SPECIAL LECTURES

Teaching Statistics To Engineers: Learning From Experiential Data

Dr. Vidhyadhar Mandrekar, Michigan State University: U.S.A

Abstract:

The purpose of the work is to claim that engineers can be motivated to study statistical concepts by using the applications of their experience connected with statistical ideas. The main idea is to choose a data from the manufacturing facility (for example, output from CMM machine) and explain that even if the parts used do not meet exact specifications they are used in production. By graphing a data, one can show that the error is random but follows a distribution, that is, there is regularity in data in the statistical sense. As the error distribution is continuous, we advocate that the concept of randomness be introduced starting with continuous random variables with probabilities connected with areas under the density. The discrete random variables are then introduced in terms of decision connected with size of the errors before generating to abstract concept of probability. Using software, they can then be motivated to study statistical analysis of the data they encounter and the use of this analysis to make engineering and management decisions.

From Ancient Mathematics To Modern Technology

Author: Dr. Damjan Kobal

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Abstract:

There are simple intuitive ideas which have been known since ancient times and which have profound meaning and applicability in technology. They can be described by elementary mathematical concepts. These ideas are useful in mathematical teaching as only elementary knowledge is a prerequisite, but its meaning is profound and applicable. They can be described intuitively and backed by modern technology providing advanced computer simulations to visualize the concepts. Ideas offer easy progression into challenges which can go beyond regular high school mathematics and reach even advanced

mathematical analysis for its full comprehension, while its intuitive understanding remains accessible to any curious mind.
We present the idea of *the arithmetic mean* in connection to a differential gear, which is an important part of car technology.

Use Of Large Primes In Cryptography

Author: Dr. S.A. Katre
Affiliation: Custodian, Bhaskaracharya Prathisthana, Pune
Abstract:
Product of very large numbers is easily obtainable by computers; however, factorization of large numbers is a difficult problem. In particular, if a number N is a product of two large primes of more than 100 digits, then it is very difficult even for fast computers to get the factors. Because of this fact it is also difficult to find ϕ (N), where ϕ denotes the Euler function. Using this data, in 1976, Rivest, Shamir and Adelman devised a method of sending secret messages. This method is illustrated in this paper. Nowadays this method finds its applications in online banking, online purchases and others

Conjectures And Proofs

Author: Dr. R. Sivaraman
Affiliation: Associate Professor and Founder Trustee
Pie Mathematics Association
Chennai
Abstract:
The world of mathematics has been filled with splendid conjectures right from the time when humans began to count. In due course of time, several conjectures have been resolved and has become celebrated theorems that we know today.
This talk is presented on three aspects: The baffling unsolved conjectures, the conjectures getting resolved thereby becoming theorems and select theorems which are widely used in several branches of Science.
It is because of these captivating conjectures, mathematics had grown tremendously in the past few centuries, yet still some of them had not seen its fate. Mathematicians upon trying to prove or disprove them had discovered many new ideas unexpectedly. This is the beauty of tackling conjectures and in this aspect, the talk will be about emphasizing the beauty and impact of most celebrated conjectures in mathematics.

Introduction To Mathematical Modelling

Author: Kiran Barve
Affiliation: Bhaskaracharya Prathishtana

Abstract:
Discussing applications of mathematics increases student's motivation. The mathematics curriculum is designed thus. Mathematical modelling is a powerful tool to solve real life problems. In every subject may it be science, social science, arts Mathematical modelling is used extensively. .

The real life problem is transformed to a mathematics problem by understanding the desired output, important parameters, constraints and relations between the parameters. Making suitable assumptions mathematical problem is formulated. It is solved using mathematical techniques and taking the help of computers. The solution is converted in the real life scenario. If you do not get the desired output the assumptions are changed, relationships are investigated more closely and the process is repeated.

Some simple applications will be discussed. The variety of applications from different subjects will be indicated.

WORKSHOPS

Inductive And Deductive Strategies

Author: Jeffrey Wanko, Ph. D. Associate Provost
Professor - Mathematics Education
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Abstract:
It is critical that students develop both inductive and deductive reasoning strategies. Deduction forms the basis of logic and proof. Induction is the foundation for critical observation and making educated guesses. When combined, these skills help students to develop into mathematical problem solvers. Students can develop these skills through working with language-independent logic puzzles. In fact, all aspects of proof-development are modelled through this process: verification, explanation, discovery, systematization, intellectual challenge, and communication. In this presentation, we will explore different opportunities for helping students to develop both types of reasoning skills through exploring and solving these puzzles. Together we will develop strategies, hypotheses, and formal reasoning while learning about new and innovative puzzle techniques. After the presentation, you will have a richer understanding of inductive and deductive reasoning strategies as

well as a new appreciation for ways that recreational mathematics can be used to develop deeper understanding.

E^5!

Author: Praneetha Singh,
Affiliation: Hills Grammar School, Sydney, Australia

Abstract:
This session will give the audience a taste of 5 by 12 minutes sessions of Enriching, Excelling, Enhancing, Exciting and Exhilarating mathematical activities that stimulates and extends the brain. Solving mathematical problems can vary in time. An essential ingredient in helping this process is quick precise thinking. This 60-minute session is designed to take participants down a mathematical Journey encouraging them to use their thinking, wit and application of core mathematical knowledge.

Origami And Mathematics

Author: Siva Shankara Sastri

Abstract:
In the year 1893, the Indian Mathematics is Sundara Rao published a book titled "Geometric Exercises in Paper Folding". This contains illustrations how paper folding is used to prove geometrical results. The construction of origami models is based on the crease patterns formed on paper because of the folding. This branch is made more mathematical by rigorously defining certain terms and proving certain theorems (Maekawa's theorem, Kawasaki's theorems, Haga's theorems). In this workshop the participants will be learning about the principles of Origami applied to mathematics. It should be noted that International Conferences and Meetings are held on the topic Origami in Science, Mathematics and Educations. In 2014, a five-day conference was held on this topic in Tokyo. The seventh International meeting on Origami in Science, Mathematics and Education will be held during 5th-7th September 2018 in Oxford.

ADULT'S PRESENTATIONS

Use Of Nonlinear Methods In The Analysis Of EEG Signals

Author: G. Muralidhar Bairy, Associate Professor (Senior Scale)

Affiliation: Department of Biomedical Engineering, Manipal Institute of Technology, Manipal University

Abstract:

This paper gives a brief overview on autism, current statistics and the importance of neuro-imaging techniques to discover the mathematical markers in the detection of autistic brain variations.

The human brain is known for its complex genetic structure and compound neural connectivity. The synaptic connections between the neurons increase with development. The understanding of psychological disorders is based on the study of functional brain regions and their neural connectivity. Autism is a neuro-developmental disorder characterized by cognitive impairment, repetitive behaviour and lack of interactive skills. The behavioural symptoms arise in children above 1.5-2 years of age. According to the reports of Centre for Disease Control (CDC), the prevalence rate of autism in 2006 was 1 in 110 births and 1 in 88 births by 2012. Recent prevalence rate of autism in the world is 1 in 68 births and thus, it is named as one of the fastest rising disorders. Studies indicate that siblings of autistic children have 2-18% possibility of being autistic. In non-identical twins, if one child is autistic, the probability of the other child being autistic is in 0-30% range and in identical twins; it is in 36-95% range.

Several techniques are developed to supervise the working of human body and understand the complexities involved. Non-invasive techniques are preferred by psychologists, neurophysiologists and researchers to determine the functionality of different brain regions. Electroencephalogram (EEG) is one of the non-invasive diagnostic tools that record the electrical activity of the brain. The EEG signals vary with brain regions and their activity. Similarly, the normal and abnormal EEG signals show variations in their signal pattern. These variations cannot be perceived by sheer visual inspection because they are highly non-

stationary, irregular signals. From the literature, it is observed that nonlinear methods help in the efficient analysis of EEG signals.

Mathematical markers of the EEG signals can be discovered using nonlinear dynamics and chaos theory. Some of the nonlinear methods employed in EEG signal analysis are approximate entropy, sample entropy, recurrence quantification analysis, fractal dimension, largest Lyapunov exponent, correlation dimension and higher order spectra. In this work, right occipital channel recording of 10 seconds duration is selected and sampled at 1 kHz. The discrete wavelet transforms (DWT) is used to obtain the detail and approximation coefficients of a signal. Entropies and higher order spectra are applied to the DWT coefficients to determine the degree of complexity in normal and autistic EEG signals. The nonlinear coefficients are ranked using t-value to reduce the number of features and select the best discriminating features. The significant features are fed to three different classifiers (k-nearest neighbour, support vector machine, fuzzy Sugeno classifier). Ten-fold cross validation technique is used to model the classifier and its performance is evaluated based on the accuracy, sensitivity, specificity and positive predictive value.

The Positive Connection Between Exposure To Mental Math Enhancement Activities And Student Attitudes Towards Mathematics Of Middle School Students

Author: Shailaja Bairy
B.Sc, B.Ed, M.A, Teacher, Madhava Kripa School, Manipal.

Abstract:

On streamlining the variables which directly influence the quality of mathematics learning, mental mathematics technique stands first in the queue. Hence, this action research focuses on enhancement of student attitude towards mathematics through frequent exposure to mental mathematics methods and the study of the link between the two. 120 students from grades 6, 7 and 8 took part in the weekly arithmetic sessions and benefitted from daily quiz activities, number talks and integration of shortcut methods to classroom teaching. The present Mathematics curriculum of Middle school has been modified to suit this action research. Due to the recent change in the CBSE evaluation norms, the action research turned relevant and could help students adapt to the change. A positive connection was established between student performance and their interest in mental mathematics. The results clearly justified our hypothesis by

showing an ascending graph, by stages, for student computational skills. Towards the end of this research, students' mental reasoning, thinking flexibility both saw a considerable increase. This reciprocal influence highly resonated with student attitude and ensured in them respect for the subject Mathematics.

Playing Well Designed Games With Number Cards: Learning Experience For The Children

Author: Ketaki Joshi
Affiliation: Faculty of Mathematics in Bhaskaracharya Pratishthana, Pune

Abstract:
Teaching and learning Mathematics can be a difficult experience for some teachers and students. Various methods are being discussed and implemented. In this regard, one must remember 'No one can teach anybody anything'. Only creating a situation to make students understand the language of mathematics is needed. To reduce the fear of mathematics, educators should consider both activities and games. A mathematical game does not need any hi-fi apparatus. Gough (1999) stated that "A 'game' needs to have two or more players, who take turns, each competing to achieve a 'winning' situation of some kind, each able to exercise some choice about how to move at any time through the playing". The key idea in this statement is that of 'choice'. In this sense, something like Snakes and Ladders is NOT a game because winning relies totally on chance. The players make no decisions, nor do they have to think further than counting. There is also no interaction between players - nothing that one player does affect other player's turns in any way.
There is no fixed Syllabus or no explicit Teaching, but students learn the concepts of mathematics on their own. The concept of 'No Exam' allows students to learn with greater speed. There is no evaluation or comparison between students. There is always a space for discussion.

Ancient Indian Mathematics for Modern-Day Curriculum

Author: Vinay Nair
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Abstract
During the dark ages of Europe, India was shining in light. The development of various sciences in India was far advanced than what it was in the rest of the world till about 400 years ago. However, during the colonial rule and change in

educational system, this indigenous system somehow started fading away. Today, even though the scientific community has slowly started acknowledging the contributions by Indians in various fields of sciences, the ancient knowledge is yet to reach the common man. The Sanskrit Pundits and a few historians are doing a great task in reviving the ancient knowledge, but the common man is not aware of most of these. A normal school student looks up to Europe for ideal figures in Science and Mathematics thinking not realizing the great stalwarts that India has produced in the past. A change in the teaching materials and programs can probably bring about sharing this great knowledge of ancient India to the future generations.

Presently, there is a great aversion in students for the subject of Mathematics mainly because they do not see any connect of what they learn (apart from arithmetic calculations) to what is used in daily life. Neither do they see the plausible motivation behind development of various topics in Mathematics. When we look at ancient Indian Mathematics, we see that Mathematicians (includes astronomers, musicians, alchemists and other polymath) in those days discussed about a particular topic mainly because it had to be applied somewhere.

Evaluation In Mathematics

Author: Atul Deo, Sanjeevani Damle
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Abstract:

Evaluation can be one of the most threatening steps for the inexperienced teacher. Planning for student evaluation is an integral part of planning for teaching, not just the final step of the instructional process.

"Everybody is a genius. But you judge a fish by its ability to climb a tree – it will live its whole life believing it is stupid" - Albert Einstein.

Psychological development is not uniform across individuals. It occurs at different rates in different persons. Any attempt to fast track this development leads to an early burn out in child hood and individual may be rendered incapable during his / her later years.

Assessment of student learning at its best enables students to identify their own strengths and weaknesses and to determine the kinds of information they need to correct their learning deficiencies and misconceptions. When such evaluation is properly employed, gathered during such assessments also can serve as a basis for more formative and summative evaluations that have an impact on important personal decisions.

Project Method Of Learning Mathematics

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Abstract:
Project method is the best solution to many problems in teaching-learning process. It is useful in the following ways –

1) The project method provides learner opportunity to do the following –
a) Hands-on activities and so understand the concepts meaningfully and at one's own pace.
b) Explain the project to the peers/ teachers/ parents, thus increasing confidence level in the subject.
c) Study the projects of peers and learn from them.
2) The project method provides the teacher opportunity to do the following –
a) Break up the syllabus into different projects and create new learning resources for the class every year.
b) Preserve the best projects every year and enrich the collection of learning resources.
c) Evaluate each learner more meaningfully and continuously and give feedbacks.

The school and the system should make necessary changes in the pattern of evaluation in order to adopt project method on a large scale.

A Concurrency Theorem And Its Applications

Author: Michael Raja Climax, Sai Prasad Kumar
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Abstract:
When three or more lines pass through a point then they are called concurrent lines. There are so many special concurrent lines connected to a triangle. Ceva's theorem gives the condition for concurrency of three lines through the three vertices of a triangle. There are many results derived from Ceva's theorem. These results serve as an individual result only. When a result can be applied to several situations, then it enjoys the status of a theorem. Concurrency theorem is one such result which can be applied to prove many geometrical results. In this paper, a proof of the currency theorem is given and around 25 applications are given with proof. The simple looking "Concurrency Theorem" is stated as in triangle ABC, D, E, F are points on the sides BC, CA, AD respectively such that AD, BE, CF are concurrent (at O) DE, EF and FD meet the Cevians at I, G, H respectively. Then $\frac{AG}{GO}=\frac{AD}{DO},\frac{BH}{HO}=\frac{BE}{EO},\frac{CI}{IO}=\frac{CF}{FO}$.

Bhaskaracharya And Binomial Expansion

Author: Meghraj J. Bhatt

Abstract:

Bhaskaracharya-2nd is a great Mathematician of ancient India of 12th century. "Siddhantsiromany" is a 4-part granth by him. "Bijganitam" is one part of it. In it, he has dealt with several topics of Algebra that we teach in high school today.

We know the binomial expansion $(a + b)^n$ for natural number 'n'. This expansion has (n + 1) terms and the coefficient of the $(r + 1)^{th}$ term is nothing but the value of $\binom{n}{r}$. To write the value of $\binom{n}{r}$, we should have either the formula of it or the Pascal triangle. A simple method of writing the value of $\binom{n}{r}$ is presented here using none of the above two. This is based on the book mentioned above. A proof is also provided.

On A Geometric Problem - Usage Of Technology

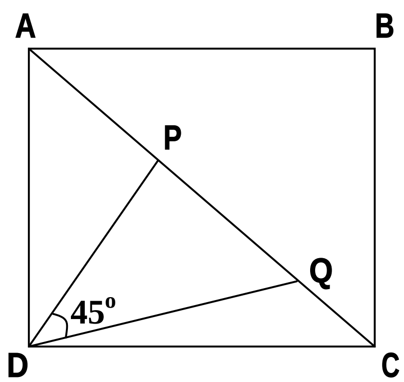
Author: K. Veera Swamy

Affiliation: S.R. Digischool, Warangal

Abstract:

ABCD is a square. AC is the diagonal. From D, two lines DP, DQ are drawn such that $P\hat{D}Q = 45^o$, where P and Q are on AC. Then AP, PQ, QC form the sides of a right triangle. Using GeoGebra software P, Q are moved on AC satisfying the condition $P\hat{D}Q = 45^o$. It is verified that $AP^2 + QC^2 = PQ^2$ by GeoGebra.

Two rigorous proofs are given; are using Sine-rule of trigonometry, and the other involving the methods of coordinate geometry. In the coordinate geometry proof, because the arbitrariness of the points P, Q satisfying the condition $P\hat{D}Q = 45^o$, an angle θ has to be introduced. This gives rise to trigonometric methods to be used again. But the two proofs are different.



A3-Point finite difference method for a particular class of boundary value problem

Author: Khushbu Wajare
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Abstract:
A Class of Singular two point boundary value problem is taken as follows:

$$\left(p(x)y^1\right)^1 = p(x)\,f(x,y), 0 < x < 1 ----1$$
$$y(0) = A, y(1) = B$$

With $p(x) = x^{\alpha} q(x), \alpha \in [0,1)$ and A, B are finite constants.

Certain assumption are made on $f(x,y)$

i) $f(x,y)$ is continuous for all $(x,y) \in \{[0,1] \times R\}$

ii) $\frac{\partial f}{\partial y}$ exists and continuous for all $(x,y) \in \{[0,1] \times R\}$

iii) $\frac{\partial f}{\partial y} \geq 0$, for $0 \leq x \leq 1$ for all real y.

A 3-point finite difference method is applied to solve the differential equation (1). This leads to a tridiagonal system of N-1 equations in N-1 unknowns, which can be solved. In the process, an appropriate non-uniform mesh over the domain is established.

STUDENT'S PRESENTATIONS

Fibonacci's Retracement

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Abstract:

Fibonacci Retracement is a term used in technical analysis to refer to areas of resistance (price stops going higher) and areas of support (price stops going lower). These retracements use horizontal lines to indicates the areas of support and resistance. These horizontal lines are drawn by dividing the vertical lines (i.e. the Y-axis) by key Fibonacci key ratios
(i.e. 23.6%, 38.2%,50%,61.8%,100%). It is named after the 13^{th} century mathematician Leonardo da Pisa. Fibonacci Retracement levels are static prices

(i.e. the prices remain the same no matter what the external factors are), unlike moving averages. This static nature of the price levels allows traders and investors for quick and easy identification for recalling their shares or investing in them. In the paper we shall find how the Fibonacci key ratios were derived and how these ratios help in selling and purchasing of goods in an efficient manner.

Application Of Statistical Models To Study Networks Of Neurons

Author: Shrivallabh N. Pol
Affiliation: Jnana Prabodhini Prashala - Pune

Abstract:
When neurologists study the brain of an animal, a part of their investigation is about how its neurons are interconnected, *viz*. how complex the network of neurons is and how distributed it is. I contacted a team of brain researchers who were studying the brain of a fruit fly. They framed hypotheses by calculating the probability of a certain outcome i.e. the configuration of neurons. They had some initial data assuming the distribution of neurons is purely random and unbiased.

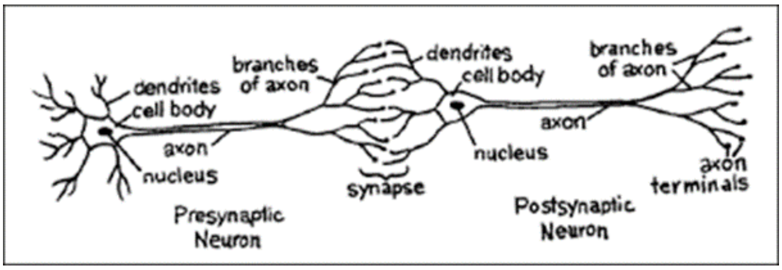

Figure 1 A Synapse between two neurons

In order to validate that data, I found combinatorial solutions for some situations and generalised them, using a bin-ball model. Here the 'bins' are the synapses, which join two or more neurons and the 'balls' are the possible connections, which may or may not form. The probability is a fraction of the total number of ways, which is the sum of the first (r+1) numbers of the form C(r+n-1, n) where n is the number of neurons. The Bin-Ball model led me to conclude that these solutions for the probability of these networks follow the Poisson distribution model.

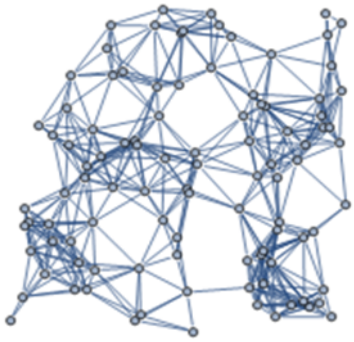

Figure 2: A Neural Network logically, the neurons might be in a well-ordered state in a certain region of the brain to coordinate and might have biases. However, the empirical data from experiments matches with the derived model in which the connections were assumed to be at random. Indeed, the connections in the network of neurons do follow a Poisson distribution, which is quite surprising. This work could be useful in building artificial neural networks. I conclude the paper by probing a few questions for future work.

<u>The Quadratic Mean And Its Applications</u>

Author: D. Sai Aishwarya
Affiliation: Sri Prakash Synergy school, Peddapuram, Andhra Pradesh
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<u>Abstract:</u>
Mean is a measure which gives an idea of two or more quantities. For example, the mean marks of a class in an examination gives an idea about the class. Pythagoras and Pythagoreans were the first to study different types of means. They defined around 10 means out of which three are commonly known as arithmetic mean, geometric mean, and harmonic mean.
The applications of some other means are also discussed. Why should we have so many other means? This is because several means are appearing in nature and physical phenomena. For example, the root mean square of two quantities a, b is defined as $\sqrt{\frac{a^2+b^2}{2}}$.Such a mean is defined because it appears in many physical situations. This mean is also called as “quadratic mean”.
A train with constant acceleration passes through a single pole. The front part of the engine crosses the pole with a velocity u and the rear of the train crosses the pole with the velocity v. Then the mid portion of the train crosses the pole with what velocity? It is not $\frac{u+v}{2}$.It is $\sqrt{\frac{u^2+v^2}{2}}$.
In this paper the appearance of quadratic mean is discussed.

Generalization of high school game of ball picking

Authors: Anish Kulkarni and Mahavir Gandhi

Abstract:

Games have always been a fun way to learn complex mathematical concepts. People of all ages love to play games. Most importantly games help people to develop their strategic and logical thinking skills. Complicated mathematics can be made simpler by forming a game out of it. When played repeatedly games increase student’s computational skills. So, in today’s world, game theory is pursued as an important branch of mathematics. It mainly targets at the determination of winning strategy of certain types of games. The games must be finite, non-random/non-chance ones and consist of 2 or more players.

Other than that, there is another important aspect of games that is application of games in theoretical computers. Most of the games, typically made for higher school students, have an application in theoretical computers in one way or other. The simple games played in classroom are used for solving very complex theoretical computer problems

On The Life And Works Of Thabit ibn Quarrah

Author: Ankesh Raj

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Abstract:

This paper is to focus on the life and work of Thabit ibn Qurrah(Al-Sabi). He was born in 836 AD, Syria and died in 901 AD, Baghdad, Iraq. Thabit was an Arab mathematician, astronomer, physician and philosopher. He wrote original works on geometry, statics, magic squares and the theory of numbers. His treatise on the sector figure deals with Menelaus’ theorem and on the composition of ratios. He discovered an expression to determine Amicable numbers. Thabit ibn Qurra is probably most well known for his translation of ancient Greek texts into Arabic and most of them were written about mathematics. After the destruction of the greet library of Alexandria the original Greek version of many books on mathematics were lost, because Thabit translated into Arabic we could regain them. Most mathematical historian think that he discovered the basics of integral calculus, in one of his books he calculated the area of the parabolic segments and it is different from what Archimedes used.

Key words: Thabit ibn Qurrah, Geometrical work, Ambicable numbers.

<u>On The Life And Works Of Omar Khayyam</u>

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<u>Abstract</u>:
This paper is to describe the life and works of Omar Khayyam. Omar ibn Ibrahim Khayyam was born on 18th May 1048, in Nishapur, Iran and died on 4th December 1131. He was a Persian mathematician, astronomer, philosopher and poet. Khayyam worked on problems of geometric algebra. He wrote one of the most important treatises on algebra. His treatise was on demonstration of problems of algebra which includes a geometrical method for solving cubic equations by intersecting a hyperbola with a circle.

<u>Key words:</u> Omar Khayyam, Cubic equations.

<u>Mathematics In Ancient Cultures</u>

Author: Arman Singh and Vibhor Dave
Affiliation: Bhavan's B.P. Vidya Mandir, Ashti

Abstract:
Mathematics is a science of numbers, expressions, shapes and spaces. It is an art which has a canvas decorated with endless pattern of numbers, variables and shapes. Maths didn't had a particular start in a place, but it simultaneously evolved around the world, without knowing one's existence by another civilization. Maths can be traced to the **Mahabharata**, where armies were formed by mathematical ratios and army formations like the **Chakravyuha** were made using geometrical shapes. Applied mathematics can be seen in the daily lives of the people, their lifestyle, their dances and date of rituals, i.e., it can be found in the prehistoric period of mankind. **Chichèn Itzá**, the **Taj mahal**, all was made through simple geometric structures and **complex mathematical ratios** which would **reduce the risk** of getting **damaged by any calamity**. If math's' seen through music, Musicians make combinations of notes thus forming a tune of a song, by just using simple combinatorics. If seen by art, ratios matter a lot in paintings like **Mona Lisa**, where the body is correctly proportional to a human body. In dances, it plays a major role. The Argentine Tango, which is a branch of ballroom dancing, involves simultaneous steps in correct posture, which too were invented with ratios and **combinatorics**. In food, for example, it is a fact that all **spaghettis** have their same diameter of its noodle. Also, vegetables are put in ratios to make a world class Sāmbhar for idlis. If there was no ratio of putting ingredients in foods all would taste quite hellish! The branch of algebra came from the quest to finds

dates for the next rituals to come. For example, the **Hindu New Year** runs parallel to the **lunar calendar**, which was calculated by ancient mathematicians by using algebra then. If seen through **interior design**, tiles in early Greece were arranged in **symmetrical patterns, tessellations**, etc. by ratios and geometry. In India, the dot rangoli patterns in walls and houses are made by mathematical and symmetrical visualization. Clothes like saris, **togas,** have permanent ratios of cloth used (example, saris have ratio 6:1.5 or 12:3, whereas roman togas have the ratio of 4.75: 2 or, 19:8). In embroidery, symmetrical patterns are used like in **Chikankari**, **kalamkari**, Greek designs, etc. Math's had another use too. There were different base systems in the world, from **sexagesimal system** of Babylon to the **Decimal system** of India. People found out numbers, whose sum was unique and no. could be represented by these sum (Virahanka numbers or the **Fibonacci sequence**), they learned to form basic arithmetic formations. The most innovative were the Indian mathematicians, but the most famous were the Greeks. This was because of their outstanding knowledge about Geometry (example- the Pythagoras theorem). Math's is embedded in the gene of mankind, its present in everything. If seen at a proper way, math's is MYSTERIOUSLY EASY AND INTERESING to learn. Still there are many things yet to be revealed in the world histories and research is as fast as it can be.

Objective and What is introduced

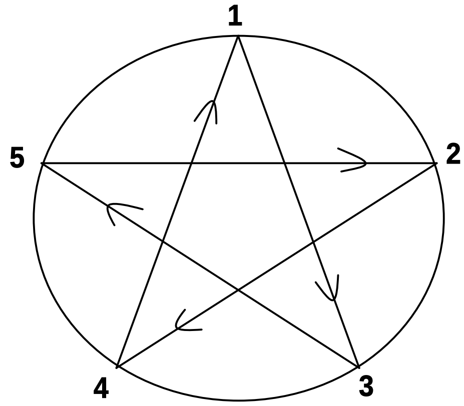
Objective behind the paper is to reveal the ancient methods and codes discovering mathematics in a new form. The project will mainly describe the geometry and architecture around the ancient world. Algebra in the form of calculating the dates of rituals is explained. Geometry and architecture picked from the various civilizations of the world like Incan, Mayan, African, Chinese and Indian civilizations and places like Greece, Babylon, Polynesia and Persia are thus included in the paper. Also, the base systems like the sexagesimal system of Babylon are introduced.

Keywords- Mahabharata, Chakravyuha, Chichèn Itzá, Taj mahal, complex mathematical ratios, calamity, Mona Lisa, The Argentine Tango, combinatorics, spaghettis, Sāmbhar, lunar calendar, Hindu New Year, symmetrical patterns, togas, Decimal system, sexagesimal system kalamkari, Chikankari, Fibonacci sequence

Stars (A Paper On Geometric Stars)

Author: Atharv Sagar Suryawanshi
Affiliation: Podar International School - Satara

Abstract:
Any Star can be represented in the form {n/k} where n is the number of vertices of the star and (k-1) are the number of points to be skipped. That is the first point is joined to the kth point. The points are taken along a circle. As an example, {5/2} gives rise to the following star. We take equidistant points on the circle to get a symmetric star. In this paper the rules for unique star are discussed. There are four rules which are explained in this paper. The angle sum property is also explained regarding a star {n/k}.



Solving An Algebraic Equation Using The GeoGebra Software

Author: A.S.S.S. Datta
Affiliation: Sri Prakash Synergy School, Peddapuram, Andhra Pradesh.
E-mail: data19189@gmail.com.

Abstract:
GeoGebra software is a very useful software to learn and teach geometry and it can be used to solve algebraic equations as well. The equations $y=x^3-x^2+3x-4$ and $y=ax^2-x-4$ are considered. The equations $y=x^3-x^2+3x-4$ and $y=ax^2-x-4$ are graphed. By changing the value of the parameter "a", we get different intersection points at different co-ordinates. An investigation has been done on the values of real parameter "a" for which the two equations simultaneously have solutions. An algebraic proof and the range of "a", where the number of intersection points varies are also presented in this paper.

Solving a Non-Algebraic Equation And Finding Its Roots Using GeoGebra Software

Author: T.GeethKuldeep
Affiliation: Sri Prakash Synergy School, Andhra Pradesh
Email: geethkuldeep@gmail.com

Abstract:

Geogebra software is a student friendly software to analyse geometrical situations and it can be used to find solutions of algebraic and non-algebraic equations also.

This paper discusses the value of the real parameter "*p*" for which the equation

$$2\log_3^2 x - |\log_3 x| + p = 0$$

has one or more solutions; using the software.

A rigorous method is also given to support the geogebra solution.

Ethnomathematics: The Cultural Aspects Of Mathematics

Author: Karan Agrawal, Varanyam Joshi.

Affiliation: Bhavan's B.P.Vidya Mandir, Ashti , Nagpur.

Abstract:

Ethnomathematics studies the cultural aspects of mathematics. It presents mathematical concepts of the school curriculum in a way in which these concepts are related to the students' cultural and daily experiences, thereby enhancing their abilities to elaborate meaningful connections and deepening their understanding of mathematics. Ethnomathematical approaches to mathematics curriculum are intended to make school mathematics more relevant and meaningful for students and to promote the overall quality of their education. In this context, the implementation of an ethnomathematical perspective in the school mathematics curriculum helps to develop students' intellectual, social, emotional, and political learning by using their own unique cultural referents to impart their knowledge, skills, and attitudes. This kind of curriculum provides ways for students to maintain their identity while succeeding academically.

In mathematics education, **ethnomathematics** is the study of the relationship between mathematics and culture. Often associated with "cultures without written expression", it may also be defined as "the mathematics which is practised among identifiable cultural groups". It refers to a broad cluster of ideas ranging from distinct numerical and mathematical systems to multicultural mathematics education. The goal of ethnomathematics is to contribute both to the understanding of culture and the understanding of mathematics, and mainly to lead to an appreciation of the connections between the two.

Permutational Square

Author: K. Kavya, P. Godha
Affiliation: Tejaswi Concept school, Prashanthi Nagar, Hanam Konda

Abstract:
Permutation means arrangement. If we have two distinct objects *a*, *b*, then *ab* and *ba* are the two permutations of these two objects taken both at a time. If a two-digit number for example 23 in taken, then the two permutations are 23 and 32. If these two numbers are added, then 55 results. But 55 is not a perfect square. Instead if the number 74 is taken, the two permutations are 74 and 47, when added gives 121 which is 11^2.Thus only few two digits numbers will satisfy this properly. In this paper, the method of finding such two-digit numbers is discussed. Further if a three-digit number is taken, will the sum of all its permutations be a square? Will there be 2-digit or 3-digit number such that the sum of all its permutation a cube also is discussed.

Generating Patterns For Multiple Coding Systems

Author: Maithri Bairy
Affiliation: Madhava Kripa School - Manipal

Abstract:
This Paper and the Project came into force from the inspiration received from the Odd X Odd number magic square and the Ramanujan magic square. Further, the creation of distinct patterns using my very own algorithm and multiple wonder patterns of several properties from a hypothesis are the main highlights. By making use of self-created algorithm a complete set of three-digit numbers, having middle number patterns is generated. Moving ahead, the same intriguing pattern for any number of rows X number of columns (the number varies) was devised. Thus, this wonder pattern worked by adding one three-digit number from each column to give one and only final code. Palindrome squares and symmetric magic squares, with a thrilling star pattern of an extended format, all from random/ non-continuous numbers are a step ahead to the initial findings. In this project, my unique algorithm or rule works well in many aspects to give the desired result. Each and every number used in creating the patterns here are randomly chosen and isn't continuous.

These patterns find immense use in coding and decoding systems. Their recreational value can be converted effectively to produce a utility. Its

applications include – sets of die with particular non-continuous three-digit numbers were in, total remains constant however all the dice are thrown. Designing an android app for recreational purposes, as a game can be useful. Locking systems, LANs (local area networks) can incorporate this through diverse coding and decoding methods. There is much more to this, as this pattern can prove productive in wherever coding and decoding is concerned. The procedure, program details and the input/output will be explained with a flex. The computer program to enable protected network connections between several computers using security measures will be executed practically.

Mathematics In Italy- Leonardo Da Pisa

Author: D. Mani Chandana
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Andhra Pradesh.
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Abstract:
Leonardo Da Pisa was an Italian mathematician from the Republic of Pisa considered to be the most talented western mathematician of the middle ages. He travelled extensively around Mediterranean coast, meeting many merchants and learning about their systems of doing arithmetic. His contributions in algebra have seen a great success from his book “Liber Abbaci”. Leonardo Da Pisa is also called Fibonacci. A series developed by him on observing the reproduction of rabbits was looked as simple result. But the applications of Fibonacci series are enormous. There is a journal called “Fibonacci Quarterly” devoted to the research of the applications of Fibonacci series. The far-reaching appearance of the series in some natural phenomena and practical situations are ample. In this paper an attempt is made to discuss the content of “Liber Abbaci and some applications of the series.

Analysis Of A Geometrical Problem Using Technology

Author: P. Kusumasri
Affiliation: Tejaswi Concept High School, Prashanthnagar, Hanamkonda.
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Abstract:
Using GeoGebra software the following problems was analysed.

In a parallelogram ABCD, a line *l* is drawn through the vertex D. Three perpendiculars are drawn from the vertexes A, B and C to the line. Let them be AP, BQ and CR. Then BQ=AP+CR.
Using GeoGebra software this problem is visualized and various cases of the inclination of the line *l* were taken into consideration and conclusion were drawn.

Recreational Mathematics Using Technology

Author: K. Satya Pavan Kiran
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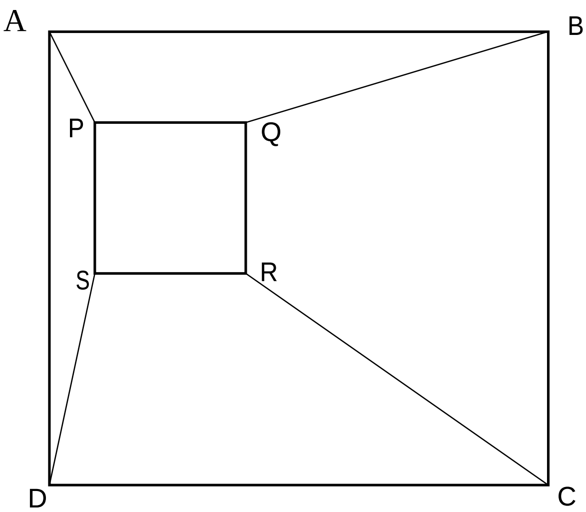
Abstract:
This paper focuses on the Recreational Mathematics using technology. The following problem in geometry is considered ABCD, PQRS are two squares; the squares PQRS is inside the square ABCD. by joining the vertices of smaller to bigger, we get four trapeziums {the sides of smaller square are parallel to the bigger square}. an investigation has been done using GeoGebra software, the areas of the four trapeziums formed.



Ptolemy's Almagest

Author: Rushwanth chitturi
Affiliation: Sri Prakash synergy school, Peddapuram, Andhra Pradesh.
E-mail: rushwanth.chitturi@gmail.com
Abstract:
During AD 100-170, Claudius Ptolemy lived in Greece. He wrote a book “The Almagest”, which gives the astronomy prevailing during this time in the

Ancient Greece. The book "Almagest" consists of 152 pages written in Latin. Ptolemy introduced the concept of longitude and latitude in the sphere and developed the cartographic projection method. Using those tools, he catalogued around 8000 cities, rivers, and other important features of Earth. In this paper, the content of the book "The Almagest" is discussed.

A Tribute To Kaprekar- His Life's And Work

Authors: Saket Kumar, Vidit Parth
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Abstract:
Dattathreya Ramchandra Kaprekar, a school teacher, who lived during 1905 to 1986 in Maharashtra. It is apt to talk about his life and work in this conference, which is conducted in Maharashtra. A wonderful tribute is given by Martin Gardener, an American recreational mathematician. Kaprekar Constant is the number observed by Kaprekar which is 6174. There is not only 4- digit Kaprekar Constant, we have 3- digit Kaprekar Constant available in net but according to our investigation on 5 – digit and 6- digit numbers the results obtained are in a cyclic form. The numbers repeat themselves in a particular order. In this paper we deal with his life and other works also like Demlo Numbers, Kaprekar Constant etc.

Rational Triangles

Author: M. Sai Sathwik

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Abstract:

A triangle in which all the sides and the area are rational numbers is called a Rational Triangle or a Heron Triangle. Brahmagupta , Bachet , Vieta , Frans Van Schooten , Matsunaga , Nakane Geneker and Leonard Euler contributed several results on this . S.Curtius proposed the following interesting problem.

Three archers A, B and C stand at the same distance from a parrot, B being 66 feet from C , B 50 feet from A and A 104feet from C. If the parrot rises 156 feet from the ground, how far must the archers shoot to reach the parrot?

Bachet in his commentary on Diophantus , sights a problem in which the method of finding a triangle with rational sides and rational altitude explained. In this short paper such type of problems and results are discussed.

History Of Mathematics In India

Author: Shreyas Raut, Rishi Dhole
Affiliation: Bhavan's B.P. Vidya Mandir, Ashti, Nagpur

Abstract:

In India mathematics was prevailing even around 5000BC. This is now evident from the researches done on the dates of Vedas. The shathapatha Brahmana, which is a part of Shukla Yajur Veda, contains details of description of geometrical constructions commonly called Pythagoras theorem. It deals with irrational numbers also. Another important development of mathematics was done by Jains. Jaina mathematicians investigated the concept of infinity also. Lot of results were found in Number theory, geometry, combinatonics. The Pascal's triangle was known to them as early as 500CE. The classical era of Indian Mathematics from 500CE to 1200CE was developed by stalwarts like, Aryabhatta, Brahmagupta, Bhaskara, Mahavira, and others. In modern times we had srinivasa Ramanujan, Harish Chandra and others. A living examples of a fine mathematician is the fields medallist Manjul Bhargava.

Mathematics In Ancient Cultures

Author: Sparsh Badjate, Siddhant Baiswar
Affiliation: Bhavan's B.P. Vidya Mandir, Ashti, Nagpur

Abstract:

Mathematics in ancient times was rather developed as a practical science than a theoretical one. In any culture whether Indian, Egyptian or Babylonian, mathematics was not developed as a theoretical science. In Vedic period in India, much geometry was used to make sacrificial altars. In Egyptian and Babylonian culture geometry arose as a tool for measuring lands. A second leap of mathematics happened in constructions of buildings. Whether it was a temple in India or Pyramids of Egypt, mathematics appeared in an advanced form. Another aspect of the advancement of mathematics took place when people of these cultures started studying astronomy. Geometry as a deductive subject existed only in Ancient Greece. Pythagoreans and the Euclid contributed the best methods in geometry which we follow now also. The logical development of geometry is due to Ancient Greeks only. Many results in geometry were known to people of other cultures prior to Euclid also but no one had put geometry into a deductive logical frame work except Greeks. In this paper, the mathematics prevailing in Ancient cultures are discussed.

Navigation Through Sextant

Author: M. Srinivas Raj
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Email: srinivasraj0909@gmail.com

Abstract:

Sextant is an instrument with a gradated arc of 60˚ and a sighting mechanism. It is used for measuring the angular distances between objects and specially for taking altitudes in navigation and surveying. It can be used to measure the lunar distance between the moon and other celestial objects in order to determine Greenwich Mean Time and hence longitude of the place can be determined. This paper is about the mathematical principles used in celestial navigation.

Construction Of Direct Common Tangent(S) And Transverse Common Tangent(S) To Two Different Co-Planar Circle By Using Harmonic Conjugates

Author: Umang Bhavar, Advaita Lute, Shlok Darekar, Mrunal Vibhute
Affiliation: Ramanujan Academy, Nashik

Abstract:

Note: Here all elements considered are co-planar.

We know the method how to draw a tangent to a circle from the point on the circle and the tangents to the circle from a point in the exterior of the circle.

When we consider two different circles, then there may exist a common tangent or tangents, which can be drawn to both the circles. Such tangents are common tangents. They are termed as Transverse Common Tangent (TCT) and Direct Common Tangent (DCT).

There is a usual method to draw TCT and DCT. The points on the line joining the centres of two circles which divide the line segment joining their centres internally and externally in the ratio of their radii, such points are called as the Centres of Similitude of the Circles. The Centres of Similitude of the circles are also the Harmonic Conjugates of the line segment joining their centres.

We use this fact to contrast the TCT and DCT

About The Distribution Of Prime Numbers.

Author: Vivek Veer
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Abstract:
Primes are of utmost importance in number theory because they are the building blocks of whole numbers. There has been constant research in finding new primes. Till the 19th century it was thought that was we move further on the number line the primes are becoming more scarce and random. The further studies and researches in beautiful results like prime number theorem, Riemann hypothesis showed that primes aren't that random as they were thought to be.
The following theorem might help in bounding the next prime number.
Theorem - **For every natural number $k \geq 2$ there exists a prime p such that,**

$$k \leq p < 2k$$

Proof-
Let p denote the largest prime less than 2k.
By Goldbach conjecture there exists prime q, r such that,

$$q + r = 2k \qquad (1)$$

But we have

$$q + r \leq 2p$$

From equation (1) we get,

$$2k \leq 2p$$

$$\text{i.e. } k \leq p$$

As desired.
One might also note that how a simple application of Goldbach conjecture led us to the proof. This is the power of Goldbach conjecture; its truth might help us in deep study of prime numbers.

Mathematics In Ancient Cultures

Author: Yasdeep Paddav, P.V Sairam Saketh
Affiliation: Bhavan's B.P. Vidya Mandir, Ashti, Nagpur

Abstract:
Mathematics was developed in many ancient cultures, from 2000BC and even beyond. The following ancient cultures are taken and the mathematics prevailing in those cultures is discussed.
1. India 2. Egypt 3. Babylon 4. China 5. Greece
India was a seat of mathematics even from 5000 BC, where Vedas were in the way of Indian life. Many ancient texts written in Sanskrit language are now available to us. Famous mathematicians like Boundhayana, Aryabhatta,

Brahmagupta, Mahavira, Bhaskara and others contributed to Ancient and Medieval Indian mathematics.

In Egypt mathematics was studied right from around 3000 BC. Egyptians made a number system for counting. They were using areas of plane figures, surface area and volume of three dimensional objects also.

Babylonia, in Mesopotamia during 6000BC, text books on mathematics were prevailing. They contained fractions, algebra, solving quadratic and cubic equations and Pythagoras theorem also

In china, mathematics emerged in 11^{th} century BC. They developed negative numbers, decimals, binary system, algebra and geometry. In Greece, mathematics was systematically developed from 7^{th} century BC onwards. From Greek Mathematicians only, we get the deductive logic in geometry.

Ethno Mathematics

Author: Yusra Khan, Arya Ninawe

Affiliation: Bhavan's B.P. Vidya Mandir, Ashti, Nagpur

Abstract:

Ethno mathematics is the study of the relationship between mathematics and culture. It is also understood that Ethno mathematics is the mathematics practised among identifiable cultural groups. The main aspect of ethno mathematics is that it gives not only the mathematical aspects developed by the particular cultural group but it gives some information about the culture itself. The methods of Ethno mathematics are not rigorous. But they reflect the efforts of human brain to interpret phenomena of nature mathematically. Ethno mathematics has an advantage in teaching mathematics for a particular geographical region. As an example, many parts of India, playing cards are not familiar to school students. If we give a problem on bridge game, it will be totally baffling to them. Lot of researchers contributed to this area of Ethno mathematics and teaching mathematics using Ethnic aspect. In this paper, it is stressed that the usage of ethno mathematics in classrooms is important.

Exhibits

Generating Tests Of Divisibility

Author: Asmita Gangadhar Pawar

Affiliation: S N D T Kanya Shala, Pune

Email: learningclubpune@gmail.com

Abstract:

Text book gives tests of divisibility by a few numbers like 2, 3, 4, 5, 6, 8, 9, 11, etc. But the tests of divisibility by many prime numbers should be designed. It is really very simple to design a test of divisibility. However, it is more desirable to design different TODs for a 4-digit number, a 5-digit number, etc.

Some TODs are designed and presented in this exhibit.

Test of divisibility by 29
for 5-digit number

Let $\overline{abcde}$ be a 5-digit number.

$$\overline{abcde} = 10000a + 1000b + 100c + 10d + e$$
$$= 10005a - 5a + 986b + 14b + 87c + 13c + 10d + e$$
$$= (10005a + 986b + 87c) + (-5a + 14b + 13c + 10d + e)$$

$\therefore$ If $-5a + 14b + 13c + 10d + e = 29n$
then $\overline{abcde}$ is divisible by 29

This can be a good Math Lab Activity.

Enthusiastic Explorative Learning

Author: Ketaki Milind Jog

Affiliation: Naveen Marathi Shala, Pune

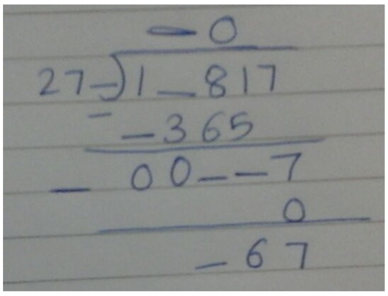
Email: learningclubpune@gmail.com

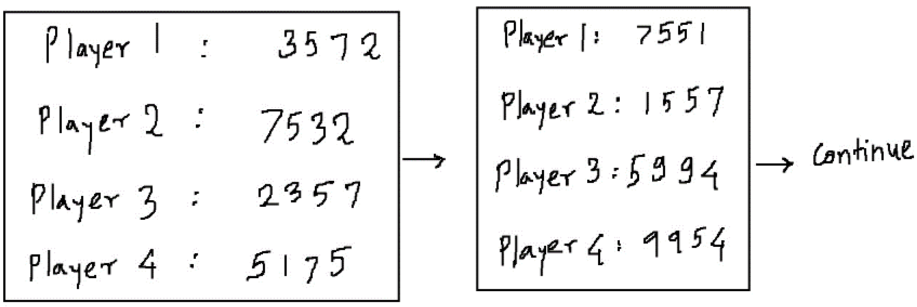
Abstract:

This is a demonstration of enthusiastic explorative learning. The following ventures are done:

1) Making 20 puzzles on division algorithm and sharing with friends.
2) Discovering new geometrical shapes from a rectangle and discovering a few properties of these geometrical shapes.
3) A game based on Kaprekar's constant.

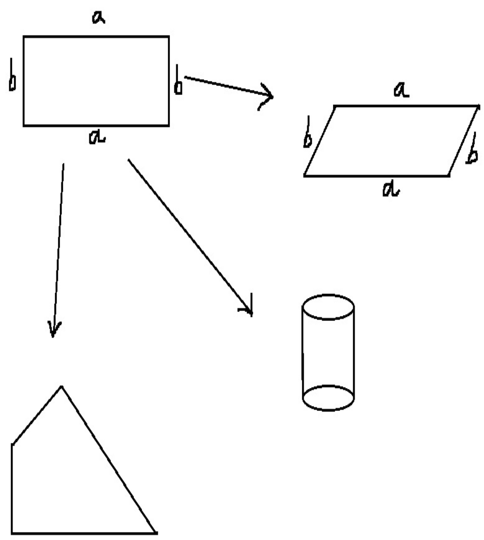
The message of the exhibit is that there is nothing like minimum age required for explorative learning. For a learner, solving questions from some books is ok, but making one's own questions and posing challenges before friends is more interesting.





Rules: ① If a player enters wrong number, −10 points.
If a player enters correct number, +30 points

② The player entering 6174 as the correct number gets a Gold Coin worth 100 points.



Play Math

Brouwer's Fixed Point Theorem

Author: Navya sri Alugubilli
Affiliation: Sri Prakash synergy school, Peddapuram, Andhra Pradesh
E-mail: **navyasrialugubilli@gmail.com**

Abstract:
Brouwer's fixed point theorem states that "for any continuous function "f" mapping a compact convex set to itself has a fixed-point $x_\circ$. such that $f(x_\circ) = x_\circ$". This theorem has a variety of applications extending to the fields like games, general insurance etc. This poster contains some several applications of Brouwer's fixed point theorem.

Triangle – Ellipse – Ellipsoid

Author: Netra Bijoy Bhutada

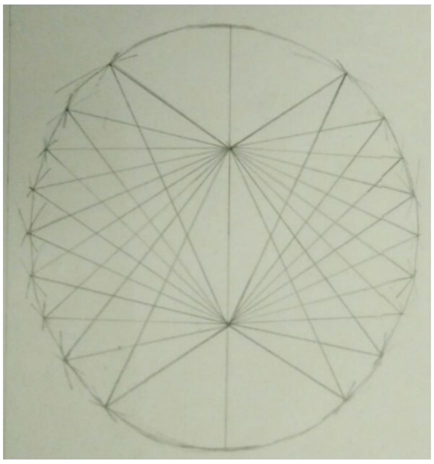
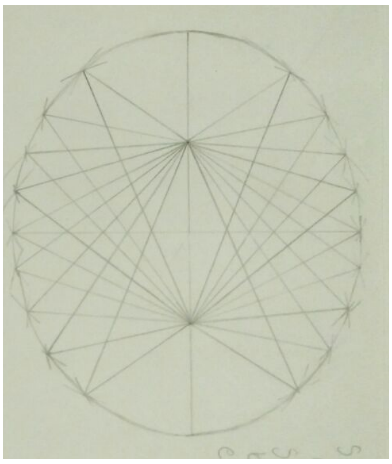
Affiliation: The Bishop's Co-Ed School, Pune

Email: learningclubpune@gmail.com

Abstract:

In Geography test book, it is given that the orbits of planets are elliptical. Ellipse is a geometrical shape, but no math text book till class 10 introduces ellipse. Keeping a side of triangle constant, many triangles can be drawn on it

such that they have the same perimeter. The set of third vertices of all such triangles is an ellipse. The same thing can be extended to 3D and an ellipsoid can be formed.

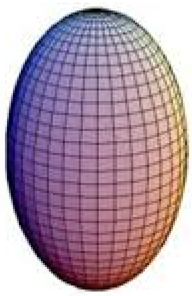
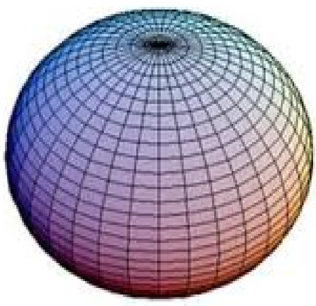



Every ellipse has two focal points and two axes of symmetry.

The longer line segment along an axis of symmetry is called the MAJOR AXIS.

The shorter line segment along the other axis of symmetry is called the MINOR AXIS

Sum of distances of any point on an ellipse from its foci is always constant.

Ellipsoids are 3D figures. They can also be thought as solids of revolution of an ellipse around an axis of symmetry. Thus, one ellipse can give rise to two ellipsoids, the axes of rotation being different. An ellipsoid can also be constructed starting from a triangle.

Visual Solution Of An Arithmetic Problem

Author: G.S.S Pranit Sai
Affiliation: Sri Prakash Synergy School, Peddapuram, Andhra Pradesh.
Email: praneethsai333@gmail.com

Abstract

The following problem is a common example, in books on arithmetic in school level.

Distance between two points A and B is 30mts, two people A' and B' start from A and B respectively at the same time, moving to and fro continuously between the points A and B. A' moves at a speed of 2m/s towards B and B' moves at a

speed of 3m/s towards A. In the time period of one minute, how many times do they cross each other?

Usually an arithmetic solution is given in the course. In this paper a visual solution has been tried. Velocities, time and distance are changed to get different situations and generalisation is done.

A Mathematical Game

Author: Priyatham Reddy
Affiliation: Sri Prakash Synergy School, Peddapuram, Andhra Pradesh
E-mail: priyathamreddy2001@gmail.com

Abstract:

Six cards of 3 black and 3 white are arranged in a row of 7 slots as follows

	W	W	W	B	B	B

B is black and w is white

A person is asked to move the cards in such a way that, he gets the following outcome in a minimum number of moves.

B	B	B		W	W	W

The rules of the game are

1. At a time only one card can be taken
2. Once a card is taken it should be placed in an empty slot
3. A card can skip at most two slots only an either way.

A Mathematical Game

Author: T. Sakshith
Affiliation: Sri Prakash Synergy School, Peddapuram, Andhra Pradesh
E-mail: sakshith0132@gmail.com

Abstract:

The first 8 natural numbers are written one each on a card. They are arranged in 2 rows of 4 each. A person is asked to think of a number between 1 and 8[both inclusive] and disclose whether it is in the first or in the second row. Then the two rows are shuffled in a particular fashion and rearranged again in 2 rows of 4 each. The person has to identify and tell in which row the number is. One more shuffle in a different manner is done and again the cards are arranged in 2 rows

of 4 each and the person has to identify in which row the number is. Then the correct card is picked this is extended for 16 numbers with 3 shuffles.

Josephus Problem

Author: V.D.D. Santosh Kumar
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Abstract:-

Flavius Josephus was commanding a place called Jotapata, a Jewish town of Yodfat (67 AD). Roman forces sieged this town for 47 days and captured the survivors. Along with 40 companions while escaping, Josephus got caught by the Roman soldiers. They all wanted to kill themselves. Josephus and his friend wanted to survive. They suggested that they all will be arranged in a circle and every third person will be killed going in clockwise direction. By choosing the position 31 and 16 in the circle they both survived. **How did they manage it?** There are several variants of Josephus problem. Instead of skipping two persons, one person is skipped etc. Therefore, let's see the solution when one person is skipped.

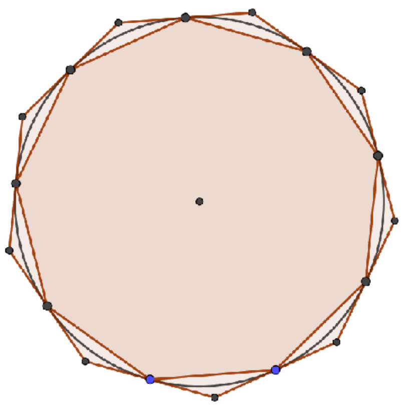
Going Near π

Author: Shubhangi Gangadhar Pawar

Email: learningclubpune@gmail.com

Abstract:

A circle is constructed and a regular n-gon is inscribed and circumscribed in and around the circle respectively. The value of π obviously lies between the ratios of perimeters of the two n-gons to the diameter of the circle. Average of the two ratios can be accepted as the working value of π.More is the value of n, better is the working value of π thus obtained. For different values of n, different figures are constructed. The working value of π for each figure is calculated along with.



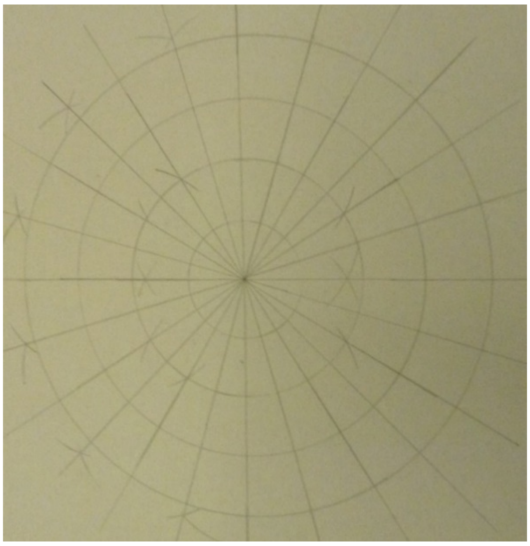
Polar Graphs

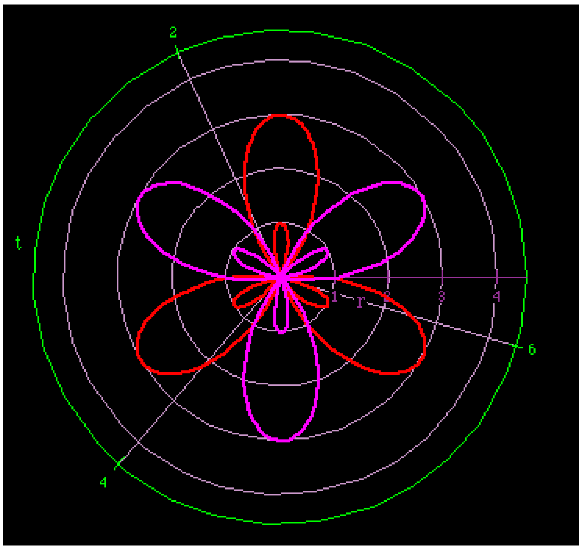
Author: Sunaina Bijoy Bhutada
Affiliation: Orchid School, Pune
Email: learningclubpune@gmail.com

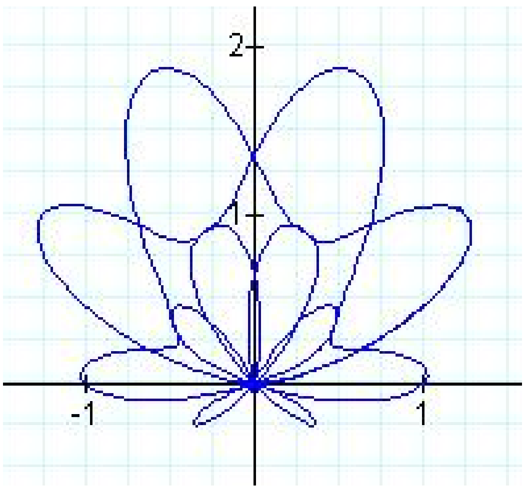
Abstract:

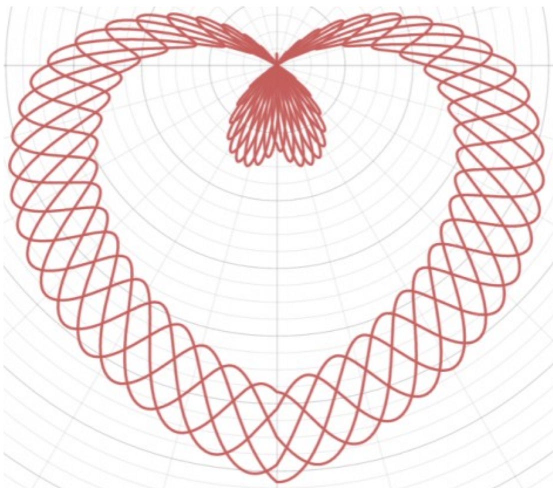
Up to class 12, polar graphs are not introduced in the syllabus. However, polar graphs can have good role in designing. The students having interest in drawing and painting can make intelligent use of polar graphs and make good designs.

Before using tools like graphic calculator, some polar graphs should be drawn manually. That helps the learner have clarity of the concept. Some such polar graphs are presented in this exhibit. This can be a good activity in Math Club in schools though it is not a part of the syllabus for exam.





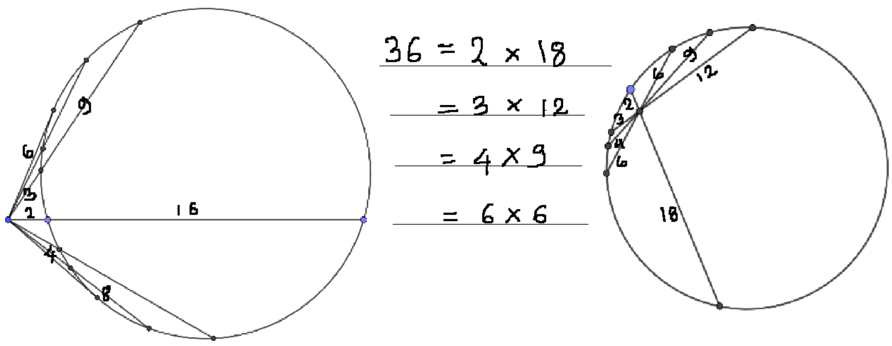




Equal Products In Circles

Author: Sushrut Milind Jog
Affiliation: Jnana Prabodhini Prashala, Pune
Email: learningclubpune@gmail.com

Abstract:
Pairs of factors of a natural number are obtained. The numbers in each pair are taken as lengths of segments along a line. Each pair of factors, thus, generates two collinear line segments. All such segments are concurrent. The end-points of all such segments are concyclic.



Procedure 1: A line segment PB of length 18 units is drawn and point A is taken on it such that PA = 2. A circle is constructed such that AB is a chord of the circle. Point C is taken on the circle such that PC = 3. Ray PC meets the circle in one more point D. Point E is taken on the circle such that PE = 4. Ray PE meets the circle in one more point F. Point T is taken on the circle such that PT = 6. Ray PT is extended.

Observations – CD = 9, EF = 5. Ray PT is tangent to the circle.

Conclusion – $PA \times PB = PC \times CD = PE \times PF = PT^2 = 36$

Procedure 2 – A line segment AB of length 20 units is taken. Point P is taken on it such that AP = 2.

Point C is taken on the circle such that PC = 3. Ray CP meets the circle in one more point D. Point E is taken on the circle such that PE = 4. Ray EP meets the circle in one more point F. Point T is taken on the circle such that PT = 6. Ray TP meets the circle in one more point S.

Observations – PD = 12, PF = 9, PS = 6

Conclusion – $PA \times PB = PC \times PD = PT \times PS = 36$

Along with statements and proofs of theorems in the text book, such Math Lab activities help the students to understand the theorems more meaningfully.

3D Coordinate Geometry In Math Lab

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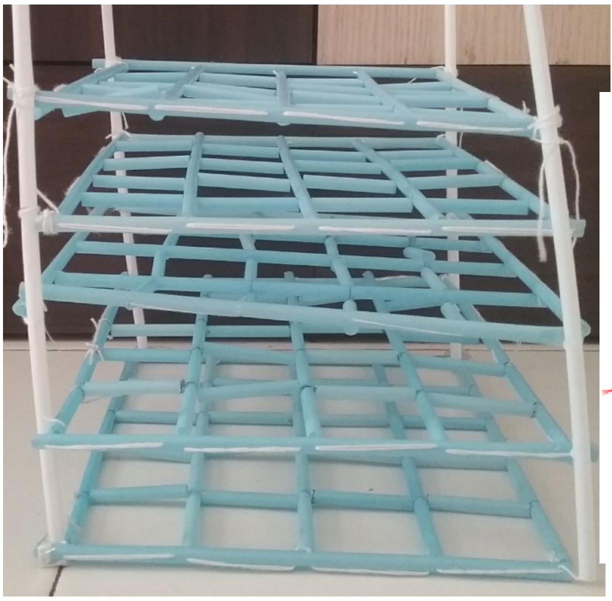
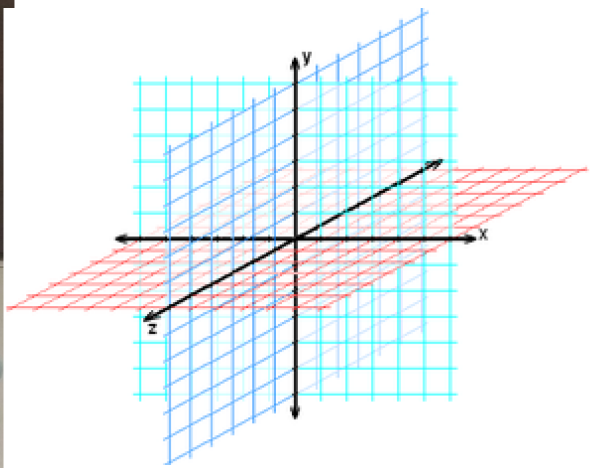
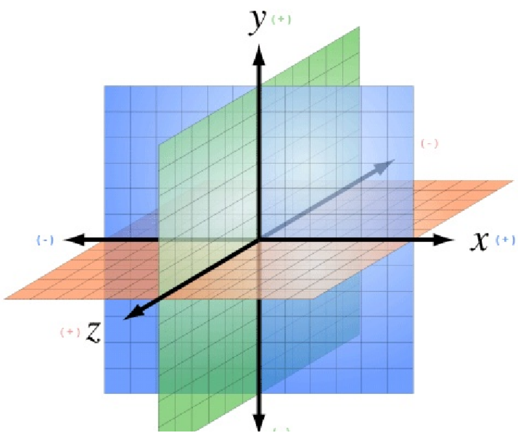
Abstract:

Students are aware of Cartesian frame in 2D. But for beginners, the concept of octants in 3D becomes hard to understand. To address this problem, a 3D grid is prepared using low cost materials and plotting points in that grid is demonstrated.

This activity can be introduced as a Math Lab activity in the syllabus. This is a good tool to nurture spatial intelligence of students.







Hands-on activities are always recommended in learning process to develop clarity of concepts. This is one such activity.