Palette-o-Math

KALINDI COLLEGE UNIVERSITY OF DELHI

(ACCREDITED WITH GRADE 'A' BY NAAC)

Department of
Mathematics
Kalindi College
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Letter from
The Principal

Recently, lunar eclipse has been in news, especially the occurrence of 'Blue Moon'. These astronomical phenomena teach us periodicity (importance of time) and precision. I believe young students should adopt this precision in their lives. In addition to that, students of Mathematics should be inspired to explore more on the mathematical aspects of astronomy when such phenomena happen.

Like astronomy, I am very glad that this newsletter is being released in good order and precision, credit for which certainly goes to the incessant efforts of the faculty, students and all the contributors to it. Like every newsletter, I am looking forward to the next edition.

Dr. Anula Maurya

Letter from
The Head Department of Mathematics

I am happy that Department of Mathematics, Kalindi College is bringing out a newsletter "Palette-o-Math". This is nicely edited by Ms. Anshu Chotani and Dr. Prempal Singh. My congratulations to all those associated with bringing out this newsletter.

The newsletter has several interesting items. The article about Kaprekar's operation by Sanjay Kumar and "Indians Invented 'Zero' 500 Years Earlier Than Thought" by Ms. Ayushi Saini are of particular interest. **LETTER** Continued on page 2.

Prof. V. Ravichandran

From the Chair of
The Mathematics Department

With this fourth edition of newsletter, I am proud to say that it has now grown out of the initial difficult and evolving stage into a standardized and self – perpetuating framework. Yet, the team is as excited, involved and even nervous as it had been at the time of the first edition. **LETTER** Continued on page 2.

Ms. Anju Rattan

The Editor In Chief

I take it as an honor to mention here that our respected Principal Dr. Anula Maurya provides the best possible atmosphere to our department. Madam Principal not only motivates us at every aspect of academic and social responsibility but also guides us to achieve our goals. Mathematics Society is doing exceptionally well. I hope you will enjoy reading various articles highlighted in this newsletter.

Ms. Anshu Chotani

Letter from
The Alumni Convener

With the guidance and support of our Principal and the fellow faculty members, I feel delighted to express my happiness seeing our alumni circle strengthen day by day and our students receiving great honors and appreciations for their hard work. Our student Alumni of 1996 batch, Dr. Ruchika Verma (formely Ruchika Batra) presently an associate professor in Department of Mathematics, Ramjas College, Delhi University, was awarded the best faculty few years back.

I feel proud to mention that our alumni students Ms. Honey Garg, Ms. Mohini Rastogi, Dr. Aditi Jain, Ms. Subhadra Yadav, Ms. Ruchika all are doing exceptionally well. We take them all as fruits of success of our faculty members and guidance in seeing them achieve their goals. I wish you all many more Brilliant Achievements ahead.

Ms. Neelam Bareja

Letter from
The Editor

It is impossible to explain in words what I achieve from this institute in the past twelve years. Our respected principal Dr. Anula Maurya, give us every opportunity to not only grow to exponential heights in academics as well as to perform our social responsibilities by providing amazing atmosphere within the college.

I feel extremely proud to mention that I belong to a department which is very much committed to achieve excellence in academics in university.

The entire department prepares this newsletter as an honest team work. Articles by faculty members are amazing facts and motivated by their areas of interest. Our students are always very creative and ambitious to achieve their academic and carrier goal.

I wish a great future to everyone.

Dr. Prempal Singh

Letter from
The Alumni Student

I have always been proud of the Kalindi Family and this is again one of those moments, when we come out with the Departmental Newsletter, with the committed hard work of all. It has over the years become a platform for the members; especially us, the Alumnae, to get to know the growth that has been achieved. I feel so elated to see the progress we have made and that in too such short a span. I wish this trend of growth takes the department to the pinnacle of success.

Ms. Somya (Alumni 2014 Batch)
Ms. Tanvi Sachdeva (Alumni 2016 Batch)

Letter from
The Student Editor

We feel extremely glad as the Department of Mathematics issues another edition of its newsletter. It is a proud moment for the college as it marks a remarkable growth of the Department. It would present the accomplishments and activities of the college in the field of Mathematics. We wish to witness more such proud moments of the college in future as well.
Best wishes.

Ms. Smriti Raman , B. Sc. (Hons) Maths III Year
Ms. Mahima Mahajan, B. Sc. (Hons) Maths II Year

Letter from the Head ….

Knowing history of mathematics is important. You must be knowing that complex number were studied to overcome problems that came when solving cubic equations though we motivate by often saying that the equation $x^2 + 1 = 0$ has no solutions in integer and so we need complex number. Though we need complex numbers to solve this, Cardan formula expresses the real root of a cubic equation using complex numbers and that is the real reason for studying complex numbers.

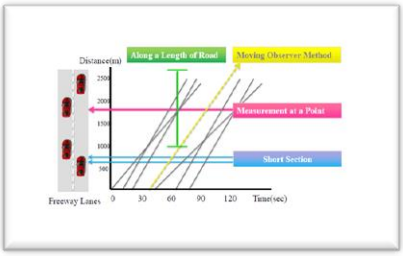
Counting in different ways gives us interesting formulas. Combinatorics has several interesting identities involving combinatorial numbers all of which can be proved without writing using the formula for the combinatorial numbers. You must have seen some of them in your high-school or college course. I will explain you such proofs in a talk that I deliver to you all soon.

From the Chair …

There have been several developments in the Mathematics department especially in terms of research and expansion of faculty. Apart from that, the department has also witnessed enlightening seminars recently. This newsletter strives to bring forth glimpses of all such events and be keeper of memories, which we might forget with time. I really thank everyone involved in this newsletter, even the avid readers, without whom this would not be possible.

Traffic Flow Theory

The most common and irritating problem one faces in our country is getting caught in traffic jams. We can analyze traffic flow theory after study of few key factors.



Four Methods of Obtaining Traffic Data

Following are variables of interest for measurement procedures in traffic flow theory:

- rates of flow (vehicles per unit time)
- speeds (distance per unit time)
- travel time over a known length
- occupancy (percent of time a point on the road is occupied by vehicles)
- density (vehicles per unit distance)
- time headway between vehicles (time per vehicle
- spacing, or space headway between vehicles (distance per vehicle)
- concentration (measured by density or occupancy)

Measurement capabilities for obtaining traffic data have changed over the nearly 60-year span of interest in traffic flow, and more so in the past 40 years during which there have been a large number of freeways. Indeed, measurement capabilities are still changing. Five measurement procedures are discussed in this section:

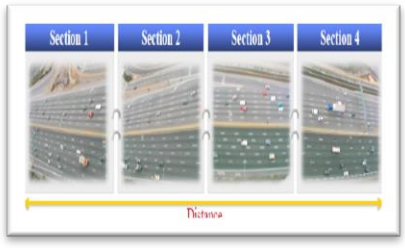
Measurement at a Point by Tube

Measurement over a short section

Measurement over a length of road

Observer moving in the traffic stream

Wide-area samples



Intelligent Transportation Systems

Variables of Interest:
Flow Rate
Speed

Complete analysis and a mathematical model regarding traffic flow theory has been obtained in the project "Differential Equations and Mathematical Modeling: Case Study Traffic Flow in Delhi" by Ms. Neelam Bareja and Dr. Prempal Singh.

Dr. Prempal Singh

Mystery No. 6174

In 1949 mathematician D.R. Kapekar from India devised a process now known as *Kaprekar's operation*. First choose a four digit number where the digits are not all the same (that is not 1111, 2222,). Then rearrange the digits to get the largest and smallest numbers these digits can make. Finally, subtract the smallest number from the largest to get a new number, and carry on repeating the operation for each new number. We reach 6174 the operation repeats itself, returning 6174 every time. We call the number 6174 a *kernel* of this operation. So 6174 is a kernel for Kaprekar's operation

$$9871 - 1789 = 8082$$
$$8820 - 0288 = 8532$$
$$8532 - 2358 = 6174$$

The digits of any four digit number can be arranged into a maximum number by putting the digits in descending order, and a minimum number by putting them in ascending order. So for four digits a,b,c,d where

$$9 \geq a \geq b \geq c \geq d \geq 0$$

and $a,\ b,\ c,\ d$ are not all the same digit, the maximum number is $abcd$ and the minimum is $dcba$.

We can calculate the result of Kaprekar's operation using the standard method of subtraction applied to each column of this problem:

$$\begin{array}{r} abcd \\ -dcba \\ \hline \end{array}$$

$$A\ \ BCD$$

which gives the relations

$D = 10 + d - a$ (as $a > d$)
$C = 10 + c - 1 - b = 9 + c - b$ (as $b > c - 1$)
$B = b - 1 - c$ (as $b > c$)
$A = a - d$

for those numbers where $a>b>c>d$.

A number will be repeated under Kaprekar's operation if the resulting number $ABCD$ can be written using the initial four digits a,b,c and d. So we can find the kernels of Kaprekar's operation by considering all the possible combinations Each of the 4! combinations gives a system of four simultaneous equations with four unknowns, so we should be able to solve this system for $a,\ b,\ c$ and d.

Mr. Sanjay Kumar

Relevance of Vedic Mathematics in the Present Era

Veda is a Sanskrit word which means 'Knowledge' and Mathematics means calculations, therefore Vedic Mathematics is the name given to the ancient system of Indian Mathematics which was rediscovered from the Vedas between 1911 and 1918 by Sri Bharati Krihsna Tirthaji (1884-1960). According to his research all of mathematics is based on sixteen Sutras, or word-formulae.
These formulae describe the way the mind naturally works and are therefore a great help in directing the student to the appropriate method of solution.

These striking and beautiful methods are just a part of a complete system of mathematics which is far more Using regular mathematical steps, solving problems sometimes are complex and time consuming. But using Vedic Mathematics' General Techniques (applicable to all sets of given data) and Specific Techniques (applicable to specific sets of given data), numerical calculations can be done very fast. Some Vedic Math Scholars mentioned that Using Vedic Maths tricks you can do calculations 10-15 times faster than our usual methods.

The Vedic Sutras mean string of knowledge. The following are the Vedic sutras on which the entire Vedic mathematics calculations are based:

Today, student faces competition among their peer group and wants to secure very good marks in Mathematics. They need to appear in several competitive examinations like AIEEE,JEE, GATE, GMAT etc for their higher educations.

Students of Vedic Mathematics can not only do simple calculations of subtraction, addition, multiplication but also very complex calculations such as algebra, geometry, calculus and trigonometry.

Instead of learning by repetition, Vedic Mathematics involves logic and understanding the fundamental concepts.One of the most beneficial features of Vedic math is that it enriches and enhances the knowledge and understanding of the maths so that you can learn it in an easy way. This method saves a lot of time as it does not require remembering a large amount of formulae. Also, it helps in enabling faster calculations, unlike the other conventional methods. It, provides a set of the checking procedures for independent cross-checking of whatever we do. Also, the element of choice helps in developing the clarity of mind and intuition.

	Name / Sutra	Sub-Sutra	Meaning
1	Ekadhikena Purvena	Anurupyena	By one more than the previous one
2	Nikhilam Navatashcaramam Dashatah	Sisyate Sesasamjnah	All from 9 and the last from 10
3	Urdhva-Tiryagbyham	Adyamadyenantyamantyena	Vertically and crosswise
4	Paravartya Yojayet	Kevalaih Saptakam Gunyat	Transpose and adjust
5	Shunyam Saamyasamuccaye	Vestanam	When the sum is the same that sum is zero
6	Anurupye Shunyamanyat	Shunya Anyat	If one is in ratio, the other is zero
7	Sankalana-vyavakalanabhyam	Yavadunam Tavadunikritya Varga Yojayet	By addition and by subtraction
8	Puranapuranabyham	Antyayordashake'pi	By the completion or non-completion
9	Chalana-Kalanabyham	Antyayoreva	Differences and Similarities
10	Yavadunam	Samuccayagunitah	Whatever the extent of its deficiency
11	Vyashtisamasthi	Lopanasthapanabhyam	Part and Whole
12	Shesanyankena Charamena	Vilokanam	The remainders by the last digit
13	Sopaantyadvayamantyam	Gunitasamuccayah Samuccayagunitah	The ultimate and twice the penultimate
14	Ekanyunena Purvena	Dhvajanka	By one less than the previous one
15	Gunitasamuchyah	Dwandwa Yoga	The product of the sum is equal to the sum of the product
16	Gunakasamuchyah	Adyam Antyam Madhyam	The factors of the sum is equal to the sum of the factors

Dr. Anuradha Gupta, Associate Professor (Delhi College of Arts & Commerce)

Largest known prime number discovered

Discovery made on computer belonging to electrical engineer who searched for the elusive number for 14 Years. A collaborative computational effort has uncovered the longest known prime number. They are a mathematical mystery, the secrets of which mathematicians have been trying to uncover ever since Euclid proved that they have no end. An ongoing project "the Great Internet Mersenne Prime Search" which aims to discover more and more primes of a particularly rare kind has recently resulted in the discovery of the largest prime number known to date. Stretching to 23,249,425 digits, it is so large that it would easily fill 9,000 book pages. By comparison, the number of atoms in the entire observable universe is estimated to have no more than 100 digits to the endeavour.

The number, simply written as $2^{77232917}-1$ (two to the power of 77,232,917, minus one) was found by a volunteer who had dedicated 14 years of computing time. You may be wondering, if the number stretches to more than 23m digits, why we need to know about it? Surely the most important numbers are the ones that we can use to quantify our world? That's not the case. We need to know about the properties of different numbers so that we can not only keep developing the technology we rely on, but also keep it secure.

Dr. Mohd. Nadeem

What did we "MEAN" in Ancient Time

We have started to believe that apart from zero and some popular glimpses of Vedic mathematics, ancient India existed for several millennial without any practical mathematics. It is only with the advent of Europeans on the world scene that mathematics was born, as we know it. Though logic defied it, it was so believed until recently when the focus of various researches has turned backward to explore the past. The more we dredge the past, the prouder we become of our own heritage.

Mr. Amartya Kumar Dutta of Stat-Math Unit, Indian Statistical Institute Kolkata, has also taken up an explorative journey into the past. In his article "Weighted Arithmetic Mean in Ancient India" published in Bhavana in October 2017, he shatters the earlier European belief that earliest reference to Arithmetic Mean is found only in Europe of the 17th century. As Churchill Eisenhart most prejudicially phrased:

"..I fully expected that I would find some good examples of mean taking in ancient astronomy; and, perhaps, also in ancient physics. I have not found any. And I now believe that no such examples will be found in ancient science."

In mathematics, the Arithmetic Mean of n numbers $x_1, x_2, \ldots\ldots x_n$ is formally defined to be the number:

$$\bar{x} = \frac{x_1 + x_2 + \cdots . + x_n}{n}$$

As Mr. Dutta has beautifully stated, "It is an exact mathematical concept. But it is widely applied in the study of approximations. (Contrary to what is believed), there is a clear and precise use of the Arithmetic Mean in the treatises of ancient Indian mathematicians like Brahmagupta (628 CE), Sridharacharya (c.750 CE) etc". It has been illustrated in said article that these Indian mathematicians define and apply the more general and sophisticated concept of *weighted Arithmetic Mean*. Mr. Dutta further elaborates, "There is a verbal presentation of the formula for weighted Arithmetic Mean in the treatise Brahma Sphuta Siddhanta (628 CE) by Brahmagupta. The formulation is made in the context of finding the mean depth of an excavated region whose top and base have identical rectangular dimensions but whose depth varies. In the spirit of integral calculus, the region is subdivided into sections such that the depth can be taken to be uniform throughout each section. Then the principle of weighted Arithmetic Mean is applied. The relevant portion of the verse is as follows:

"mukha-tala-tulya-bhujaikyany-ekagrah-rtaani samarajjuh"

It may be translated as follows:

"In an excavation whose face and base have the same measurements, the mean depth is given by the sum of the products of the lengths and depths of the sections divided by the total length."

Referring to Figure 1 (borrowed from the article itself), he has explained the concept as follows:

"If an excavated region of uniform length (but variable depth) comprises n sections of lengths $l_1, l_2, \ldots\ldots\ldots l_n$ and depths $d_1, d_2, \ldots d_n$, respectively, then the mean depth d of the excavation is defined to be:

$$\bar{d} = \frac{l_1 d_1 + l_2 d_2 + \cdots . + l_n d_n}{l_1 + l_2 + \cdots . + l_n}$$

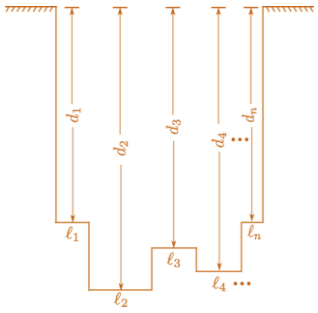


Figure 1

The article concludes that "from at least the 7th century CE, Indian mathematicians have not only defined the Arithmetic Mean explicitly, not only given the concept an appropriate name, but have also treated it as a representative value. And yet, the abundant occurrence of Arithmetic Mean in ancient Indian mathematics texts gets overlooked in accounts on history of statistics. Should we in India cling to our culture of cultivated ignorance about ancient Indian science?"

Arithmetic Mean may be a very basic concept today especially to a mathematician or a statistician. However, its various applications in ancient India have been explained in a very interesting manner in the article. I totally recommend at least one reading of the entire article as it not only it adds to the knowledge, it also adds to our pride. The article is available at the link:

https://www.isical.ac.in/~statmath/amartya/AmartyaWAMarticle.pdf

Ms. Sunita Sharma

What's your Happiness Formula?

To become happy is everyone's right, but where can we find happiness? How to reach it? To fill our Quest for Happiness, Mathematics comes with an answer. Winning over depression, anxiety and all such negative aspects of human behavior, we realized that happiness might not have a direct equation, but it can unobjectionably be stated as:

H = f(S, C, V)

H stands for enduring level of happiness
S is your set range
C is the circumstances in your life, and
V represents factors under your voluntary

H: Your Enduring Level of Happiness: This helps to distinguish between *momentary* and *absolute happiness* and no matter how many instances of such transient happiness we may get, they will never reach the absolute (*enduring level of happiness*). Hence, the factors on which enduring level of happiness depends on are:

S: Our Set Range: About 50% of our happiness is completely out of our control as it depends on our *genes*. We always gravitate towards the so-called *happiness set-point* in good as well as in bad times and this set range is what keeps our level of happiness from increasing.

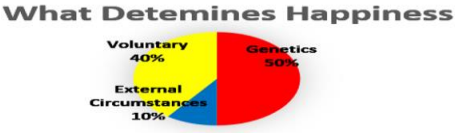
C: Circumstances: They just contribute to about 10% of our happiness. If we think that, we can raise our level of happiness by focusing only on the *external circumstances* then let's think again. Blaming a situation or circumstance is just misdirected.

V: Voluntary Variables: These internal circumstances, accounting to about 40% of our happiness provide a *lasting impact*. The Voluntary Variables are divided into three buckets:

Positive emotions about the past - The more positive our view of the past, the happier we will be.

Positive emotions about the future - Recognize our pessimistic thoughts and dispute them.

Positive emotions about the present - Use our signature strengths to produce happiness and abundant gratification.



The more positive we are about our past, future, and present, the happier we will be. Therefore, to raise the lasting level of happiness, we have to change on how we feel about our past, how we think about the future, and how we experience the present.

Happiness to me is,

Happiness = (Meaningful Work + Joyful Activity + Loving People) * Time to Appreciate It

What would your happiness equation be?

What makes you happy, and what doesn't:

Source: Explained for dummies, Sandip Roy, Happiness India Project On Happiness Equations, Jeremy McCarthy, Positive Psychology, Questions of Science

Ms. Neelam Bareja

"There is geometry in the humming of strings; there is music in spacing of spheres."

Pythagoras

Mathematics and Music

Ancient Indians, Egyptians and Mesopotamians are known to have studied the mathematical principles of sound. Mathematician like Pythagoras, of ancient Greece were the first researchers known to have investigated the expression of musical scales in terms of numerical ratios, particularly the ratios of small integers. Their central doctrine was that "all nature consists of harmony arising out of numbers".

From the time of Plato, harmony was considered a fundamental branch of physics, now known as musical acoustics. Early Indian theorists show similar approaches, all sought to show that the mathematical laws of harmonics and rhythms were fundamental not only to our understanding of the world but to human well-being. Confucius, like Pythagoras, regarded the small numbers 1,2,3,4 as the source of all perfection.

Expanding on the methods of musical set theory, some theorists have used abstract algebra to analyze music. For example, the pitch classes in an equally tempered octave form an abelian group with 12 elements. It is possible to describe just intonation in terms of a free abelian group.

Transformational theory is a branch of music theory developed by David Lewin. The theory allows for great generality because it emphasizes transformations between musical objects, rather than the musical objects themselves. Theorists have also proposed musical applications of more sophisticated algebraic concepts.

So the chromatic scale can be thought of as a torsor.

The attempt to structure and communicate new ways of composing and hearing music has led to musical applications of set theory, abstract algebra and number theory. Some composers have incorporated the golden ratio and Fibonacci numbers into their work.

Think and explore the connection, what Mathematics and Music have in common and how Mathematics is used to create the Music you enjoy.

Topology can be discussed for optimal values

Topology is a mathematical discipline which gives precise formulations for the concept of a general spatial structure and deals with all properties of a space that are invariant under one to one bi-continuous mappings. A basic problem of topology is to define a general space and to investigate relationships between the topological structures defined in different ways. The notion of 'nearness' has also a psychological appeal. The notion of 'distance' was made precise by 'Frechet' in 1906 when he introduced metric spaces. The concept of 'nearness' was replaced by the mathematical concept of 'neighbourhood' introduced by 'Housdorff' in 1914. The notion of introducing a spatial structure though 'convergence' was undertaken by 'Frechet' but abandoned later as it proved tedious to formulate the axioms in terms of 'convergence'.

Topology has two main branches, General Topology and Algebraic Topology. General Topology makes use of set-theoretic techniques and Algebraic Topology uses group theory to a great extent. General Topology contains a detailed treatment of metric spaces, topological spaces, convergence, continuity, homeomorphism, product topology, compactness, connectedness etc. One of the main aims of General Topology is to extend and generalise the notions of 'convergence and continuity' to more general spaces than a real line. Algebraic Topology is another domain which prominently associates groups to the objects the theory is interested in. There, groups are used to describe certain invariants of topological spaces. They are called "invariant" because they are defined in such a way that they do not change if the space is subjected to some deformation. For example, the fundamental group "counts" how many paths in the space are essentially different. The Poincare conjecture, proved in 2002, is a prominent application of this idea. Algebraic Topology also deals Homotopic groups. For example,

If C is a non-empty compact convex subset of, X, a locally convex Housdorff Topological Vector Space over R, and if K is an ordering cone on X such that the quasi-interiors of K and the dual cone K* are nonempty then the set of points in C optimizing (maximizing or minimizing) strictly positive linear functionals is dense in set of optimal points (maximal and minimal respectively) of C.

This result is important to investigate the Topological properties of various efficient point sets. It is also useful for Optimization theories. Topological optimization gives the tools for maximum performance with minimal restrictions. Topological optimization is a mathematical method that optimizes material layout within a given design space for a given boundary conditions and constraints with the goal of maximizing the performance of the system.

डॉ॰ अम्बेडकर : भारतीय विरासत के रक्षक

डॉ .भीमराव अम्बेडकर उन गिने-चुने भारतीय मनीषियों में से एक हैं,जिन्होंने भारत में लोकतंत्र और समता पर आधारित राज्य –व्यवस्था की आधारशिला रखी थी ।भारतीय संविधान के निर्माण में उनकी ऐतिहासिक भूमिका सर्वविदित है । समता और समरसता से युक्त समाज की स्थापना भारत का प्राचीन काल से लक्ष्य रहा है । बाबा साहब को इसकी बड़ी वेदना रहती थी कि पूर्वजों द्वारा अपेक्षित समाज-रचना का स्थपित होना तो दूर रहा ,सर्वत्र विषमता का ही बोलबाला है ,और " सियाराममय सब जग जानी " की आस्थाओं वाला हिन्दू समाज अपने सनातन लक्ष्य के विपरीत चल पड़ा है ।उन्होंने इस विसंगति को दूर करने के लिए आजीवन संघर्ष किया ।उन्होंने भेद-भाव की विकृति को भारतीय समाज की आन्तरिक समस्या माना और समानता-प्राप्ति की लड़ाई लड़ते हुए उन्होंने राष्ट्रीय एकता सदा ध्रुव तारे के समान आँखों के सामने रखा , भगवान शिव की तरह स्यंव विष पिया पर समाज को अमृत दिया और गौतम के संदेश से भारतीय विरासत की रक्षा की ।

Dr. Abhishek Kumar Singh

The effect of Stochasticity on Repair of DNA Double Strand Breaks throughout Non-homologous end joining Pathway

Mathematical models are important tools in basic scientific research in many areas of biology, including physiology, ecology, evolution, toxicology, immunology, natural resource management, and conservation biology. The result obtained from analysis and simulation of system models are used to test and extend biological theory, and to suggest new hypotheses or experiments. Models are also widely used to synthesize available information and provide quantitative answers to practical questions. What measures can be used to reverse the decline in sea turtle populations, and how soon can we tell if they are working? How can laboratory experiments on chemical carcinogenicity be scaled up to set safe exposure limits on humans? For questions like these, where it is desirable to predict the outcome accurately before action is taken, quantitative modelling is essential.

DNA double strand breaks (DSBs) are the most lethal lessons of DNA induced by ionizing radiation, industrial chemicals and a wide variety of drugs used in chemotherapy. In the context of DNA damage response system modelling, uncertainty may arise in several ways such as number of induced DSBs, kinetic rates and measurement error in observable quantities. Therefore, using the stochastic approaches is imperative to gain further insight into the dynamic behavior of DSBs repair process.

Mr. Avneesh Kumar

Abel Prize

Abel prize is awarded annually by the Norwegian Academy of Science and Letters to one or more outstanding mathematicians. It is named after Norwegian Mathematician Niels Henrick Abel..

The award was established by the Government of Norway in 2001. It is described as the mathematician's Nobel Prize and is one of the world's top prizes in Mathematics. It carries a monetary reward of *6* pivotal role in the development of the Mathematical theory of wavelets (small waves or ripples). His theory is used for applications ranging from image compression to the detection of gravitational waves from the merging of black holes. It also allowed scientists to create unique.

Ms. Smriti Raman
B. Sc. (Hons) Mathematics III Year

Indians Invented 'Zero' 500 Years Earlier Than Thought

An ancient Indian manuscript, dating back to the third century, has revealed the oldest recorded use of 'zero' pushing back one of the greatest breakthroughs in the history of mathematics back by over 500 years, Oxford scientists say.

Bakhshali manuscript was found in 1881, buried in a field in what was then an Indian village called Bakhshali, now in Pakistan. It has been at the Bodleian Libraries in the UK since 1902. Researchers at University of Oxford in the UK used carbon dating to trace the origins of zero to the Bakhshali manuscript. They found that the text contained hundreds of zeroes, putting the birth of 'zero' or 'nought' as it is also known, at 500 years earlier than scholars first thought.

The text dates back to the third or fourth century, making it the oldest recorded use of the symbol.

The concept of the symbol as we know and use today, began as a simple The earliest recorded example of the use of zero was previously believed to be a 9th century inscription of the symbol on the wall of a temple in Gwalior, Madhya Pradesh. The creation of zero as a number in its own right, which evolved from the placeholder dot symbol found in the Bakhshali manuscript, was one of the greatest breakthroughs in the history of mathematics. "We now know that it was as early as the 3rd century that mathematicians in India planted the seed of the idea that would later become so fundamental to the modern world."

Ms. Ayushi Saini
B. Sc. (Hons) Mathematics III Year

Mathematics Anxiety

Mathematics anxiety has been defined as feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations. Maths anxiety can cause one to forget and lose one's self-confidence.

Given the fact that many students experience math anxiety in the traditional classroom; teachers should design classrooms that will make children feel more successful. Students must have a high level of success or a level of faliure that they can tolerate. Therefore, incorrect responses must be handled in a positive way to encourage student participation and enhance student confidence. Students today have a need for practical math. Therefore, math needs to be relevant to their everyday lives. Students enjoy experimenting. to learn math's , students must be engaged in humor is greatly needed. Young children enjoy cartoons and jokes. Cartoons may be used to introduce a concept or class discussion. Most children will master mathematical concepts and skills more readily if they are presented first in concrete

Abstractions they represent. students enjoy the change from lecture and books and they are more inclined to explore with manipulatives and, manipulatives , pictures and symbols to model or represent abstract ideas , the stage is set for young learners to understand the with them throughout the rest of their lives.

Ms. Lakshika Singh
B. Sc. (Hons) Mathematics I Year

Fibonacci Numbers

In mathematics, the Fibonacci numbers are the numbers in the following integer sequence called the Fibonacci sequence and characterized by the fact that every number after the first two is the sum of the two preceding ones. List of Fibonacci numbers Fn for n=0,1,2,3,.....,10.

F_0 =0 F_1=1 F_2=2 F_3=3 F_4=5 F_5=5 F_6=8 F_7=13 F_8=21 F_9=34

The sequence can also be extended by recurrence relation

$F_n=F_{n-1}+F_{n-2}$ [where F_1=1, F_2=1 or F_0=0, F_1=1]

The sequence is named after Italian mathematician Leonardo of Pisa, known as Fibonacci. His result extended to negative index using the re-arranged recurrence relation book *liber abaci* introduced the sequence to western European mathematics, although the sequence had been described earlier in Indian mathematics, The sequence described in *liber Abaci* began with F_1=1.The Fibonacci numbers are important in the computational run- time analysis of Euclid's algorithm to determine the greatest common integers: the worst case input for this algorithm is a pair of consecutive Fibonacci numbers.

The Fibonacci numbers are also an example of a complete sequence. This means that every positive integer can be written as a sum of Fibonacci numbers, where any one number is used once at most.

Keith Devlin tells his incredible and important story in The man of numbers: Fibonacci's Arithmetic Revolution, tracing how Fibonacci Revolutionized everything from education to economics by making arithmetic available to the masses. If you think the personal computing revolution of the 1980 was a milestone of our civilization, consider the personal computation revolution.

Ms. Manvi Surya
B. Sc. (Hons) Mathematics I Year

"An equation means nothing to me unless it expresses a thought of God."

-Srinivasa Ramanujan

TERMINOLOGY DILEMMA: 'Math' or 'Maths'?

Math or Maths? This debate is going on for a long time now. But the answer depends on which part of the world you are in .Americans called Mathematics 'Math', saying that the function of the same is a singular noun and with that logic, they prefer saying 'Math', which is singular too. On the other hand, speakers of British English would always say 'Maths' as in 'I have a degree in Maths'.

However, there are logical arguments for both the spellings. The Oxford and Webster Dictionaries say that the world is plural because of the letter's' in the end .On the contrary, however, it is unusually used as a singular noun. For example-'Mathematics is my favorite subject' and not 'Mathematics are my favorite subject'.

Ms. Vaishnavi Arya
B. Sc. (Hons) Mathematics I Year

World Maths Day: Interesting and Amazing Facts

A word such as formula, equation and calculation sounds fun for those who have keen interest towards solving equations/problems. October 14th is celebrated as World Maths Day. Let us know some interesting and amazing facts about Mathematics.

- Zero (0) is the only number which cannot be represented by Roman numerals.
- What comes after a million, billion and trillion? A quadrillion, quintillion, sextillion, septillion, octillion, nonillion, decillion and undecillion.
- Plus (+) and Minus (-) sign symbols were used as early as 1489 A.D**4**. 2 and 5 are the only primes that end in 2 or 5
- An icosagon is a shape with 20 sides.
- Among all shapes with the same perimeter a circle has the largest area.
- Among all shapes with the same area circle has the shortest perimeter.
- 40 when written "forty" is the only number with letters in alphabetical order, while "one" is the only one with letters in reverse order
- 'FOUR' is the only number in the English language that is spelt with the same number of letters as the number itself
- From 0 to 1,000, the letter "A" only appears in 1,000 ("one thousand")
- 12,345,678,987,654,321 is the product of 111,111,111 x 111,111,111. Notice the sequence of the numbers 1 to 9 and back to 1.
- Have you ever noticed that the opposite sides a die always add up to seven (7) **13.** If you add up the numbers 1-100 consecutively (1+2+3+4+5...) the total is 5050.
- A 'jiffy' is an actual unit of time for 1/100th of a second**.**
- Have you heard about a Palindrome Number? It is a number that reads the same backwards and forward, e.g. 12421.

Ms. Nidhi Sharma
B. Sc. (Hons) Mathematics III Year

Ring Theory In Our Real World

In Ring theory we all are familiar with rings and semi rings. These have many applications in our real life. As semi rings are used all over the place in **computer science**, from databases to machine learning to formal language theory.

Other than this **Cryptography** is an area of study with significant application of ring theory. A simple example, taken from *Understanding Cryptography* (Paar), is that of the affine cipher. The affine cipher gives a method for encrypting text by substituting each letter of the alphabet with some other letter. If each letter is mapped to a number between 0 and 25, then the affine cipher is a function on the integers modulo 26. The affine cipher maps letters of the alphabet by multiplying them by a constant and then shifting them by another constant as follows:

$$y = ax + bmod26 y = ax + mod26$$
$$x = a - 1(y - b)mod26 x = a - 1(y - b)mod26$$

Thus, we can create a simple encryption cipher for the alphabet using an integer ring. Though this is one of the simplest examples of encryption, the concepts carry over to the rest of cryptography as much of cryptography comes down to addition and multiplication of numbers in a ring. When working with bits, ring theory can be used to study the integers modulo 2 with addition mimicking a XOR operation and multiplication mimicking an AND operation.

Ms. Rupanshi Sharma
B. Sc. (Hons) Mathematics II Year

Applications of Group Theory in our Real World

Group theory actually has a huge number of applications in the real world. Without knowing exactly what your daily life involves it's hard to say which are relevant to you, but here are some examples.

Buying things online

The most basic forms of encryption essentially consist of a few rules applied to your message; the recipient can then reverse these rules to understand it. (Equivalent) securely. We do this via encryption.

Magic Tricks

Suppose for example you place a card in the middle of a deck, how can you shuffle the deck so that it always ends up as the top card? All these kinds of questions can be answered with group theory. You can similarly find a method of solving Rubik's cubes by considering the possible movements as the action of a group.

Music

The basic notion of an octave is immediately reminiscent of a cyclic group and things like the Chromatic scale naturally fork groups.

Other stuff

Group theory also has many applications in medical imaging, computer vision etc. As well as being fundamental to some areas of physics and chemistry.

Ms. Kanchan
B. Sc. (Hons) Mathematics II Year

Mathematics gave us.....

To analyse the Complex
Mathematics game us Simplex,
To learn what's Integration
Mathematics gave us Differentiation,
To know what are Functions
Mathematics gave us Relations,
To know what's Stability
Mathematics gave us Probability,
To learn more about Reality
Mathematics gave us LPP,
For all the created Illusions
Mathematics provided the Solutions,
From Physics to Chemistry
Mathematics was the hidden mystery,
From what you see to what you wanna be
Mathematics would always be in History,
From Graphs to Charts
From gilli danda to darts
Mathematics has been a part
From Random experiments to
Obtaining a Sample Space,
Mathematics is running on a better pace.
From reality to Imaginary stage
Mathematics gave us Epsilon & Iota in gaze.
So, for every little hope,
Mathematics provides a Slope,
And thus to reach at the Top
Let Mathematics be an Allotrope!

Ms. Megha Taneja
B. Sc. (Hons) Mathematics III Year

गणित के अध्यापक की कविता

(हास्य कविता)

एक बार गणित के एक अध्यापक से उसकी पत्नी ने
गणित में प्यार के दो शब्द कहने को कहा,
पति ने पूरी कविता ही लिख दी...

म्हारी गुणनखण्ड सी नार, काळजो मत बाळ
थन समझाऊँ बार हजार, काळजो मत बाळ।

दशमलव सी आँख्याँ थारी, न्यूनकोण सा काण,
त्रिभुज जेडो नाक, नाक री नथणी ने त्रिज्या जाण,
काळजो मत बाळ।

वक्ररेखा सी पलक थारी, सरल भिन्न सा दाँत,
समअष्टभुज सा मुण्डा ये, थारे मांख्या की बरात,
काळजो मत बाळ।

रेखाखण्ड सरीखी टाँगा थारी, बेलन जेड़ो हाथ,
मंझला कोष्ठक सा होठां पर टपटप पड़ रही लार-,
काळजो मत बाळ।

आयत जेड़ी पूरी काया थारी, जाणे ना हानि लाभ,
तू ल.प.स., तू मप.स., चुप कर घन घानाभ,
काळजो मत बाळ।

थारा म्हारा गुणा क्यूं, यो फूट्या म्हारा भाग,
आरोही अवरोही हो गयो, मुंडे आ गियो झाग,
काळजो मत बाळ।

म्हारी गुणनखण्ड सी नार, काळजो मत बाळ
थन समझाऊँ बार हजार, काळजो मत बाळ।

साक्षी गोस्वामी
बीएससी ऑनर्स गणित), तृतीय वर्ष

Maths of Love

I never count the number,
But, I count the stars.

I never divided the number,
But, I divide my feelings

I never multiply the number,
But, I multiply my emotions.

I never add any number,
But, I added my heart with your Soul

I never minus the number,
But, I minus my life in love

I failed in Mathematics,
But, didn't want to fail to Maths of Love

I thought about to square and absolute value
When all on my mind is you

As long as I add you to my day
It already sums up my week

We learn about addition and subtraction
But, if you subtract yourself from my life

I'd fail even before the day ends
And I'd crumble faster than a simple division.

Ms. Akansha Srivastava
B. Sc. (Hons) Mathematics III Year

Importance of Modeling

Modeling is a strong tool to plan the steps in development of the system and check the feasibility of ides as before final action on it. Moreover, Modeling reduces the complexity of the system and hence saves resources.
For this we use different design and strategies and models. Modeling creates a base for implementation of the system and its testing. It gives specification for its use by customer.

Measuring Software Reliability
The purpose of reliability measurement is to assign some reliability measure to a system, such as predicting the number of faults remaining; the number of failures expected in a given time, how much time is needed to find a specified number of faults, or the probability of operating without failure in a specified time. Hence, the analyst needs to know the system configuration either to allocate system reliability to component reliabilities or to combine component reliabilities to establish system reliability.

The system may evolve with new code or components and these may affect usage of the reliability estimations. Software reliability analysis is performed at various stages during the process of software development, for a system, as an attempt to evaluate if the software reliability requirements have been (or might be) met. The analysis results not only provide feedback to the designers but also become a measure of software quality.

Software Development Life Cycle (SDLC)
Software development process is often called Software development life cycle (SDLC), because it describes the life of a software product. Basically, it involves designing the application from scratch, documenting everything, adding the improvements and fixing the bugs that occur in the SDLC. It is the lifecycle of Software from concept to obsolescence.
The software development life cycle consists of the following.

- Requirement analysis and specification
- Design
- Coding
- Integration & Testing
- Implementation
- Maintenance.

Dr. Indarpal Singh

Mathematics Quotes

- ✓ ***Pure Mathematics is, in its way, the poetry of logical ideas.*** — *Albert Einstein*
- ✓ ***God used beautiful mathematics in creating the world.*** — *Paul Dirac*
- ✓ ***Mathematics is the art of giving the same name to different things.*** — *Henri Poincare*
- ✓ ***Mathematics knows no races or geographic boundaries; for mathematics, the cultural world is one country.*** — *David Hilbert*

Maths goes to the Movies

We have all marveled at the incredibly life-like computer generated images in the movies. What most of us don't realize is that the dinosaurs of Jurassic Park and the wonders of Lord of the Rings – particularly the star turn of Gollum – would not have been possible without mathematics.

Rotation in 2D

Multiplication of complex numbers had a geometric description: rotation. Let's look at what happens if we multiple1 $+ i$, represented by the point (1, 1) by i. i.e. $i(1 + i) = i - 1 =$ $-1 + i$ which is represented by the point (-1,1), a rotation of 90 degrees. Multiplying by i again gives: $i(-1 + i) = -i - 1 = -1 - i$, which is the point (-1, -1), a rotation of 90 degrees again. Multiplying by i is an instruction to rotate by 90 degrees! In fact, any rotation, not only the 90 degree one, can be achieved using multiplication by a complex number.

Moving to 3D

The mathematician *Sir William Rowan Hamilton* is perhaps Trinity College devoted the last two decades of his life to searching for a way to represent 3-dimensional rotations in a similar manner as complex numbers can represent rotations in two dimensions.

Towards the end of his life Hamilton discovered the answer; in the form of something he called *quaternions*: numbers of the form: $q = a_0 + a_1 i + a_2 j + a_3 k$ where $i^2 = j^2 = k^2 = -1 = ijk, and\ \ a_0, a_1, a_2$ are real numbers.

Bringing images to LIFE

Hamilton's invention is now used in many graphics applications to move objects or create motion. Two of the most important tools in computer graphics are deformations and interpolations.

The techniques described above are essential tools for classical animation, and we are quite happy to believe their results for cartoon characters. But when used to animate humans we can immediately spot it as false. To create realistic motion, generally *motion capture* is required.

So the next time you settle into your cinema seat to enjoy a Computer Generated spectacle, raise your popcorn to mathematics, the hidden star of the show.

Just as we did for complex numbers, we can describe quaternions geometrically and use them to represent rotations. But this time rather than rotations in two dimensions, these are rotations in three-dimensional space.

Hamilton's flash of brilliance, as he walked under that bridge in Dublin, turns out to be the most efficient way to rotate objects in three dimensions. But not everyone was happy with his new method of multiplication. Particularly worrying to some was the fact that when you multiply two quaternions the answer depends on the order in which you multiply them, a property called *non-commutativity*.

Ms. Somya
Alumni (2014 Batch)

Newly Discovered Pentagon Type Is a Perfect Fit

Here's a puzzle for you: Take a bunch of pentagons and try to fit them together so that they cover a tabletop perfectly, with no gaps or overlaps. If you try it with ordinary pentagons, with equal sides, you'll soon see it just won't work. But loosen the requirements by allowing unequal sides, and all becomes possible. Mathematicians had found 14 different types of pentagons that worked, but for 30 years, no one could find another. In August, mathematicians Casey Mann, Jennifer McLoud-Mann and David Von Derau of the University of Washington in Bothell discovered a 15th. They developed a clever computer algorithm to sort through all the possible configurations to find one that fit. The new pattern is certain to inspire fresh mathematical art, but additionally, tiling problems like this connect richly to other areas of mathematics. Not only does the new pentagon give bathroom floor decorators new possibilities, scientists could create a new material with novel properties that use this pattern at a molecular level.

Ms. Mansi Agarwal
B.Sc. (Hons) Mathematics II Year

PROBLEM! PROBLEM!! & PROBLEMS!

"A problem is set of information (implicit or explicit or both) with one or more questions"...

I get an opportunity to share my views with young and energetic mathematicians, seeking their career in mathematics. I feel pride when realize that very few teachers & professors of Mathematics get a chance to talk to such a large number of students of various universities. Though it happens through pen but I'm lucky enough. Thanks to my readers!!

This brings us to the point that while learning something, the understanding of the word PROBLEM should be in priority, because while learning, delivering something or examining ourselves, we come across this word invariably. So let's start thinking about the word "PROBLEM"- Before I define the word PROBLEM, Let me clear that this word is not stick to one subject- Mathematics. We are concerned with the word PROBLEM in totality-wherever it may appear, let it be. e.g. financial matters, family matters, national or international affairs or it can even be love affair' or anything you may think of. Here I try to define of the word PROBLEM.

"A problem is set of information (implicit or explicit or both) with one or more questions" Seems interesting!!

It is seen that amateur mathematicians - in fact, Lawyers, Philosophers, and priests by profession but mathematicians by chance had great contribution to the development of mathematics as a subject we study today. Have you ever given a thought that why is it so? How they are able to think on the typical mathematical pattern?

It seems that they are conditioned to think upon the PROBLEM in totality. They might have understood the word "PROBLEM" perfectly and therefore while attacking the problem; they attacked every part of the 'PROBLEM'. For them, the word 'PROBLEM' is first to find answer or at least something from it. It is only after that the subject of the problem is concerned. And therefore, their innovative approach in the quest of solutions had given them a vision which often came out as a 'theorem' though they themselves might not have been able to prove it at that time or the proof given by them is incorrect today. But their theorem is beyond doubt remarkable. Fermat's last theorem is a remarkable example..

Now, if we adopt this definition of the word 'PROBLEM' it is not difficult to define the word SOLUTION; here it comes as a natural consequence:

"The 'SOLUTION' is to find the 'right sequence' of the information given in the PROBLEM, which leads us to the answer of the questions raised in the problem".

Prof. Rajendra Dubey
Dips Academy

Faculty Research/ Conferences/Seminars/Workshop attended by Faculty and Students

In the words of Laplace, the celebrated French scholar who made significant contributions to Mathematics –*"It is India that gave us the ingenious method of expressing all numbers by means of ten symbols, each symbol receiving a value of position as well as an absolute value; a profound and important idea which appears so simple to us now that we ignore its true merit. But its very simplicity and the great ease which it has lent to computations put our arithmetic in the first rank of useful inventions; and we shall appreciate the grandeur of the achievement the more when we remember that it escaped the genius of Archimedes and Apollonius, two of the greatest men produced by antiquity".*

We are provided an excellent platform to develop research skills within students in college by our respected Principal Madam, Prof. Anula Maurya.

We are divided in four teams with each team having a staff advisor and one or more principal investigator with students. Details of various projects are as following:

Project 1: Title: : *"History of Indian Mathematics: A Research from Vedic to Modern"*

- *Ms. Neelam Bareja (Staff advisor and Principal Investigator)*
- *Dr. Prempal Singh (Principal Investigator)*
- *Students Investigators: Total 12*

Project 2: Title:: Applications of Group Theory

- Ms. Anju Rattan *(Staff advisor)*
- *Dr. Abhishek Kumar Singh (Principal Investigator)*
- *Mr. Sanjay Kumar (Principal Investigator)*
- *Students Investigators: Total 4*

Project 3: Title: Portfolio Optimization with Emphasis on Investments made by Emphasis on Investments made by Housewives in Delhi in popular portfolios.

- Ms. Charu Khanna *(Staff advisor)*
- *Ms. Sunita Sharma (Principal Investigator)*
- *Students Investigators: Total 4*

Project 4: Title: : A Study on Functions of Numerical Analysis and Quantitative Analysis

- Ms. Anshu Chotani *(Staff advisor)*
- *Dr. Indarpal Singh (Principal Investigator)*
- *Dr. Md. Nadeem (Principal Investigator)*

Students Investigators: Total 4

From the time of introduction of such research projects the awareness towards skill developments and social responsibilities within students has grown up to notable heights. Our students doing well not only in academics also they are much more aware about their future.

It has been another banner year for the Department of Mathematics. Our students, faculty and staff continue to excel in teaching, research and service.

Dr. Mohd. Nadeem awarded his Ph. D. degree in September, 2017 from IIT Roorkee one of the famously known universities for applied Mathematics. Two of our faculty members, registered themselves in research to pursue doctorate. Ms. Sunita Sharma has been registered in Amity University to pursue her doctorate in Applied Mathematics. Mr. Dilip Kumar, another faculty member has been registered in University of Delhi to expand his academics in one of the celebrated branch complex analysis of pure mathematics to pursue his research.

Our faculty members attended several workshops, national and International seminars and conferences. Dr. Prempal Singh, Ms. Sunita Sharma and Dr. Abhishek Kumar Singh presented their research papers also.

Mathematics Society: Academic Year 217- 18

Mathematics Society of Department worked exceptionally well in past few years. We organized each and every activity held in the department in past few years with a great motivation and team spirit. The office bearers of Mathematics society and class representatives of all three years with batches, for the session 2017-18 are as following:

Name of the Office Bearer	Course and Semester	Name of Post
Smriti Raman	B.Sc.(H) Maths, VI Sem	President
Anjali	B.Sc.(H) Maths, VI Sem	Secretary
Nidhi Sharma	B.Sc.(H) Maths, VI Sem	Deputy President
Mansi Agarwal	B.Sc.(H) Maths, IV Sem	Vice-President
Shweta	B.Sc.(H) Maths, IV Sem	Treasurer

Name of the Class Representative	Course and Semester
Aarti	B.Sc.(H) Maths, VI Sem
Vaishali Sharma	B.Sc.(H) Maths, IV Sem
Lakshika	B.Sc.(H) Maths, II Sem

Mathematics Society organized academic social and cultural programs with great zeal every year. Following activities held in the Department during odd semester 2017:

Departmental Orientation Programme- 2017

Session for academic year 2017- 18 begin with the departmental Orientation programme for the first year students. Newly admitted students along with their parents attended the programme. The students introduced themselves. *Ms. Anju Rattan* gave a brief introduction of the faculty members along with an overview of the curriculum.

Opening Ceremony- 2017

Opening ceremony of the Department was held on August 18, 2017, in Sangam Parisar. The presence of Principal ma'am, Dr. Anula Maurya added zeal to the programme. She welcomed the first years with her inspirational words. The department had come up the third issue of the mathematics newsletter "Palette-O-Math", which was then released in the presence of Principal ma'am, teachers of the department and student editorial team. This was followed by a quiz competition in which six teams of three participants each competed against each other.

Workshop on Vedic Mathematics

Unveiling ancient knowledge is always a mystic experience. Vedic mathematics is a gift given to this world by the ancient sages of India. The Department organized a workshop on Vedic Mathematics during October 30-November 1, 2017. Dr. Anuradha Gupta, Associate Professor, Department of Mathematics, Delhi College of Arts and Commerce, University of Delhi as resource person effectively explain importance of Vedic Mathematics. The workshop aimed to assist students to learn techniques/Sutras to solve mathematical problems in easy and faster way. The workshop was spread over three days. Apart from the faculty members of the Mathematics Department of Kalindi College, Dr.Manju Lata, Mr. Vishvajeet Vidyalankar from Sanskrit department, Dr. Rashmi Chaudhary from Economics department also participated in the workshop. Faculty members Ms. Anita Bakshi, Ms. Anju Nagpal and Ms. Seema Taneja of the Mathematics Department of Vivekananda College, University Of Delhi participated in the workshop. Sixty seven students including students of Mathematics Department and B.A.(Prog) from Kalindi College while twenty eight students of Mathematics Department and B.A.(Prog) from Dr.Bhim Rao Ambedkar College, Delhi college of Arts and Commerce, Lakshmibai College, Vivekananda college, Zakir Husain Delhi College(Evening) also participated in the workshop.