Palette-o-Math

KALINDI COLLEGE UNIVERSITY OF DELHI
(ACCREDITED WITH GRADE 'A' BY NAAC)

Message from
The Principal

John Von Neumann said "If people do not believe that mathematics is simple, it is only because they do not realize how complicated life is". Recently *Pi Day* was celebrated on March 14th around the world. Pi is all over the natural world, for instance, measuring patterns in the DNA double helix spiral or ripples travelling in water, Pi helps to describe wave patterns or the meandering patterns of rivers. This is just an example of the numerous marvels of nature; I strongly believe young students should explore and learn from the simple phenomenon that mother nature has to offer. As Srinivasa Ramanujan once said "An equation for me has no meaning, unless it

Dr. Anula Maurya

expresses a thought of God." Lastly, I would like to heartily congratulate all the members of the Mathematics department for yet another successful edition of the department newsletter, credit for which goes to the incessant efforts of the faculty, students and all the contributors to it. I am really looking forward to the next edition.

Message from
The Teacher In- charge

It feels like yesterday that we were planning release a department newsletter; and here we are with the 5th edition of Pallett-o-Math. The seed we planted in 2016 is now growing with full glory and continuously achieving new heights. I would really like to thank all the members of the department for their untiring hard work and support, and last but not the least, our Principal Ma'am for her continued guidance, under whose aegis we all started this magnificent periodic.

Ms. Anju Rattan

Message from
The Editors

Dr. Prempal Singh

We 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. We hope you will enjoy reading various articles highlighted in this newsletter.

Mr. Sanjay Kumar

From the Alumni

Ms. Smriti Raman

Graduation is an exciting time. It's both an ending and a beginning. Its warm memories are past remains big dreams for the future. Life become even more special if we are having Mathematics as our graduation subject and we guys have the best teacher as our subject itself because they even teaches us the way to live one's life. They teaches us that there always exists a solution to any problem and we are the best equipped ones to solve any problem, to cross any hurdle coming to us in the coming future. We are also the strongest ones as we choose the most difficult one. It teaches us that no matter what path you choose , how long or short it is , what matters the most is the result , if it is right then you will get full marks just like life. With these words I want to say that never regret to have Mathematics as your subject because it's not only getting you a degree but also making you stronger to face any problems coming your way.. !!!

Ms. Anjali Yadav

I had a great experience as a student of B.Sc. Mathematics in Kalindi College, Delhi University. Now I am pursuing M.Sc. Mathematics in Hansraj College, Delhi University. The Mathematics Department of Kalindi College especially faculty plays a very important role in my career as a student. I had learnt a lot from my teachers. As a teacher they give us their best, not only this apart from teaching they gives us various information regarding our careers. They also helped me in my personal growth. As a cultural Secretary of Mathematics Department, I have learnt a lot. I became more confident which will also help me ahead in my life. In fest of Mathematics Department "Math-e-Magic", the workshop, They become a part of extra information apart my course. The education and experience as a student of Mathematics in Kalindi College help me to find my pathway for my career. "The pure Mathematician, like the magician, is a free creator of his world of ordered beauty."

Ms. Tamanna

Respected Principal, teachers and my dear friends, thank you for giving us this golden opportunity to meet and greet our classmates and our seniors. It gives me immense pleasure to address you all on this auspicious occasion. The function was a reunion between us and our alma mater that helped to shape our future. When, after so long, I came into the college, I thought I would feel different, alien. But it just felt live everyday as if after a long travel away. I have come back to my home. That's how it was for me, just as I am sure for you too. Time has been flying by for all of us. We have been living life fast pace. This institution has given me so much that when it comes to expressing my feelings. I get short of words. I have had the opportunity to be with some of the prodigies and to get in touch with the brilliant faculty. In all this, I wish to confess that my deepest fear was that would I be able to fit in and to my surprise I was able to because this college believes in taking everybody along. The power of unity is un-expressible. We may not realize it, but we are quite prepared for our future, the values we given at home and college comes to full play after we step out of our nutshell into the bigger world. Thank You!

From the Student Editors

Ms. Mansi Agarwal
B. Sc. (Hons) Maths III Year

Ms. Rupanshi Sharma
B. Sc. (Hons) Maths III Year

Ms. Lakashika
B. Sc. (Hons) Maths II Year

Ms. Pratiksha Dhaka
**B. Sc. (Hons) Maths II Year**

At the College of Delhi University, we are always on the move. Our teachers gave us an opportunity to work as editors of newsletter of mathematics department of Kalindi College. This work was quite interesting thus we were eager to be a part of it. Our whole department lends great helping hand and it helped us to hone writing skills. It was great experience to work as editors of newsletter along with our teachers. Newsletter editors have great responsibility, and we all were tensed enough to do so but with the help of our teachers we did everything quite perfectly.

This was remarkable experience for me through this I came to realize the work of an editor's life. We are highly privileged to work for the editorial board of the newsletter. Our efforts to rejuvenate the knowledge in the field of mathematics have so far been successful. We express our sincere gratitude for all the help provided by our teachers, students, department of mathematics of Kalindi college and also a very big thanks to give us such a great opportunity to showcase our talent in culture activities and academics also. The newsletter has become more effective with the articles it contains. We highly admire all the writers of the newsletter.

Differential Equations and Mathematica Modeling

A World Health Organization report released on October 12, 2018 found that Delhi has the worst air quality in the world. India's capital was found to have a heavy presence of PM_{10} particular matter - 292 micrograms per cubic meter. The annual safe limit set by the WHO is 60. Air pollution in urban and rural India is a growing public concern, and our capital Delhi is one of the most studied cities in the world. Continuous development and increase of population in the urban areas, invites a series of problems related to environment such as

- ✓ Deforestation
- ✓ Release of Toxic Materials
- ✓ Solid Waste Disposals
- ✓ Air pollution and many more….
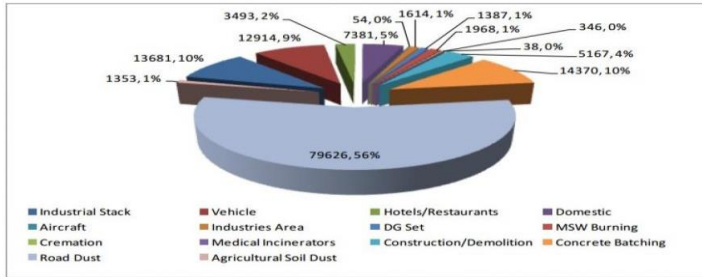
PM$_{10}$ Emission Load of Different Sources in the City of Delhi

We took the liberty of converting the PM10 shares into PM2.5- assuming 15% dust in PM10 surviving in the pm2.5 fraction and 100% of all the other combustion sources surviving in the PM2.5 fraction. The pie graph below is an average of all samples reported in the CPCB (2018) study
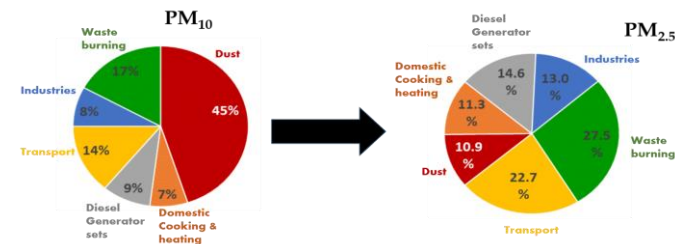
The secondary sulfate aerosols, from the chemical conversion of SO_2 emissions, are likely to originate from coal and diesel consumption. Similarly, nitrate aerosols, from the chemical conversation of NO_2 emissions, are likely to originate from coal, diesel, and petrol combustion. We can club all the constructions, soil and road dust into dust category. Since, the categories are listed along the fuel lines, we can interpret that all the diesel and petrol is linked to the vehicle exhaust and diesel generator sets; biomass burning can be linked to the crop residue burning (especially for the winter months) and biomass used for cooking and heating; coal could be consumed at industries, cooking, and heating.

Daily Air quality index (AQI) is a comprehensive assessment of air quality concentration of criteria pollutants namely:

- ➢ Respirable Suspended Particulate Matter (RSPM)
- ➢ Sulphur dioxide (SO_2)
- ➢ Nitrogen dioxide (NO_2) and
- ➢ Suspended Particulate Matter (SPM)

In Delhi Central Pollution Control Board (CPCB) monitor AQI continuously. A method of US Environmental Protection Agency (USEPA) has been used for estimating the AQI, in which the sub-index and breakpoint pollutant concentrations depend on Indian National Ambient Air Quality Standard (NAAQS).

There are primarily two steps involved in formulating an AQI:
- ❖ First the formation of sub-indices of each pollutant.
- ❖ Second the aggregation (breakpoints) of sub-indices.

The Breakpoint concentration of each pollutant, used in calculation of AQI, is a result of epidemiological studies indicating the risk of adverse health effects of specific pollutants. It has been noticed that different breakpoint concentrations and different air quality standards has been reported in literature (Environmental Protection Agency, 1999). The formula, to calculate AQI for four criteria pollutants RSPM, SO_2, NO_2 and SPM is:

$$I_p = \left[\frac{(I_{Hi} - I_{Lo})}{(BP_{Hi} - BP_{Lo})} \right] (C_P - BP_{Lo}) + I_{Lo}$$

Where I_p = the AQI for pollutant 'p'
C_p = Actual ambient concentration of the pollutant 'p'
BP_{Hi} = The breakpoint that is greater than or equal to C_p
BP_{Lo} = The breakpoint that is less than or equal to C_p
I_{Hi} = The sub index value corresponding to BP_{Hi}
I_{Lo} = The sub index value corresponding to BP_{Lo}

S. No.	Index Values	Descriptor	SO$_2$	NO$_2$	RSPM	SPM
1	0-100	Good[a]	0-80	0-80	0-100	0-200
2	101-200	Moderate[b]	81-367	81-180	101-150	201- 260
3	201-300	Poor[c]	368-786	181-564	151-350	261- 400
4	301-400	Very Poor[d]	787-1572	565-1272	351-420	401- 800
5	401-500	Severe[e]	> 1572	> 1272	> 420	> 800

All the values of SO$_2$ NO$_2$, RSPM AND SPM are in $\mu g/m^3$

- a) Good: Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people.
- b) Moderate: Members of sensitive groups may experience health effects.
- c) Poor: Members of sensitive groups may experience more serious health effects.
- d) Very Poor: Triggers health alter, everyone may experience more serious health effects.
- e) Severe: Triggers health warnings of emergency conditions.

Deterministic air quality model is developed by relating the rate of change of pollutant concentration in terms of average wind and turbulent diffusion which, in turn, is derived from the mass conservation principle.

$$\frac{\partial C}{\partial t} = -\left(u \frac{\partial C}{\partial x} + v \frac{\partial C}{\partial y} + w \frac{\partial C}{\partial z} \right) + \frac{\partial}{\partial x} K_H \frac{\partial C}{\partial x} + \frac{\partial}{\partial y} K_H \frac{\partial C}{\partial y} + \frac{\partial}{\partial z} K_z \frac{\partial C}{\partial z} + Q + R.$$

The above diffusion equation can be derived in several ways under different set of assumptions for development of air quality models.

The Power of Pi:

Pi is all over the natural world, measuring patterns in the DNA double helix spiral or how ripples travel outward in water. It helps describe wave patterns or the meandering patterns of rivers. Pi even enters into Heisenberg's Uncertainty Principle; the equation that defines how precisely we can know the state of the universe.

Pi and pizzas are linked: the volume of a pizza that has a nominal radius of (z) and height (a) will, of course, be: pi × z × z × a

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Dr. Prempal Singh
Department of Mathematics

Wavelets and Shearlets

Wavelets are crafted to have specific properties that make them useful for signal processing. Wavelets can be used to extract information from many different kinds of data including audio signals and images. Wavelets as isotropic objects are not capable of capturing phenomena governed by anisotropic features. Shearlets are extension of wavelets, to accommodate the fact that multivariate functions are ruled by non-isotropic features such as edges in images or shock front in solutions of transport dominated equations etc.

Shearlets is more useful with compare to wavelets and playing a great role in new developments in Mathematical and Social world.

Shearlets are multi-scale framework which allows to encode anisotropic features in multivariate problems. Anisotropy is the property of being directionally dependent, which implies different property in different directions, opposed to isotropy. Isotropy is uniformity in all orientations; anisotropy is used to describe situations where properties vary systematically, dependent on direction.

Anisotropy can be defined as differences, when measured along different axes, in material's physical and mechanical properties (absorbance, refractive index, conductivity, tensile strengths etc).

Image of gravity-bound or man-bound environment are particularly anisotropic in orientation domain.

Shearlets are introduced for the analysis as well as sparse approximation of functions, $f \in L^2(\mathbb{R}^2)$.

Sparse approximation is sparse vector that approximately solve the system of equations. Sparse matrix is a matrix in which most of the elements are zero. Shearlets are extension of wavelets to accommodate the fact of that multivariate functions are typically governed by anisotropic features such as edges in images or shock fronts in solutions of transport dominated equations etc. However, wavelets as isotropic objects are not capable of capturing such phenomena.

Shearlets are most widely used today due to their optimal sparse approximation properties in combination with their unified treatment of the continuum and digital realm, also its faithful implementations. The Capabilities is enhanced by Shearlets in developing efficient multivariate encoding methodologies in the research community.

Applications of Shearlets:

Shearlets provide optimally sparse approximations of anisotropic features. The most imaging data, natural images which are governed by such features (edge like structures etc.) allowed by the Shearlets methodological approach. Shearlets are useful for,

- ➢ **Separation of images**
- ➢ **In painting images or videos**
- ➢ **Reconstruction of images**
- ➢ **Segmentation of images**

In painting is a process to interpolation, approximation and extrapolation for deteriorated parts of images and videos. It is very active field of research and tackled by various approaches. Segmentation is a fundamental work in image processing. It plays a role in many pre-processing steps. For image multi-labelling and for texture segmentation containing coherent curves, Shearlets regularization gives superior results and more….

Dr. Abhishek Kumar Singh
Department of Mathematics

Navier-Stokes Equations

What are the Navier-Stokes Equations?

Waves follow our boat as we meander across the lake, and turbulent air currents follow our flight in a modern jet. Mathematicians and physicists believe that an explanation for and the prediction of both the breeze and the turbulence can be found through an understanding of solutions to the Navier-Stokes equations. These equations describe how the velocity, pressure, temperature and density of a moving fluid are related and they govern the motion of fluids. The equations were derived independently by G.G. Stokes, in England, and M. Navier, in France, in the early 1800's.

Here, I am not going to scare you people with the complex equations, rather triger your mind to enquire more about these equations by giving some facts about them....!!!

How Do They Apply to Simulation and Modeling?

These equations are at the heart of fluid flow modeling. Solving them, for a particular set of boundary conditions (such as inlets, outlets, and walls), predicts the fluid velocity and its pressure in a given geometry. Because of their complexity, these equations only admit a limited number of analytical solutions. It is relatively easy, for instance, to solve these equations for a flow between two parallel plates or for the flow in a circular pipe. This is also a Millennium Prize Problem, meaning that the Clay Mathematics Institute offers one million dollars to whoever solves it completely in the form they present it. The challenge is to make substantial progress toward a mathematical theory which will unlock the secrets hidden in the Navier-Stokes equations.

Mr. Sanjay Kumar
Department of Mathematics

The magic of secret codes: Katapayadi Sankhya

Katapayadi is an ancient Indian system by which alphabets are denoted by numbers. Although it may sound very primitive, the applications of this simple technique had been very interesting.

Using this technique, the string of numbers is converted to alphabets such that they form meaningful sentences. Apart from merely coding such that string of numbers may be memorized as meaningful sentences.

The oldest available evidence of the use of *Kaṭapayādi* System is in *Grahacāraṇibandhana* by Haridatta in 683 CE. It has also been used in *Laghubhāskariyavivarana* written by *Sankaranārāyana* in 869 CE. The language used in the ancient times was *Sanskrit* and the alphabets were in *devanagri* script. The ancient coding system followed little-ending system, which is the opposite of what we use today. In other words, the number at unit's place was written on the left followed by the number at 10's place, ending with the highest order on the right. For example, One Hundred and Thirty Two would be written as '231'.

KATAPAYADI Sankhya- Assignment Table

The alphabets are assigned as per the following table:

कटपयादि संख्या - kaTapayAdi for Melakarta Ragam Names & Numbers									
1	2	3	4	5	6	7	8	9	0
क	ख	ग	घ	ङ	च	छ	ज	झ	ञ
ट	ठ	ड	ढ	ण	त	थ	द	ध	न
प	फ	ब	भ	म					
य	र	ल	व	श	ष	स	ह		
ka	kha	ga	gha	nga	cha	Cha	ja	Jha	nya
Ta	Tha	Da	Dha	Na	ta	tha	da	dha	na
pa	pha	ba	bha	ma					
ya	ra	la	va	sha	Sha	sa	ha		

Stand-alone vowels denote '0': Observations vis-à-vis the Table:

- All consonants without a vowel are ignored;
- Vowels do not change the number allotted. For example, Ka, Ke and Ki all have the value '1';
- More than one alphabet has been allotted to a number;
- '1' has been allotted the maximum alphabets (consonants) and '0' the least;
- Decimal could not be represented by this system;

Since any combination of any vowel with a consonant is allotted the same number, this system imparts great flexibility of combining different alphabets to form meaningful sentences and paragraphs. Similarly, allocation of more than one alphabet to a number also gives such flexibility.

KATAPAYADI Sankhya has been used in ancient times to encode the value of 'pi'. The value of 'pi', up to 17 digits after decimal is: **3.14159265358979324.** One ancient example used the following encoding:

bha	drā	m	bu	ddhi	sa	ddha	ja	n	ma	ga	ṇi	ta	śra	ddha	s	ma	ya	bhu	pa	gi
4	2	3	9	7	9	8	5	3	5	6	2	9	5	1	4	1	3			

Since the ancient Indian system used the little-ending way of writing, the alphabets have been allotted to the reverse string of the value of 'pi'. This gave rise to the following *sloka* :

भद्राम्बुद्धिसिद्धजन्मगणितश्रद्धा स्म यद् भूपगी:

(*bhadrāṃbuddhisiddhajanmagaṇitaśraddhā sma yad bhūpagīḥ*)

Another code for the value of 'pi' as used in ancient India is:

> "*gopi bhagya madhuvrata*
> *srngiso dadhi sandhiga*
> *khala jivita khatava*
> *gala hala rasandara*"

This is a praise for Lord Krishna and translates into:

"O Lord anointed with the yoghurt of the milkmaids' worship (Krishna), O savior of the fallen, O master of Shiva, please protect me."

This encoding gives the value of 'pi' up to 31 places after decimal i.e. **3.1415926535897932384626433832792.**

Now something for you to guess: Using the above table the following sentence encodes a certain mathematical entity: " रथ यह राजा का है " Can you guess the number!!

Let Make Some Noise:

There's an infinitely long "horn" that has a finite volume but an infinite surface area."Gabriel's Horn" also called Torricelli's trumpet, is formed by taking the curve y = 1/x and rotating it around the horizontal axis, as shown in the picture. Using techniques from calculus that make it possible to calculate areas and volumes of shapes constructed this way, it's possible to see that the infinitely long horn actually has a finite volume equal to π, but an infinite surface area.

This means that the horn could hold a finite volume of paint but would require an infinite amount of paint to cover its entire surface.

Ms. Sunita Sharma
Department of Mathematics

Epidemic model on the Impact of Rumors in Cyber Consumers

In the 21th century, rapid technological advancements take place mainly through information and communication technology (ICT) enabled structures like Internet, World Wide Web (WWW), wireless networks, sensor networks, Internet of things, nanotechnology and so on. These technological advancements changed our world in many directions. A paradigm shift forms traditional consumerism to cyber consumerism in doing business is one of them. The first question answers why a large number of internet users are still not active cyber consumers even after knowing the ease and convenience of e-commerce and thereafter the development of our different modeling frameworks in order to provide better understanding and implementation of e-commerce strategies.

Since the backbone of e-commerce is the online payment mechanism, it must address issues of security in online financial transactions and privacy among the parties involved. In cyber space, there is always a threat of malware attacks. Various types of malware attacks like virus, worm, trojan horse, spyware, ransomware, denial-of-service and phishing attacks are the greatest concerns of cyber consumers in doing e-commerce and it may be the main reason behind the huge gap between Internet users and cyber consumers.. Through a large numbers of mathematical models on different malware attacks were developed for understanding and planning proper security strategies in e-commerce, not even a single model on rumor propagation in cyber consumerism exist.

Dr. Inderpal Singh
Department of Mathematics

Energy-Efficient Elevator Operating

In modern smart buildings, the energy consumption of a building is monitored every time. Smart buildings are also equipped with sensors that can collect various physical data such as temperature, motion, and light. In this paper, we use smart sensor technologies in the design of an efficient elevator operating system (EOS). Specifically, multiple sensor devices are used together to detect elevator passengers' behavior before they arrive at the elevator door and press the elevator call button. The detected information is then delivered to EOS through building networks and the scheduling system utilizes this information for the efficient control of the elevator cars. Specifically, when the number of passengers becomes large, EOS increases the number of working elevator cars to reduce the waiting time of passengers. In contrast, when the elevator traffic lessens, EOS reduces the number of working elevator cars in order to save the energy consumption. Experimental results with a wide range of configurations show that our EOS outperforms the conventional elevator scheduling system that does not consider sensor information or electricity price changes.

Specifically, we use multiple sensor devices to detect passengers' information before they actually push the elevator call button. In particular, three types of sensor devices, RFID, video, and floor sensors are used to estimate passenger information precisely. Our simulation results showed that the proposed elevator operating system significantly reduces the average waiting time, the maximum waiting time, and the energy consumption.

Mr. Avneesh Kumar
Department of Mathematics

Mathematics is everywhere

Financial services, security, defense, health, manufacturing, transport, film-making, and many other sectors all make use of many fields within the mathematical sciences. Developments in genomics, data science, economics, physics, quantum computing, biology, advanced engineering, epidemiology, zoology, sociology, geography, ecology, climate science, cybersecurity, social media analytics and numerous other fields all require the use not only of existing mathematical methods, but also the development of new, more powerful mathematical tools to continually spur advances and innovation." The report includes a quote from Professor Dame Julia Slingo, formerly Chief Scientist, the Met Office:

"Over the decades the Met Office has been at the forefront of international developments in weather and climate prediction. This is in part because it has a world-class research department that draws heavily on mathematical skills and employs high quality mathematicians"

Anjali B. Sc. (Hons) III Year

A woman just won the prize known as "Math's Nobel" for the first time ever Women took another step forward in the still male-dominated world of science, as American Karen Uhlenbeck won the Abel Prize in mathematics for her work on partial differential equations.

"Karen Uhlenbeck receives the Abel Prize 2019 for her fundamental work in geometric analysis and gauge theory, which has dramatically changed the mathematical landscape,"

She is the first woman to win the prize, which comes with a cheque for six million kroner (620,000 euros, $703,000). She is also an advocate for gender equality in science and mathematics. Uhlenbeck, 76, is a visiting senior research scholar at Princeton University, as well as visiting associate at the Institute for Advanced Study (IAS), both in the US.

Named after the 19th century Norwegian mathematician Niels Henrik Abel, the prize was established by the Oslo government in 2002 and first awarded a year later, to honor outstanding scientific work in the field of mathematics, a discipline not included among the Nobel awards. Along with the Fields Medal, which is awarded every four years at the Congress of the International Mathematical Union (IMU), it is one of the world's most prestigious math's prizes. "I am aware of the fact that I am a role model for young women in mathematics"

Karen Uhlenbeck

Shiwani Yadav B. Sc. (Hons) III Year

Mathematicians reveal secret to human sperm's swimming prowess

Virtual human sperm in cervical mucus analogue (3D view): the tail is stabilized by the reinforced coating (blue). Credit: Dr. Hermes Gadelha, University of York. Researchers have discovered what gives human sperm the strength to succeed in the race to fertilize the egg. The researchers, from the universities of York and Oxford, discovered that a reinforcing outer-layer which coats the tails of human sperm is what gives them the strength to make the powerful rhythmic strokes needed to break through the cervical mucus barrier. Only around 15 out of the 55 million sperm that embark on the treacherous journey to fertilize the egg are able to make it through the reproductive tract where cervical mucus, which is one hundred times thicker than water, forms part of one of nature's toughest selective challenges.

The findings could lead to better sperm-selection methods in IVF clinics, with the fittest sperm being identified under conditions that mimic nature more closely.3.5 million people in the UK are affected by fertility issues and couples who opt for IVF spend an average of £20,000Dr. Hermes Gadêlha, from the Department of Mathematics at the University of York, said: "We still don't fully understand how, but a sperm's ability to swim could be associated with genetic integrity. Cervical mucus forms part of the process in the female body of ensuring only the best swimmers make it to the egg.

"During the sperm selection process, IVF clinics don't currently use a highly viscous liquid to test for the best sperm as until now it was not entirely clear whether this is important. Our study suggests that more clinical tests and research are needed to explore the impact of this element of the natural environment when selecting sperm for IVF treatments. "Sperm tails—or flagella—are incredibly complex and measure just the breadth of a hair in length. Virtual human sperm in cervical mucus analogue (top view): the tail is stabilized by the reinforced coating (blue). Credit: Hermes Gadelha, University of York. The researchers used virtual sperm model to compare the tails of sperm from humans and other mammals, which fertilize inside the body; with sperm from sea urchins, which fertilize outside the body by releasing their sperm into sea water. While the tails of sea urchin and human sperm share the same bendy inner core, the study suggests that the tails of sperm in mammals may have evolved a reinforcing outer layer to give them the exact amount of extra strength and stability required to overcome the thick fluid barrier they come up against in internal fertilization.

Kirti Agarwal B. Sc. (Hons) I Year

Mathematician claims to have solved 160-year-old Riemann hypothesis

One of the world's most renowned mathematicians showed how he solved the 160-year-old Riemann hypothesis at a lecture earlier this week — and he will be awarded $1m (£760,000) if his solution is confirmed. Sir Michael Atiyah, who has already won the two biggest prizes in mathematics - the Fields Medal and Abel Prize - took the stage at the Heidelberg Laureate Forum in Germany to present his work. To solve the hypothesis you need to find a way to predict the occurrence of every prime number, even though primes have historically been regarded as randomly distributed.

Sir Michael's solution will need to be checked by other mathematicians and then published before it is fully accepted. Only then, will he be able to claim the prize from the Clay Mathematics Institute of Cambridge (CMI). The Riemann hypothesis is one of seven unsolved "Millennium prizes" from CMI, each worth $1m

What is the Riemann hypothesis, and how did Atiyah solve it?

First posited by Bernhard Riemann in 1859, it attempts to answer an old question about prime numbers (numbers that divide only by themselves and 1). The hypothesis states that the distribution of primes is not random, but might follow a pattern described by an equation called the Riemann zeta function. So far 10,000,000,000,000 prime numbers have been checked and are consistent with the equation, but there is no proof that all primes follow the pattern.

Muskan Gupta B. Sc. (Hons) I Year

Riemann Sphere

In mathematics, the Riemann sphere, named after Bernhard Riemann, is a model of the extended complex plane, the plane plus a point at infinity. This extended plane represents the extended complex numbers, that is, the complex numbers plus a value ∞ for infinity. With the Riemann model, the point "∞" is near to very large numbers, just as the point "0" is near to very small numbers.
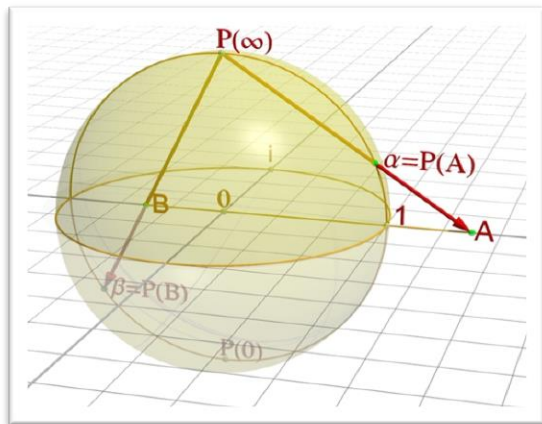
When studying complex functions for bigger values of $|z|$, the argand plane gets bothersome. This is why a Riemann Sphere is more apt, as for every point in the complex plane, there lies a unique image of that point on this sphere of diameter 1 unit. It can be visualized as a sphere of diameter 1 touching the z plane at $z = 0$. The point on the Riemann sphere that lies perpendicular to the plane is called the 'North Pole', and the point diametrically opposite to North Pole is the 'South Pole'. Thus by using this we can make the complex plane as the equatorial plane of the sphere.

Now, how to map a point from the complex plane to the Riemann Sphere?

To map a point P from the complex plane to this sphere (say P'), draw a line between z and the North Pole, and extend it in both the directions. The point on sphere where the line intersects the sphere is the corresponding image of z on Riemann Sphere.

Further,

1. If the P lies on the equator of the sphere, then P' lies at the same point.
2. If P lies inside the Sphere, then P' lies in the Southern hemisphere of the sphere
3. If P lies outside the Sphere, then P' lies in the Northern hemisphere of the sphere.

Note that it does not compromise with the concept of infinity in any way, as on the Riemann sphere too, infinity is only achievable if the line is tangent to the sphere at the North pole, meaning, it is parallel to complex plane(intuitively, coming from infinity).

Rupanshi Sharma B. Sc. (Hons) III Year

The word googol was made up by a 9-year old boy

In the 1930's an American Mathematician named Edward Kasner asked his nine-year old nephew Milton Sirotta to make up a word for him to use. Milton made up the world 'googol' which Edward Kasner later used to describe the number. The search engine Google was later named after the 'googol' meaning that Milton Sirotta had unwittingly helped name one of the world's most famous companies.

Ritu B. Sc. (Hons) III Year

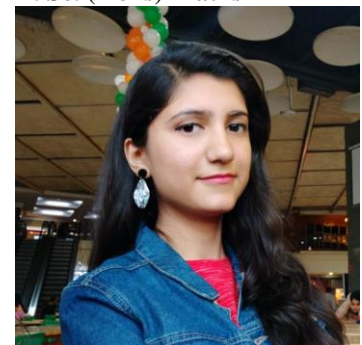### *Activity by Mathematics Society*

Society Convener: Ms. Charu Khanna

Office Bearers:

President
Mansi Agarwal
B. Sc. (Hons) Maths III Yr

Vice President
Lakashika Singh
B. Sc. (Hons) Maths II Yr

Secrateory
Mansi
B. Sc. (Hons) Maths II Yr

Treasurer
Manvi Surya
B. Sc. (Hons) Maths II Yr

Orientation Programme

The Departmental Orientation Programme for the first year students was held on July 19, 2018. Interaction with the departmental alumnae gave the first year students a better insight into the Mathematics Department, various activities in college and various avenues available after completion of the course.

Math-e- Magic 2018-19

Mathematics Society with the whole-hearted support of the principal, Dr. Anula Maurya, organized the inter college Mathematics festival, Math-e- Magic 2018-19 on October 12, 2018. The Department was honored to have the presence of **Mr. Bharatendu Nandan**, Scientist "E", Scientific Analysis Group, DRDO, who enlightened the students on the theory of Cryptography. The Department was also blessed to have the presence of **Dr. Sudha Jain,** Associate Professor (Retd.), Department of Mathematics, Kalindi College. **Ms. Anju Gupta** Director NCWEB university of Delhi as guest of honour attended the fest.

Departmental Lectures: 2018- 19

The lecture by Mr. Rajendra Dubey, Director of DIPS Academy was held on January 23, 2019. The lecture was attended by all the faculty members and students of mathematics department. The motivational speech by Mr. Dubey gave an insight into how mathematics is related to us and our daily lives..

The lecture by Mr. Manish Malik, Director of Alpha Plus was held on January 30, 2019. Mr. Malik, in his lecture enlightened students about the practical aspects of mathematics. He gave an insight into the field of Actuarial science and told students about the various career options available after pursing a course on Actuarial Science.

Lecture by Eminent Speakers

Math- e- magic- 19

Educational trip to Jaipur

The Department of Mathematics organized an educational trip to Jaipur on March 30-31, 2019. In all thirty eight persons went for the trip which included twenty six students and twelve faculty members of the Department. The main purpose of the trip was to enhance the knowledge of students and help them understand the theoretical concepts they have learnt so far, in a practical way.