was not flat but curved?

That is what we are going to explore and introduce. This is to explore geometry on planes not explored in our daily life. Such an example is a sphere. In spherical geometry all lines are circles, but all circles are not lines. Also, all perpendicular are parallel to each other in this plane.

This will be an explore geometry on a toroidal plane in a similar way. This is going to redefine the understanding of shapes to accommodate them in our plane.

This will help to visualize the routine shapes in a non-routine plane.

Keywords: non-routine geometry, understanding of shapes.

Mathematics Behind...

Anshul B
Kabir U
Affiliation: Bhavans B.P Vidya Mandir, Nagpur

Abstract

Mathematics is not just something which only some people should be doing. Mathematics has its presence in every aspect of day to day life. Complex Math can be useful for major physics, astronomy and chemistry problems but besides this complex mathematics, there are many other uses of it in various 'weird' and 'not thought of' aspects of life. In this presentation you will get to see the coupling between 'Mathematics' and 'Football' and some other sports. And how Mathematics can be used to solve criminal cases or how can it be applied in everyone's life. The application of mathematics is shown through game theory which is a very technical branch of Math, through showing the presence of Magnus effect, projectile motion, randomness, gambling tactics used by analytics and gamblers with the help of Mathematics in football and in successful organizations. The presence of mathematics, both in everyday life and researches is all important. The 10 minutes connects the audience to the speaker through a connecting medium of Mathematical importance. The examples of billionaires who became billionaire by Mathematics is crucial to the presentation. Like Matthew Benham who was a mathematician and became a billionaire by using sophisticated skills of professional gambling put in football. He even owns a club named Brentford.

The theme here is Mathematics Applied and Applicable in various places which we never think of...

Keywords: Mathematics, applied, applicable.

Technology & Mathematics

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Abstract

In the modern world, in many countries and locations around the world, there is a significant rift between the knowledge and skills students learn in school and the ones workers need in workplaces and communities. Employers report that they need students who are better prepared in skills such as professionalism and work ethic, oral and written communication, teamwork and collaboration, critical thinking and problem solving, application of information technology, and leadership. So, the emphasis in schools is increasingly on *learning how to learn*, rather than just amassing specific technical skills that keep evolving with increasing complexity. Educational institutions today encounter an ever-expanding demand in their attempt to ensure that students are well equipped to enter the workforce and navigate a complex world. Studies indicate that computer technology can help support learning, and that it is especially useful in developing the higher order skills of critical thinking, analysis, and scientific inquiry. Mathematics, to most, is a complex and difficult subject. The tendency for most students is to consider the subject as one that is boring, thus, creating lack of interest in the topics being discussed. A number of aspects modify to an extent when we bring in technology present in the world. Technology brings a change of pace to students where they can easily interact with devices which are almost omnipresent as well empowers them to focus with computational support at hand. It allows to them to think in different angles and makes ideas tangible. Now there are two aspects of technology here: one which relates to the modern paradigm of classrooms being digitally modified and the other concerning the modification of human biology; with greater respect to the brain; to improve our cognitive functions and allow us to learn faster and better. There are numerous ways to digitally enhance the classroom like computers, class blogs, electronic hardware (microphones), mobile devices, interactive whiteboards, videos, websites, online study material, games and soft wares. The full-length paper would include the results of the applications of the techniques in select areas. The highlight of the paper would the in-depth research on the modification of the human anatomy

(the brain for example) for the betterment of human minds and how technology could definitively prevent the mass epidemic of intimidating mathematics. One of the specifics would be *transcranial direct current stimulation* and existing technologies (brain training) as such which modify the human brain directly to function much more efficiently. A study showed that people who received brain stimulation during training sessions on five consecutive days learned two to five times faster than those who received sham stimulation, and they retained a 30 to 40 percent performance edge six months later. The workings of the techniques would be extensively included in the full-length paper and the results would be included as well.

There is a lot of potential in these techniques which could affect millions of people in a good way.

Keywords: technology & mathematics, skills.

Euler's Identity: 'The Most Beautiful Equation'

Ashtha Burde
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Abstract

Euler's Identity is a real classic and one can do no better than that … It is simple to look at and yet incredibly profound, it comprises the five most important mathematical constants:

- The number 0.
- The number 1.
- The number π, where, $\pi = 3.1415926535...$
- The number i, where, $i = \sqrt{-1}$
- The number e, where, $e = 2.7182818284...$

Euler's Identity is written simply as: $e^{i\pi} + 1 = 0,$

This equation combines arithmetic, calculus, trigonometry and complex analysis into what has been called "the most remarkable formula in mathematics". He seemed to have an instinctive ability to demonstrate the deep relationships between trigonometry, exponentials and complex numbers.
Euler's identity is actually a special case of **Euler's formula** ,$e^{ix} = \cos x + i\sin x,$

This formula claims that e (the base of the natural logarithm, an irrational number) raised to the power pi (relating circle circumference to diameter, also irrational) times *an imaginary number* is not only *meaningful*, but it's a real whole number: negative one.

It has been claimed that Euler's identity appears in his monumental work of mathematical analysis published in 1748, *Introductio in analysin infinitorum*, which , is a two-volume work by Leonhard Euler which lays the foundations of mathematical analysis . It was initially written in Latin .

About Euler :

Today, Euler is considered one of the greatest mathematicians of all time. His interests covered almost all aspects of mathematics, from geometry to calculus to trigonometry to algebra to number theory, as well as optics, astronomy, cartography, mechanics, weights and measures and even the theory of music.

Keywords: Euler, calculus, trigonometry.

Ethno Mathematics

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Tanvi Gajralwar

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Abstract

Ethno mathematics is study of relationship between culture and mathematics. It can be defined as "The mathematics which is practiced among identifiable cultural groups." Goal of ethno mathematics is to contribute to both culture and mathematics. In this project it is proposed why ethno mathematics is necessary to be added to school curriculum, what are its advantages, the basic techniques of it to understand mathematics. Ethno mathematical approaches to mathematics curriculum are intended to make school math's more relevant and meaningful connection for students. The concept Ethno math's is specially focused in countries like USA, Canada, etc. the project is to be made to give data of new courses to school for better understanding of students and to give awareness about this concept of learning. Main focus of this project will be on the geometrics principles of the various culture. For example, the basic's used by Egyptians to build their famous monuments like Pyramids. The project will focus on geometry but will help to spread awareness about this concept. This will show formation of great pyramids, designs of building, the architectural style of people of particular culture or area. It also focuses on the tribal life which is based on ethno.

Keywords: Ethno mathematics, cultural, geometric principles.

Teaching Methods of Geometry in School/College

Maitreyee Telang

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Abstract

Teaching methods of geometry begins with identification of different geometrical objects and memorization of formula. After memorization, different illustrative problems to be solved. Students usually copy, memorize and reproduce the answer in examination and score marks which is wrong. Ramanujan states that "An equation means nothing to me unless it expresses thought of god." But, what "thought of god" is to be understood and practiced while learning mathematics as well as geometry. This paper will guide teachers and students on how to incorporate different skills like language, logic, observation, questioning, reasoning, creativity and history of geometry.

Keywords: Teaching methods, memorization, skills.

New Result in Geometry

Trisection of a Line Segment and an Angle

Author- Mast Piyush Patil & Mast Naman Jaisingh

Affiliation- Bhavan's B.P. Vidya Mandir, Ashti

Abstract:

Part 1 – Trisection of a line segment.
In any line segment, we can trisect the line segment using our process. Taking the ex. of fig. 1, trisect the line segment using following process: -
Construct the perpendicular bisector of line segment AB. Measure the distance OA & draw an arc at C&D. A square ADBC is obtained.

Now bisect the angles-

ACD, BCD, CAB

Mark point E. Join BE and mark point F. Measure BF and cut arcs at G with center as B, at H with center as G and at A with center as H.

BG=GH=HA=AB/3 is obtained.

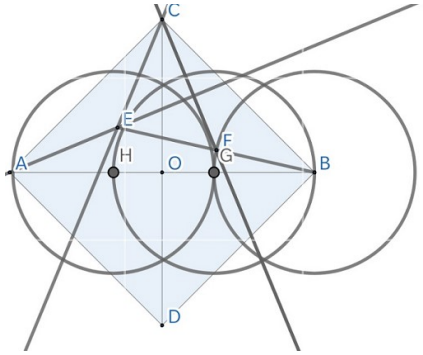

Fig.1

Part 2 – Trisection of an angle.
In any angle, we can trisect it using our process.
Taking the ex. of fig.2. , trisect the angle using the following process:-
Take any random measure in a compass and cut arcs at A&C.
Measure AC and cut arcs at D,E&C.
Taking centre as A and with centre as C cut arcs DB&DB respectively.
Now measure EF & cut arcs at G&H with center A and at I&J with centre C, at N with center H ,at M with center G ,at L with center J , at K with center I.
Join HK ,NI ,GL ,MJ and mark points Q&P.
Measure QP and cut arcs at R with centre C, at S with center R ,at A with center S.
You get measure of arc RC = measure of arc SR = measure of arc SA.
Now draw a ray from B with point on it as N, draw another ray from B with a point on it as M.
The following results are obtained–
Angle COR= Angle ROS=Angle AOS=1/3 * Angle AOC.
Any general angle cannot be trisected using only Euclidean Tools.

What is wrong in this method?

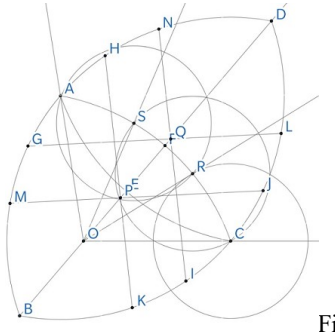

Fig.2

Keywords: Trisection, Line, Angle

The Mathematics Behind Cryptography

Rashi Suryawanshi

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Abstract

Cryptography involves creating written or generated codes that allow information to be kept secret. It is the practice and study of techniques for secure communication in the presence of third parties. In cryptography, a cipher is a series of well-defined steps that can be followed as a procedure (an algorithm). Most encryption is heavily based on Number Theory inclusions (like Fermat's little theorem, Chinese Remainder theorem etc.) most of it being abstract algebra. There is high use of modular arithmetic. Cryptography has been through numerous phases of evolution. Early uses in history involved simple substitution in ciphers like Caesar cipher, Vigenere cipher, etc. Modern algorithms that are used in current technology comprise of Modular Arithmetic and Number Theory. Some of these are Diffie- Hellman key exchange, RSA Algorithm.

It is needed for Confidentiality, Authenticity, Data Integrity, etc. Cryptography is used in many applications like banking transactions cards, computer passwords, and e-commerce transactions etc.

Keywords: The fundamental theorem of arithmetic, discrete logarithmic problem, security, computer science.

The Beauty of Mathematics

Sacchit Kale

Affiliation: Bhavans B.P Vidya Mandir, Nagpur

Abstract

Mathematics is a sense that is unique to humans. Physics, Chemistry, Biology, Humanities, in fact every branch of science needs Mathematics. Maths in simple words is finding patterns in the world. We observe that these patterns appear in one way or the another in everything. Some Famous patterns that we are aware of are:

1) Pie: (*π) The ratio of the circumference of a circle to its diameter is approximately equal to Pie. Since its discovery it has appeared in several forms. The famous Euler's equation, relativity, Kinetic Theory of gases, time period of a pendulum. From chemistry to Physics we have used pie whenever we needed to or where it was there.*

2) Golden Ratio: It is equal to the ratio of two numbers a and b such that a/b =a+b/a. = Phi (φ). This ratio has appeared in the topography of the Earth, fabric of the cosmos and it is present in all the beautiful things. From landscapes of painting to flowers, the Milky way and human faces and DNA.

3)Fractals: They are never ending patterns having different rotational symmetries. Now there is new way of looking into mathematics, through all these years of mathematical discoveries, theorems and rules looking at their simplicity and wide implication s, we find that they are beautiful, omnipresent and a simple code which is encoded by the creator in this whole universe. Mathematics is there in every atom of this universe just waiting to be discovered just you need to have the special sense to seek it. The language with which the God wrote the world is mathematics.

Keywords: Pie, Golden Ratio, Fractals.

The Mathematics of Stereotactic Neurosurgery

Soham Banode

Khusagra Hathiwala

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Abstract

Biotechnology exists and it is termed by biologists and neurosurgeon as Stereotactic Neurosurgery. It involves the mapping of the brain in a 3-dimensional (x, y, z) coordinate system. With the help of MRI (Magnetic Resonance Imaging) and CT (Computed Tomography) scans and 3D stereotactic frame, neurosurgeons are able to accurately target any area of the brain in stereotactic space (3D coordinate system). Then a sample of the target (generally tumors) is taken and sent to a pathologist to check the cause of the tumor. If it is found to be dangerous then it is operated, otherwise it is treated using medicines.

In Stereotactic Biopsy, the brain, for practical reasons is assumed to be a sphere. A 3-D frame is then placed around the patient's head and then four different parts of the skin are numbed and a ring with four pins is placed on the head

(N-Localizer).

Using CT or MRI scans; we determine the approximate position of the tumors. Then Mathematics (geometry in 3 dimensions) is used to find the accurate position of the tumor. Using needle, a hole is made in the skull and using several formulae, like:

obtain the (x_B, y_B, z_B) coordinates of the point of intersection P'_B between the long axis of rod B and the tomographic section

$$P'_B = P'_A + f(P'_C - P'_A) = fP'_C + (1-f)P'_A \qquad (1)$$

The vector form of Equation 1 shows explicitly the (x, y, z) coordinates of points P'_A, P'_B and P'_C

$$\begin{bmatrix} x_B & y_B & z_B \end{bmatrix} = f \begin{bmatrix} x_C & y_C & z_C \end{bmatrix} + (1-f) \begin{bmatrix} x_A & y_A & z_A \end{bmatrix} \qquad (2)$$

a sample of the tumor is taken.

Keywords: Neurosurgery, Stereotactic biopsy, 3-D geometry, N-Localizer

Narayan Pandita: The Great

Soham Deo
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Abstract

Narayan Pandita was a great Ancient Indian Mathematician. He lived in the15th century. His father's name was Narsimha or Narasimha. Plofker writes in his commentaries that Narayan Pandita's texts were most significant after that of Bhaskara II. He has written many books but two of his books are very famous, known as Ganit Kaumudi as his arithmetic treaties which had a lot of content about combinatorics and Bijganita Vatsama as his algebraic treaties. Narayan Pandita contributed in many fields of mathematics. Some of them are: Combinatorics, Arithmetic Progression, Algebra, Finding solutions for indeterminate equation [$Np^2 + 1 = q^2$(Pell's equation)], Magic Squares, Higher order equations, Operations with zero, Geometrical rules, Differential Calculus, Integral factorization, Cyclic quadrilaterals, Systematic generation of permutations

In this paper presentation, I emphasize Cyclic Quadrilaterals, Integral Factorization and Pell's Equation.
Cyclic Quadrilaterals: These are the Quadrilaterals which fit completely in a circle.
Integral Factorization: This is a type of factorization in which Narayana Pandita discusses about a way in which we can find factor of the given number N.
Pell's Equation: IT is an indeterminate equation in two quadratic variables where we can put a value for N and solve the equation.

Keywords: Narayana Pandita, Cyclic Quadrilaterals, Integral Factorization, Pell's Equation.

Exploring Higher Variable Expansions by Pascal's Triangle and Multi Nominal Theorem

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Sprash Badjate

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Abstract

We are aware about the binomial theorem and some of us also know that the expansions of binomial theorem that is 2 variable expansion is given by Pascal's triangle. Similarly we can get the trinomial expansions that is 3 variable expansion using a pascals pyramid these can easily be visualized but for higher variable like 4 variable we need a 4 dimensional shape which is hard to imagine but can be given on paper using some manipulation we will be giving the way of how they can be expressed also we are trying to give a algorithm to generate them for higher degree expansions and give a generalized form for n variable expansion along with the proof also we are exploring how does Pascal's triangle generate the binomial expansions and also that can any other shape be used to generate such beautiful patterns

Keywords: Pascal's triangle, multi nominal theorem.

The Beauty of Patterns In Mathematics

Authors: Tejas Masne and Surya Prabhath Pidaparthi

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Abstract

The topics viz., The relation between square numbers and triangular numbers, Ultimate sum of digits of natural numbers and the patterns that evolve(*"the ultimate sum of powers (power >= 2) of multiples of 3 is always 9"),Pattern for square numbers: Pattern for cubes, Pattern for power of 4, Pattern for power of 5, Pattern for power of 6, Pattern for power of 7,A small yet powerful pattern linking pascal's triangle and cubes of natural numbers,* The prime number's relation with the patterns in a super sum, Prime numbers that evolve in the patterns of the grid, Primes evolving in a satisfied condition are discussed in this short paper.

Keywords: square numbers, triangular numbers, patterns, prime numbers.

Work of Bhaskaracharya In Factorisation

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Abstract

The purpose of this paper is to introduce some of the contribution of BHASKARACHARYA in Factorisation. The following topic is covered in this paper:

Diophantine Equations- Basically the format of this equation is ax + by = c, where a, b& c are constants and x&y are variables.

Actually, the Kuttaka method was proposed earliest by Pingala then by Aryabhata and further explained by Bhaskaracharya.

In this method many variables were proposed by Bhaskaracharya whose values were found by given constants and in turn these found variables were used to factorise the given equation.

Keywords: Factorisation, Bhaskaracharya.

Ethnomathematics (Mathematics of Tribals)

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Abstract

Mathematics is the result of human culture as a result of activities, making patterns, designing, calculating, and applying to solve problems in everyday life. This area of ethnomathematics mainly focuses on addressing Eurocentrism by countering the common belief that most worthwhile mathematics known and used today was developed in the Western world. The area stresses that "the history of mathematics has been oversimplified" and seeks to explore the emergence of mathematics from various ages and civilizations throughout human history. Ethnomathematics is related to the evaluations, quantities, qualities and the relation between realities. The field of ethnomathematics link students' diverse ways of knowing and learning through the use of culturally embedded knowledge along with academic mathematics curriculum. Ethnomathematics also builds on and values the cultural experiences and knowledge of students regardless of whether they are represented by dominant or non-dominant cultural systems and empowers them intellectually, socially, emotionally, and politically by using cultural referents to impart their knowledge, skills, and attitudes in the pedagogical work in schools. In this perspective, students develop deeper understandings in mathematics and improve the absorption of formal mathematical concepts by applying ethnomathematics. Some examples are of Ethnomathematics in class rooms are the use of field studies, Japanese origami etc.

In our presentation we would be sharing different examples of Ethnomathematics in many areas of life, for example English and along with that we would also share the history, present day concerns and criticism of the same.

Keywords: ethnomathematics, eurocentrism, culture.

Trigonometrical Music

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Shruti Mittal
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Abstract

The sounds that we hear every day, including music, reach our ear as sound waves. These sound waves travel through the air at different angles from the original sound source. The sound then bounces off whatever is nearby, such as people or the walls of a concert hall. If a building is designed in such a way that the sound does not bounce back to the listener's ear well, then the music can be hard to hear or it can sound unbalanced. Engineers use trigonometry to figure out the angles of the sound waves and how to design a room or hall so that the waves bounce to the listener in a balanced and direct manner. Studio producers or hall managers sometimes install panels that hang from the ceiling of the room—these panels can be adjusted at specific angles to get the sound waves to bounce correctly. After you have heard us you will know how mathematics all around us can make everything better for us. If you want to win a music competition where shall you stand so that the judges fall head over heels for your music. This presentation will be the evolution of music which will further inspire youth to study mathematics whose dread is spreading every minute. We have made a model of an auditorium where no mikes are required, no speakers but you are audible to the entire audience. Not only this, you will also sound better and the sound variation in your voice will be more prominent making drama more impactful and comfortable and music more impressive.

Keywords: Trigonometry, Auditorium, Sound Waves

Golden Ratio and Its Application

Debapallab Das & Awanya Jasrasaria

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Email: skvdbr@gmail.com

Abstract

This paper will provide all you need to understand the concepts of beautiful natural and artificial things and why they seem beautiful to us. There are many pyramids in the world. But why is the pyramid of Giza so special. What is it that attracts us towards it? Here we discuss the value of the golden ratio which is often referred to as PHI, the 21st letter of the Greek alphabet. We also discuss the special properties of the divine number PHI. What so special about Monalisa and the last supper? What makes them different from other art works? Well, it is something called the divine proportion a simply the golden ration.

From the number of petals of a leaf to the distance between the course of earth and moon, it is all the divinity of the golden ratio.

Keywords: Golden ratio, Applications.

Rudrata Path-Based Image Encryption

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Abstract

"KnightCryption" is a highly efficient Image Encryption Algorithm which I have derived using the interesting concepts from game of Chess, Math, Poetry from Ancient Sanskrit Shloka and of course my favorite language "Python "and OpenCV. This algorithm ensures that it can be applied on images of varied resolutions and user can flexibly define the levels of encryption needed. The algorithm ensures it has very high Key space, high Key Sensitivity, high uniform Histogram of the encrypted image.

The algorithm takes inspiration from the work of Ancient Sanskrit Poet named Rudrata, where in a simple Sanskrit Shloka he described Knights tour of Chess in poetic and cryptic manner. Inspired by that, this Image Encryption and Decryption Algorithm in Python has been put together where a complex 16 by16 Chess board Knight tour to encrypt the image is used, where each block is further encrypted in 16 by 16, to ensure secrecy. Further level of encryption is done on each pixel using color coding filter. In comparison to existing Image Encryption algorithms, it has very wide Key Space, high level of encoding and very fast.

Keywords: Encryption Algorithm, Chess, Sanskrit Poet Rudrata.

Perfect Cuboid Problem

Author: S. Viswa

Affiliation: RJ Mantra English School

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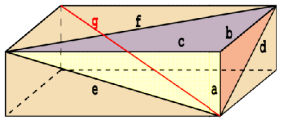
Abstract:



In the image above, they are A, B, C, and G. The first three are the dimensions of a box, and G is the diagonal running from one of the top corners to the opposite bottom corner. But there are also three more diagonals on the three surfaces (D, E, and F) and that raises an interesting question: can there be a box where all seven of these lengths are integers? The goal is to find a box where $A^2 + B^2 + C^2 = G^2$, and where all seven numbers are integers. This is called a perfect cuboid. Mathematicians have tried many different possibilities and have yet to find a single one that works. But they also haven't been able to prove that such a box doesn't exist, so the hunt is on for a perfect cuboid. In this paper, some partial solutions have been given. Starting with Pythagorean triples, a common pattern for the solution of $A^2 + B^2 + C^2 = G^2$ has been arrived at. For instance $(n)^2+ (2n)^2+ (2n)^2 = (3n)^2$ (n=1,2,3....) and $(n)^2+ (4n)^2+ (8n)^2 = (9n)^2$ (n=1,2,3....)

Keywords: Pythagorean Triples, Perfect Cuboid, Diagonal, Pattern

Gracefulness of Archimedean Graphs

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Abstract

The 13 Archimedean solids are the convex polyhedral that have a similar arrangement of nonintersecting regular convex polygons of two or more different types arranged in the same way about each vertex with all sides the same length. Archimedean graph is a graph corresponding to the skeleton of one of the Archimedean solids. In graph theory, a graceful labelling of a graph with m edges is a labelling of its vertices with some subset of the integers between 0 and m inclusive, such that no two vertices share a label, and each edge is uniquely identified by the absolute difference between its endpoints, such that this magnitude lies between 1 and m inclusive. A graph which admits a graceful labelling is called graceful graph. This paper aims to study the gracefulness of Archimedean graphs.

Keywords: Gracefulness, Archimedean graph, labelling, vertices, edges, Hamiltonian cycle, path

Trap (Trigonometry App) – Usage of Technology

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Abstract

Trigonometry is a branch of mathematics that studies relationships between side lengths and angles of triangles. Apps can transform the way you do anything you are passionate about, whether that's creating, learning, playing games, or just getting more done. Here I present trap (Trigonometry app) which gives solution for all your needs of trigonometry in single touch. The topics covered here is how to convert radian to degree, degree to radian. Also, how to find compound angle degrees and solving trigonometric equation. This app is developed using the IDE Android Studio. The program that runs this app is written using JAVA and XML. JAVA for background processing and XML for design. The targeted platform for this app is android lollipop and above versions. The app is particularly designed for the students of class XI belongs to ISCE and CBSE board.

Keywords: Trigonometry, JAVA, XML, Android, Degree, Radian

Recreational Mathematics

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Abstract

Recreational mathematics is a branch of mathematics which deals with puzzles, games ..., Apart from the recreational part, mathematics helps to understand many mathematical principles and plays an important role in logical thinking. A game has been designed and administrated to a group of students of age group 13-14 years. The outcomes of the game are statistically analysed and conclusions drawn. The game is just about the swapping of numbers.

Key words-Recreational Mathematics, Logical development and Swapping of numbers.

A Reflection Problem in a Rectangular Billiard Table

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Abstract

In this modern world, methods of inculcating mathematical knowledge are modernised too. In this short paper, we are going to explain about a problem in which a billiard table is taken having four pockets. A ball is hit from one corner of the table with an angle of 45 degrees. It is found that after certain number of bounces, the ball falls into one of the pockets.

From the above problem, we can generalise number of bounces.

Keywords: Reflection, Rectangular Billiard Table, Generalisation.

On Triangular, Pentagonal Numbers, The Pentagonal Number Theorem of Euler

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Abstract

There are certain numbers called Figurate numbers, Triangular numbers, Square numbers, Pentagonal numbers etc…
These numbers were studied by Pythagoreans. It is a rich field in number theory and many mathematicians contributed on this topic. Leonardo Euler gave a theorem called Pentagonal Number theorem. He proved an identity

$$(1-x)(1-x^2)(1-x^3)\ldots\ldots = 1-x-x^2+x^5+x^7-x^{12}-x^{15}+x^{22}+x^{26}+\cdots$$

where the exponents of x,1,2,5,7,12 etc..., are the pentagonal numbers. In this short paper we are going to tell about the basics of triangular and pentagonal numbers and some relation connecting them. Some visual proofs are also attempted. The pentagonal numbers came to limelight when some mathematicians like Srinivasa Ramanujan studied the partitions of a natural number. If $P(n)$ is the number of partitions of n then the following is a remarkable result

$$P(n) = P(n-1)+P(n-2)-P(n-5)-P(n-7)+P(n-12)+P(n-15)-\ldots$$

Keywords: Figurate numbers, Pentagonal numbers, Properties

A Locus Problem in Geometry Using Geogebra

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Abstract

Consider a circle of random radius and draw a diameter AB of the circle. Then draw a non-diameter chord CD of fixed length. Draw lines AC and BD intersecting at point E. The problem is to find the loci of point E under two cases. Case (i) fix the chord CD and rotate the diameter AB about the centre. Case (ii) fix the diameter AB and rotate the chord CD on the circumference of the circle. The problem is dealt with geogebra software and loci are found. The vigorous geometrical proof is also given.

Keywords: Geometry Problem, Locus, Geogebra Software

Application of Plane Geometry in Army Operations

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Abstract

This paper is composed of how the army officials use the concept of the plane geometry to get successful in their missions. The officials use this concept to calculate the angular distance, direction of fire and trajectory. The word mill is used to represent the angular distances. The angular distance subtended by a circle is $\frac{2\pi}{0.001}$ or 6283+ mils and this value is complicated to use practically due to which the circle is divided into 6400 equal parts in which the value of each mil is $\frac{1}{6400}$. The direction of fire is calculated by taking 2 objects parallel to the target point and the aiming point on the map. As speed is the most essential factor in the field of wars the most experienced and trained artillery officers calculate them. The direct shooting point is not visible through the gun due to which this indirect laying method is used. The trajectory of the shell is also estimated so that the shooter does not miss his target. The weight, shape, size, air resistance and the calibre of projectile all this affect the trajectory of the shell. So, the officer needs to measure all the other calculations keeping in mind all these factors that affect the trajectory. when muzzle velocity is fixed and elevation is increased from $0°\ to\ 45°$the height, the angle of fall and time of flight increases. The range is the greatest for about 45°. It decreases to 0 for an elevation of about 90°.

Keywords: Geometrical Methods, Firing a target

Mistakes, Howlers and Fallacies in Mathematics

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Abstract

Generally, we commit errors while solving mathematical problems. There are three kinds of errors. Mistakes, howlers and fallacies. Mistakes are errors which occur while solving mathematical problems due to wrong concepts or calculation. Howlers are the errors caused while solving a mathematical problem gives a correct result with wrong methods. Fallacies are wrong results with seemingly logical arguments. In this short paper the various aspects of the above sighted things are discussed with examples.

key words: Mistakes, Howler, Fallacies.

Recreational Mathematics

Author- P. Veera Anjaneyulu.
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Abstract

Recreational mathematics is a branch of mathematics which deals with puzzles, games ..., Apart from the recreational part, mathematics helps to understand many mathematical principles and plays an important role in logical thinking. A game has been designed and administrated to a group of students of age group 13-14 years. The outcomes of the game are statistically analyzed and conclusions drawn. The game is just about the four fundamentals operations and numbers.

Key words-Recreational Mathematics, Logical development and Four fundamental operations.

New Results in Geometry Attained With the Help of Geogebra Software

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Abstract

Historically, the Fermat point of a triangle, also called Fermat Torricelli point is defined as follows

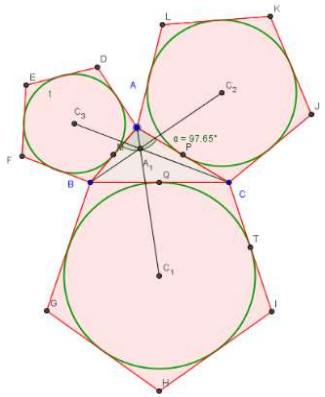
It is a point in the plane of the triangle such that the sum of its distances from the vertices is minimum.

There are several geometrical results including the Fermat point. But it is a still fertile field of research using geogebra software.

Some results are found using the software with regard to Fermat point.

ABC is any triangle. Three regular polygons which contain Odd number of sides (say Pentagon) on the three sides of the triangle ABC are constructed. It is observed that the line segments joining the vertices of the triangle ABC to their corresponding opposite vertices of regular polygons are concurrent.

Some other very interesting results also will be discussed in this paper



C_1A, C_2B, C_3C are concurrent.

Keywords: Fermat point, new results, Geogebra software.

Fractals

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Abstract

This paper starts with Pascal's triangle and its origins. The concept is further extended to find squares of two digit and three-digit numbers, by modifying Pascal's methods. Other such functions are also tried. Various properties of Pascal's triangle and Sierpinski triangle are discussed. Triangular numbers present in the triangles, Fibonacci sequences and Ramanujan's contributions to Continued fractions are analysed. Two interesting puzzles on continued fractions are considered. Different methods of finding the solution to these are given. Application of fractals in daily life is discussed.

Keywords: Continued fractions/ fractals, Pascal's Triangle, Triangular numbers, Sierpinski triangle, Puzzles

Solving Conic Section Problems Using Celestial Mechanics

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Abstract

In mathematics, a conic section is a curve obtained when a plane intersects a double cone. Depending on the angle of intersection, three types of conic sections are possible: namely hyperbola, parabola and ellipse (circle is a special case of an ellipse). In real life, conic sections arise most commonly in celestial orbits - e.g., Earth rotates around the Sun in an elliptical orbit. In fact, celestial objects like planets, comets, asteroids all follow the conic loci under the influence of the laws of gravitation. Most problems in conic sections are solved using coordinate geometry, a popular mathematical technique. In this article, we show an alternate method to solve a complex conic section problem related to finding the angle of intersection between a circle and a parabola, using celestial mechanics.

Keywords: Conic section problems, methods, celestial mechanics.

Fibonacci and Lucas Vectors

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Abstract

A vector is a quantity having both magnitude and direction. The magnitude, given by the length of the vector and the direction given by the unit vectors acting along the x, y and z axes, namely $\hat{\imath}$, $\hat{\jmath}$ and $\hat{k}$. Here, we shall discuss some special vectors in space which are in the form $a = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, where x, y and z are consecutive Fibonacci or Lucas numbers. An attempt has been made to put forth certain properties and establish a relationship between Fibonacci and Lucas vectors using a special matrix.

Keywords: Special Vectors, Components, Fibonacci or Lucas numbers.

An Analysis of The Extended Results On The Miquel Point Of A Triangle Using Technology

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ABSTRACT

Miquel Theorem states that, if on the sides of a Δ ABC points are selected on each side of the triangle and the circumcircles determined by each vertex and the points on the adjacent sides are constructed, then three circumcircles pass through a common point M called Miquel point. The circumcenters of the Miquel circles form a triangle similar to the original triangle. (Δ ABC ~ Δ PQR). The Triangle formed by the points chosen randomly on the sides of the Reference Triangle is called Miquel Triangle. Δ DEF is called Miquel Triangle. If the vertices of the Miquel triangle are the mid-points of the sides of the original triangle, then the Miquel Circles are congruent.

Now this is a treasure house to find new results.

If the Miquel Circles are congruent then,

there are several new results.

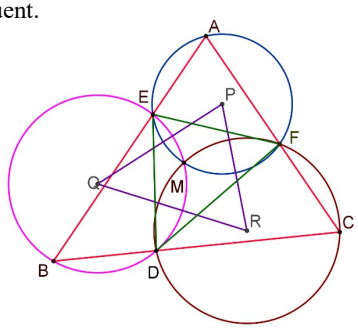
(i) Miquel Triangle, Triangle formed by the centers of the Miquel Circles and the Reference Triangle is similar.

(ii) Miquel Triangle and the Triangle formed by the centers of the Miquel Circles are Congruent.

(iii) Circumcenter of Miquel Triangle is equidistant from Circumcenter and Orthocenter of the Reference Triangle.

(iv) Area of the Miquel Triangle as well as area of the Miquel Circles will be minimum, if Miquel Triangle is Medial Triangle.

And so on . . .



Keywords: Miquel Theorem, Miquel Triangle, Miquel Circles and Euler line.

Analysis of Factors Contributing To Anxiety/Fear/Phobia in Learning School and Ways to Reduce Anxiety/Phobia/Fear

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Abstract

NCF 2005 states that developing children's abilities for mathematisation is the main goal of mathematics education. Whereas the narrow aim of school, mathematics is to 'useful' capabilities, particularly those relating to numeracy numbers. Number operations, measurements, decimal and percentage. Even after 14 years of NCF 2005 the school mathematics has yet to lead towards the goals/aims of mathematics learning. An ill focused mathematics teaching has created a fear of failure and, anxiety among majority of school going children. NCF 2005 has clearly noted that the math's phobia starts from 3rd or 4th when many children find themselves unable to cope with the demands made by mathematics like, Cumulative nature of the subject, Predominance of symbolic language, Rude method of assessment that encourages perception of mathematics as mechanical computation, Lake of teacher's confidence, preparation and support, Societal expectation. If often happens that neither the teachers nor the parents realize that their child is suffering from math phobia, a child having math anxiety avoids any participation in the leaving process , ignores the teachers get nervous and stressed when assigned to solve mathematical problems , feels feared , anxious and panicked , mentions that math is the least favorite subject , skip classes , gives selective attention , is unable to reason and think mathematically or is unable to handle abstract.

REMEDIAL ACTION SUGGESTED:

Exam oriented teaching and learning right from early school classes which cause stress of examination and reduce learning, Teaching methods are rude that emphasize the

learning of fact and least importance is given on construction of knowledge, Lack of motivation to learn because they do not find any relevance of learning mathematics beyond performance in examination, Vast syllabus that puts pressure on teachers to complete in a year and avoiding the time and space to children to learn, Mass teacher training programmer at all India level, Rude method of assessment, Language in which children are taught, Learning of mathematics to be integrated with other subject.

Keywords: Anxiety, Fear, Phobia, NCF, Mechanical Computation, Social Expectation.

The Story of Quaternion

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Abstract

In many mathematical analyses, transformation from one coordinate system to another are often performed. It is normally straight forward to resolve vectors in two dimensions. However, resolving of vectors in three dimensions are a bit involved and cumbersome. In this talk, the ambiguity of resolving vectors in three-dimensions is demonstrated. To overcome this, the concept of quaternion is introduced. In particular, the story behind its discovery by the Irish mathematician, Sir William Hamilton is presented. Its discovery had led to a new branch of mathematics. It has found applications in many practical areas. Some of these will be highlighted with selected examples. Some basics of 'Quaternion Mathematics' will be presented.

Keywords: Quaternion, History

Fermat Point (Torricelli Point) and it's Extensions

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Abstract

We can use Geogebra to find special points of a Triangle. Up to date, more than 32000 special points with respect to a triangle have been discovered, even if it is always better to explore at our own, and for this Geogebra is very useful tool.

Here we are going to see a proof of a result presented in the 2018 AIMER conference at Goa. The findings by the presenter provoked me to work on its proof.

Its background starts with very famous Fermat Point. Fermat Point or Torricelli point (or Fermat-Torricelli Point) of a given triangle is a point such that the total distance from the three vertices of the triangle to the point is the least possible. The first Fermat point can be constructed by drawing equilateral triangles on each side of a given triangle, in the exterior of the triangle. The three diagonals in the figure are concurrent and their point of concurrence is the First Fermat point (Kimberling Centre X_{13}, Kimberling 1998, page 67).

Extending the idea of drawing equilateral triangles as stated. What, if we draw any regular polygon on each side of the triangle in the exterior of the triangle? Then the particular three diagonals, as we consider in the earlier case, would be concurrent. Firstly, we find the result by using Geogebra, and then proving the result by using School Geometry!

The most general case is to consider isogonal conjugates at each vertex, outside the triangle. A special case of this point is the First Napoleon Point.

Keywords: Geogebra, Centers of a triangle, Fermat Point(s), Generalization.

The Beauty of Conics

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Abstract

The conics are likely one of the most inspiring chapters of geometry and elementary mathematics. Likely, they are also one of the most unjustifiably neglected contents of mathematics. The story of conics starts with the simple and intuitive notion of a 'distance' between the simplest geometric objects (points, lines, circles). Modest and careful observations (Leonardo da Vinci's Saper Vedere) then unveils conics in many different settings. Throughout 'the conics story' we will use only very elementary and intuitive geometry to learn many details of the conics itself. But more interestingly, we will encounter and discuss inspiring teaching methods, rich historical mathematical insights, persuasive proving concepts, motivational technology and mathematical applicability. Archimedes (more than 2200 years ago) was able to calculate an area of a parabola section – which would be quite hard task even for many of today's experts on Leibnitz and Newton's calculus – and Archimedes did it with mind-boggling simplicity. And after we comprehend Archimedes reasoning, we even appreciate and understand deeper what seems to be a very simple formula for an area of a triangle.

Key words: distance, parabola, ellipse, hyperbola

Teaching Simple Story Problems/Multistep Story Problems to Primary Children

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Abstract

This paper is about the problem which was faced while teaching story problems in the class and strategies which were used to overcome this. Few strategies were followed in the class to make students to comprehend the given story problem. Few activities were also conducted. The pre strategy methods and post strategy methods are evaluated through tests and statistically analysed. The students who were good at basic fundamental operations with respective natural numbers struggle to comprehend a story problem. All such experiences will be discussed through this presentation.

Keywords: Simple, multistep story problems, Primary children.

Seeing Maths with Indian Eyes

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Abstract

New research reveals an incomplete understanding of India's zero in the Medieval Arabic world. This meant the idea of zero as a placeholder was transmitted to Europe, yet the more profound role of zero as a number was not. As a result, an incomplete and inconsistent understanding of zero and negative numbers persist in India's lower and upper primary level classrooms. Alongside historical observations, you will learn how to start repairing and improving India's math curriculum to empower children with India's original understanding of zero that better integrates the laws of mathematics, science and common sense.

Keywords: concept of zero, ancient India.

Application Of Mathematics To Monitor The ECG Signal

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Abstract

During pregnancy, the heartbeat of mother and child can be analyzed using Fetal ECG method. The signal will be having very precise and minute information's which will be helpful to doctors during gestation. In this work, using savitzky-golay filter and adaptive noise canceller (ANC), a simple to use and well-organized methods have been implemented. For extracting FECG, the algorithm uses Fast ICA and Least Mean Square (LMS) methods. The FECG extraction method is implemented using MATLAB as a software tool. The extracted FECG signal is a noise free and exact signal. For monitoring the fetus, FECG signal recording is considered to be the best technique. It is also used for continuously monitoring the physical condition of the fetus during gestation period. FECG is a waveform which shows the overall activities of prenatal heart. FECG is obtained from a signal which is marked on the maternal womb, which is not a direct method. Abdomen signal consists of Mother's Electrocardiogram (MECG) signal, FECG signal and noise signals. Output waveform, PSNR, and Heart Rate, based on these criterions, efficiencies of all the methods mentioned above are compared. The Best technique which satisfies all the criterions is chosen.

Keywords: Maternal Heart Beat, Electrocardiogram, LMS Algorithm, Adaptive Noise Canceller, ICA, Fetal ECG extraction.

Typically Related Sets of Primes

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Abstract

For each number in the set {3,7,11,13,37}, if we take reciprocal of each number, it is a recurring decimal. If the recurring group of digits is prime factorized, in each case they show a relationship. The result will be proved and more such sets will be presented.

Keywords: primes, reciprocals, recurring digits.

A Simple Geometric Result and Its Many Applications

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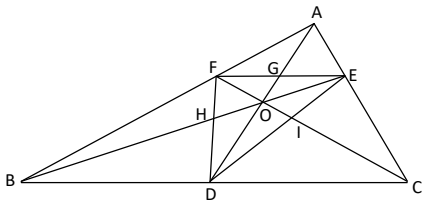
Abstract

Sub: The Unit Pieces Theorem - Developed 10 results on this theorem

In a Δ ABC, three cevians viz AD, BE & CF are concurrent at O and the points D, E & F are joined with each other as shown in the following figure.



The concurrency theorem which was developed by me in 2018 proved that $\frac{AG}{HO} = \frac{AD}{DO}$; $\frac{BH}{DO} = \frac{BE}{EO}$ and $\frac{CI}{IO} = \frac{CF}{FO}$. With the help of this concurrency theorem, a further result has been proved and it is as follows: -

$\frac{OG}{GA} + \frac{OH}{HB} + \frac{OI}{IC} = 1$ (A precise proof has also been developed for this result)

This new result has been named as "The Unit Pieces Theorem".

Based upon this result ten more sub results have also been developed. Out of the ten results, only four important results are discussed here. They are as follows;

Results:

1. In a Δ ABC, AD, BE and CF are bisector of angles A, B and C concurrent at O respectively meeting the opposite BC, CA and AB respectively at D, E and F. FE and DE are joined at AO, BO and CO respectively at G, H and I. If AB= mBD then $\frac{OH}{HB} + \frac{OI}{IC} = \frac{m}{m+1}$.

2. In Δ OBC, D is the midpoint of BC. H and I are points on OB and OC respectively such that $\frac{OH}{HB} = \frac{OI}{IC} = \frac{1}{3}$. DH and DI are joined and produced to meet CO and BO produced at F and E respectively. BF and CE are joined and produced to meet at A. Prove that A, O and D are collinear. Also prove that O is the centroid of Δ ABC.
3. No two cevians drawn inside a triangle can bisect each other.
4. In ΔABC, AD, BE and CF are Cevians concurrent at 'O', its circumcenter. FE and AO cuts at G, FD and BO at H, and DE and CF at I. If 'R' is the length of the circumradius of the ΔABC, prove that $R\left[\frac{1}{GA} + \frac{1}{HB} + \frac{1}{IC}\right] = 4$

Key words: A Geometric result, Concurrency of lines, Applications.

Ethnomathematics– Entwining Mathematics, Culture, Values and Education in Schools Worldwide

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Abstract

Ethnomathematics is a relatively new and vibrant research area that has a theoretical merit as well as a practical one, helping teachers to establish a pedagogy that takes into account students' prior everyday experience, cultural beliefs and values. Ethnomathematics has an extra value in schools worldwide where students are deeply immersed in tradition yet must cope with a modern school curriculum. In many cases, this causes a cognitive and an affective dissonance that may harm their motivations and success. I will talk about Ethnomathematical studies around the world and describe our study that attempted to address young tribal and rural students' persistent difficulties with mathematics, by integrating Ethnomathematics into a standard curriculum. First, we conducted extensive interviews with elders to identify the mathematical elements of their lives (e.g. traditional units of length, weight, embroidery etc.). Then we developed a teaching unit that integrated these elements with the standard curriculum and implemented the unit in tribal rural schools. We demonstrate that the integrated curriculum improved the students' self-perception and motivation, had a marginal improvement on achievements immediately after the experiment and a dramatic improvement in the following months. A unique extra social value was a change in students' attitudes towards their own culture and the tribe's older generation.

Keywords: Ethnomathematics, integrating with standard curriculum.

An Analysis on The Pedagogical Aspects of Number Theory to School Students.

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Abstract

Number Theory is a branch of mathematics which attracts and fascinates mathematician of all age groups. It finds not much a place in school curriculum even though the elements of Number Theory demand only elementary methods from Algebra, Number Theory finds not an important place in schools. In this short paper, the possibilities of teaching elementary Number Theory to school students are ventured through basic problems with little knowledge of algebra. An attempt is made on a group of students of age group 14 –

17 years and the responses are analyzed. It gave students an opportunity to think about the different ways in which numbers can be described (odd/even, whole number, fraction less than or greater than one, prime number, multiple of n, etc.). Students applied a variety of mathematical concepts and skills to solve problems and use mathematical reasoning to determine whether a number fits a generalization. Even though the topic is not in curriculum, the students showed keen interest in learning basic Number Theory.

Key Words: Number Theory problems, School students, Conclusions.

Generalisation of The Probability And Chess Question (Step-By-Step)

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Abstract

The main purpose for this research is to find the generalised form of the probability related to chess pieces on chess board. The other reason is to explain students that how we can extend a view towards any simple question, how we can think deeply on a particular question. In this paper I have generalised some formulae for Y dimensional $(n_1 \times n_2 \times n_3 \times ... \times n_y)$ X players chess board step-by-step starting from a normal 2 players (8×8) chess board for probability - based question for different pieces.

Keywords: probability, chess, dimensions.

Lilavati Darshan Through Workshop: Some Experiences

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Abstract

Mathematics is the subject of dislike for a majority of students in India. The studies show that this indifference is due to dull and dry style of mathematics teaching, non-relevance of problems to everyday life and underdeveloped learning prerequisites among the students. These problems need to be dealt with seriously to make mathematics popular among school students. The authors have been trying to tackle the issue by using problems from Lilavati, a mathematical treatise written by Bhaskaracharya in 12th century. They have been conducting workshops on Lilavati for the benefit of school students since June 2014. What began as a celebration of 900th birth anniversary programme of Bhaskaracharya has now become a regular activity of the Vidya Prasarak Mandal, Thane. More than 100 workshops, each lasting for three hours, have been conducted so far in three different states of India namely Maharashtra, Madhya Pradesh and Andhra Pradesh. Relevant problems are chosen from Lilavati and students are made to solve them individually during the workshops. This mode of interaction has been found beneficial in many ways. Since the problems in Lilavati are written in poetic style students get attracted to them. Direct connection of problems to day to day life motivate them to solve them. Reference to animals and plants in the problems prove to be an added attraction for school children. Girls, who usually keep away from mathematical tasks, are found to take great interest in solving problems from Lilavati. Conducting workshops based on Lilavati, thus, achieves gender equity apart from generating interest towards mathematics. The first hand experiences gained in conducting these workshops along with pedagogic implications for teaching school mathematics will be discussed during the presentation.

Keywords: pedagogic implications, generating interest towards mathematics.

Plurilingualism and Mathematics Education

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Abstract

Globalization has changed the education scenario of today. Exploration of change & exponential growth of technology have transformed today's societies worldwide into multicultural and multilingual societies. Plurilingual approach to pedagogical practices in mathematics has the potential to target high level mathematical competence and abstraction. CLIL (Content and Language Integrated Learning) is an innovative educational approach to learning, a dynamic and motivating force with holistic features. Not only does it image a shift towards curricular/cultural integration but also helps greatly to focus deeper conceptual understanding in Mathematics. Along with plurilingualism, CLIL uses technology to trigger conceptualization, insight and exploration of the subject. This paper highlights (with examples) `Plurilingualism' as one such dimension of CLIL that triggers active approach to the quality of Mathematics education. The importance of teaching mathematics as a language and specific strategies for teaching mathematics vocabulary are discussed. The Singapore Bar Model method as a visual math language which aligns to Concrete-Pictorial-Abstract (C-P-A) approach, serves as a major contributor in raising mathematical competencies and improving problem solving abilities.

Keywords: CLIL, Plurilingualism, Singapore Bar Model Method.

Identifying Layers of Mathematical Creativity

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Abstract

Although there are thoughtful works on creativity in general, but these on mathematical creativity are not plentiful. Studies on mathematical creativity being concerned with mathematical acquisitions, its educative dimension hasn't figure that much. The present author has put in some investigations in this direction. While conceptual framework has been put forward in some of these papers, that a conceptual model can equally emerge from case studies has not been taken up in-depth. This paper is basically an attempt in this direction. The author has exercised his discretion in regard to persons who possess budding characteristics of mathematical creativity. Indeed, the case study is concerned with students who have appeared in talent Search Test in Mathematics conducted by the Association for Improvement of Mathematics Teaching (AIMT) [2009]. Here the procedure is as follows. The configuration of the students considered, from mathematical standpoint, is described. Following this, the author analyses abilities and a bit of attainments in respect of mathematical exercises by them. That these students are amenable to identification from the point of view of mathematical creativity has been taken up. Going further in critical terms, the paper looks for possible representations followed by proofs, if any. Trajectories of proposed attempts for solutions are compared so as to establish the existence of layers of creativity dependent on individual characteristics of the pupils. While doing so, the author has critically brought out some layers of neighbourhood(s) leading to problem solving in exact forms. The author concludes by saying that given nutritionist of mathematical concepts, knowingly or unknowingly, even beyond the set curriculum, facilitate the emergence of mathematical creativity in different phases.

Keywords: Mathematical Creativity, Identification.

Role of Statistics in Business Studies

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Abstract

The purpose of this work is to point out to Business Majors how Statistical ideas occur in their work experience. Consider the job of an accountant to audit a big company or marketing executive to decide on advertising a product and management executive to evaluate the analysis of data of products and persons under their supervision. Auditing involves sampling from the data and thus to behaviour of sampling distribution. Advertising involves the cost of advice and the increased earnings possible from such advice, that is inference called Bayesian decision making and management involves analysing data. All three methods involve randomness and how to use Statistics in analysing random data. We shall describe it in this lecture with specific examples and how to motivate Business majors to study statistics.

Keywords: Statistics, Auditing, Advertising.

A Mathematical Pilgrimage, Ramanujan Yatra

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Abstract

A lot has been published about the great Mathematician, Srinivasa Ramanujan - a novel, books, documentaries, theatre shows, a Hollywood movie, a day in the calendar, and yet, there's so much more to Ramanujan and his life that is not commonly discussed. For instance, what kind of a person would Narayana Iyer have been to recognize the genius of Ramanujan which was ignored by some of the finest Mathematicians of his times like Baker and Hobson? What kind of sacrifice Ramanujan's wife had to make when he left her for England and pursued Mathematics for 5 years? What kind of a mind would Hardy have had to identify the genius of a college drop out? To discuss these questions and try to look more closely the life of Ramanujan and lesser known people who made him what he came to become, we did a 5-day experiential tour on wheels in November 2018 by visiting places of significance to Ramanujan in Kumbakonam and Chennai. This talk is an account of how all the Yatris of the Mathematical Pilgrimage got closer to the God of Numbers - Srinivasa Ramanujan.

Key words: Srinivasa Ramanujan, Experiential Learning, Ramanujan Yatra

Ethnomathematics– Entwining Mathematics, Culture, Values and Education in Schools Worldwide

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Abstract

Ethnomathematics is a relatively new and vibrant research area that has a theoretical merit as well as a practical one, helping teachers to establish a pedagogy that takes into account

students' prior everyday experience, cultural beliefs and values. Ethnomathematics has an extra value in schools worldwide where students are deeply immersed in tradition yet must cope with a modern school curriculum. In many cases, this causes a cognitive and an affective dissonance that may harm their motivations and success. I will talk about Ethnomathematical studies around the world and describe our study that attempted to address young tribal and rural students' persistent difficulties with mathematics, by integrating Ethnomathematics into a standard curriculum. First, we conducted extensive interviews with elders to identify the mathematical elements of their lives (e.g. traditional units of length, weight, embroidery etc.). Then we developed a teaching unit that integrated these elements with the standard curriculum and implemented the unit in tribal rural schools. We demonstrate that the integrated curriculum improved the students' self-perception and motivation, had a marginal improvement on achievements immediately after the experiment and a dramatic improvement in the following months. A unique extra social value was a change in students' attitudes towards their own culture and the tribe's older generation.

Keywords: Ethnomathematics, integrating with standard curriculum.

WORKSHOP

The Interpaly Of Creative, Problem Solving and Formal Knowledge

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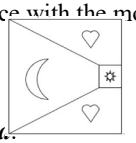
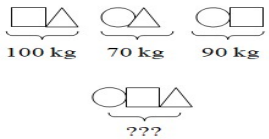
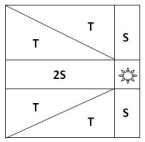
Our research was inspired by a high school teacher who visited classes in "Kidumatica" (Uziel &Amit, 2016)- a math program for young talented students (aged 10-11) and was astonished by how creative their solutions to challenging problems were compared to those of his high school students.

We designed and implemented a study (N=400) to examine students' (aged 11-18) solutions of non-routine problems in light of their age and formal mathematical knowledge. Specifically, we looked at the presence of cognitive abilities, such as creativity, visualization, argumentation, etc. in the solutions of a variety of elementary and high school students. Data was gathered from students' products and teacher observations during a series of workshops devoted to non-routine problems with multiple solution paths. A mixed method analysis was used to reveal creativity and other cognitive abilities based on Guilford (1967). Below are two examples that illustrate problems and solutions.

The cake problem	The shapes problem
Mother made a square-shaped cake. Gal got the square with the sun. Dan got the piece with the moon. Ram got two pieces with the hearts. Who ate more – Dan or Ram? 	
Algebraic solution by trapezoid area: $S_{MOON} = (b+a)(b-a)\cdot 0.5$, $S_{HEART} = (b+a)(\frac{b-a}{2})\cdot 0.5$ $\Big\} S_{MOON} = 2\cdot S_{HEART}$	***Algebraic solution*:** x+y=100, z+y=70, z+x=90 ... →x=60, y=40, z=30 →x+y+z=130
Holistic- Visual solution: $S_{MOON} = S_{HEARTS} = 2T + 2S$ 	***Holistic- Creative solution***: (100+70+90):2=130

Our findings revealed a troubling phenomenon: as mathematical age rises; creative and holistic solutions decrease. Students become 'hostages' of algebra and suffer from 'thinking fixation', that eliminates flexible thinking and prevents creative holistic approaches to solving problems. Hence, how do we promote formal knowledge without harming creativity? Will be discussed in the session.

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Workshop

A dip into Ramanujan's works

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Abstract

Mathematicians are of different kinds. There are some whose footsteps we can follow and learn some great deal of Mathematics. Euler is one such kind. One can appreciate Euler's works and understand what wrote. There are also Mathematicians whom we can only look up to with awe and wonder but very hard to emulate or trace their thought processes. One of the best examples is the great Mathematician, Srinivasa Ramanujan. However, Ramanujan did contribute in some areas of Mathematics which any middle school student can learn and explore. In this workshop, I will be discussing on some of those topics viz., Nested Radicals, Continued Fractions, Primes and Partitions.

Key words: Nested Radicals, Continued Fractions, Primes, Partitions, Srinivasa Ramanujan