A

National Webinar on

"NUMBER SEQUENCES & MUSINGS ON MOBIUS MAPS"

Organiged by

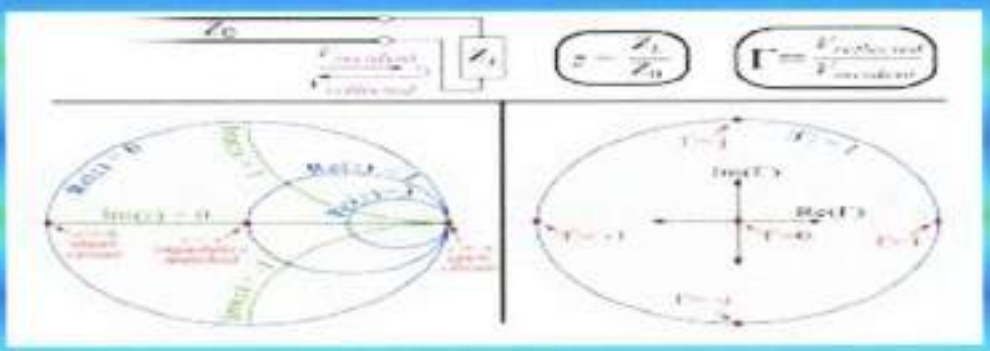
Department of Mathematics,

Pattamundai College, Pattamundai

on

10th November 2020.

Session 2020-21



REPORT

A National webinar was organised by Department of Mathematics, Pattamundai College, Pattamundai at 10.30 am on 10th November 2020 on the topic **"NUMBER SEQUENCES & MUSINGS ON MOBIUS MAPS"**.

Prof (Dr) Prasanta Kumar Ray, Professor, School of Mathematical Sciences, Sambalpur University, Burla and **Dr Tarakanta Nayak**, Associate Professor, School of Basic Sciences, Indian Institute of Technology, Bhubaneswar who graced the webinar with their analytical thinking. We were able to get the beautiful glimpses of the students of our Department in this webinar. Sri Arabinda Pandab, Head of the Department gave a key note address of the topic and introduced resource persons. Principal Prof Adhikari Laxminarayan Dash welcomed the guest and participants of different colleges of our state & other states through web.

Technical Session –I

At 11.00 am Technical session –I started. **Dr Tarakanta Nayak**, Associate Professor, School of Basic Sciences, Indian Institute of Technology was the resource person for this session. His topic was "Musings on Mobius Maps". He said Mobius Transformation was invented by August Ferdinand Mobius, a German Mathematician & Astronomer. His discussion involved translation ,Scaled rotation, Inversions, Geometry of Inversions, Mobius maps, Fixed points & implications, cross ratio, Orientation: Respective Symmetry, Isometries & Automorphism, Automorphism of Sphere, Automorphism of Plane, Automorphism of Unit disk, Through matrices, The Reimann Sphere . Questioner session began at 12.15 pm. Most of our

students took part in this questioner session. They had clarified their doubts up to maximum level.

Technical Session –II

At 12.30 pm Technical session –II started. **Prof(Dr) Prasanta Kumar Ray**, Professor, School of Mathematical Sciences , Sambalpur University, Burla was the resource person in this session. His topic of discussion was "Numbers & Number Sequences: Everyday; Everywhere". His discussion involved Figurate Numbers, interesting facts about Triangular and Square numbers, Happy & Sad numbers, Palindrome numbers, Kaprekar Numbers, Mysterious Number 22, Fibonacci Numbers & Golden Ratio, Famous Rabbit Problem, Fibonacci food, Fibonacci numbers & Music. He also explained the usefulness of the webinar for the society. Questioner session began at 1.30 pm. Most of our students took part in this questioner session. They had clarified their doubts up to maximum level.

Finally, at 2.00pm the webinar was ended with a vote of thanks by Dr Nirmal Kumar Sahoo, Lecturer in Mathematics of this college.

Arabinda Pandab
HOD& Convenor

OFFICE OF THE PRINCIPAL

PH. : 06729-224216 (O)
Fax : 06729-224215

PATTAMUNDAI COLLEGE

NAAC ACCREDITED B+ GRADE

PATTAMUNDAI, KENDRAPARA, ODISHA - 754215

Ref No. : 1027 Date 02/11/20

To

Prof (Dr) Prasanta Kumar Ray,
Professor of Mathematics,
School of Mathematical Sciences,
Sambalpur University,
Burla

Sub: - An invitation as Resource Person in the National Webinar organiged by Department of Mathematics on 10th November 2020.

Sir,

It is my pleasure to invite you as **Resource Person** in the National Webinar on the topic **"Number Sequences & Musings on Mobius Maps"** to be organiged by Department of Mathematics, at 10.30 am on 10th November 2020 in our institution.

Your kind consent in this regard is highly solicited.

Yours Faithfully,

2/11/20

Principal
Pattamundai College

Principal
Pattamundai College

URI : http://www.pattamundaicollege.org.in, E-mail . info@pattamundaicollege.org.in
pattamundaicollege@yahoo com, pattamundaicollege@gmail.com

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PATTAMUNDAI COLLEGE

NAAC ACCREDITED B+ GRADE

PATTAMUNDAI, KENDRAPARA, ODISHA - 754215

Ref No. :.....1028..... Date.....02.11.20.....

To

Dr Tarakanta Nayak,
Associate Professor of Mathematics,
School of Basic Sciences,
Indian Institute of Technology,
Bhubaneswar

Sub: - An invitation as Resource Person in the National Webinar organiged by Department of Mathematics on 10th November 2020.

Sir,

It is my pleasure to invite you as **Resource Person** in the National Webinar on the topic **"Number Sequences & Musings on Mobius Maps"** to be organiged by Department of Mathematics, at 10.30 am on 10th November 2020 in our institution.

Your kind consent in this regard is highly solicited.

Yours Faithfully,

2.11.20

Principal
Pattamundai College

Principal
Pattamundai College

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pattamundaicollege@yahoo.com, pattamundaicollege@gmail.com

Gmail

Principal Pattamundai College <pattamundaicollege@gmail.com>

Invitation as Resource Person in the National webinar on 10.11.2020 in Pattamundai College

2 messages

Principal Pattamundai College <pattamundaicollege@gmail.com> Mon, Nov 2, 2020 at 11:05 AM
To: prasantamath@suniv.ac.in
Cc: rayprasanta2008@gmail.com

Sir
Please find the attachment
Principal
Pattamundai College
pattamundaicollege@gmail.com

Dr P K Ray.pdf
153K

Prasanta Ray <rayprasanta2008@gmail.com> Mon, Nov 2, 2020 at 12:58 PM
To: Principal Pattamundai College <pattamundaicollege@gmail.com>

Thank you for your invitation. I am giving my consent as a Resource person in the said event

With regards
Prasanta Kumar Ray
[Quoted text hidden]

Gmail

Principal Pattamundai College <pattamundaicollege@gmail.com>

Invitation as Resource Person in the National Webinar on 10.11.2020 in Pattamundai College

2 messages

Principal Pattamundai College <pattamundaicollege@gmail.com> Mon, Nov 2, 2020 at 11:10 AM
To: tnayak@iitbbs.ac.in

Sir
Please Find the Attachment.
Principal
Pattamundai College
pattamundaicollege@gmail.com

Dr T Nayak.pdf
155K

Dr. Tarakanta Nayak <tnayak@iitbbs.ac.in> Mon, Nov 2, 2020 at 12:56 PM
To: Principal Pattamundai College <pattamundaicollege@gmail.com>

Dear Principal,
I am happy to accept the invitation.
Thank you for giving me the opportunity to interact with the students.

[Quoted text hidden]
--
With regards,
Tarakanta Nayak
IIT Bhubaneswar

DEPARTMENT OF MATHEMATICS

PATTAMUNDAI COLLEGE , PATTAMUNDAI

(A Non- Govt Aided College Affiliated to Utkal University, Odisha)

Organises

A National Webinar on

Number Sequences & Musings on Mobius Maps

Date: 10.11.2020 , Time:10: 30 A.M

RESOURCE PERSON

Prof (Dr) Prasanta Kumar Ray,

Professor, School of Mathematical Sciences

Sambalpur University,Burla

RESOURCE PERSON

Dr Tarakanta Nayak,

Associate Professor,

School of Basic Sciences

IIT, Bhubaneswar

Dr N K Sahoo

Co- Convenor

Sri A Pandab

HOD & Convenor

Prof A L N Dash

Principal

NO REGISTRATION FEES.

E- Certificate To All Participants

Regd Link https://forms.gle/4voCEcbEymbPA16T8

Office of the Principal
Pattamundai College, Pattamundai

NOTICE

No 1063 Dt 07/11/2020

All the staff members are requested to participate and cooperate in the National Webinar on "**Number Sequences & Musings on Mobius Maps**" to be organiged by Department of Mathematics, at 10.00 am on 10th November 2020 in our institution.

Programme

Inaugural Session: 10.00A.M - 11.00A.M

Technical Session -I: 11.00 A.M -12.30 P.M

Topic: **Musings on Mobius Maps**

Resource Person: Dr Tarakanta Nayak, IIT, Bhubaneswar

Technical Session -II: 12.30 P.M -2.00 P.M

Topic: **Numbers & Number Sequences: Everyday; Everywhere**

Resource Person: Prof.Prasanta Kumar Ray,
Sambalpur University, Burla.

Valedictory Session: 2.00 P.M -2.30P.M

7-11-20

Principal
Pattamundai College

Dr Prasanta Kumar Ray

"Education is the manifestation of perfection already existing in man." - Swami Vivekananda

Education

2009 **Ph.D, Mathematics**, *National Institute of Technology Rourkela, Odisha, India.*

1990 **M.Sc, Mathematics**, *Utkal University, Bhubaneswar, India.*

1988 **B.Sc, Mathematics(Hons)**, *Government College, Bhawanipatna, Odisha, India.*

1985 **+2 Science**, *Government College, Bhawanipatna, Odisha, India.*

1983 **Metric**, *Manikeswari High School, Bhawanipatna, Odisha, India.*

Experience

Research

2003-2005 **Independent Research**, Rorkela, India.

2006-2009 **PhD**, *National Institute of Technology, Rourkela, India.*
Thesis: Cobalancing Numbers and Cobalancers. Supervised by Prof. G. K. Panda, NIT Rourkela.

2009-till date **Independent Research**.
Broad Area: Number Theory

Teaching

January 2017–till date **Professor**, *School of Mathematical Sciences, Sambalpur University, Burla, India.*
Teaching: Post Graduate Students

May 2015–January 2017 **Associate Professor**, *Department of Mathematics, VSSUT Burla, India.*
Teaching: Under Graduate and Post Graduate Students

Aug 2011–May2015 **Assistant Professor**, *Department of Mathematics, IIIT Bhubaneaswr, India.*
Teaching: Under Graduate and Post Graduate Students

Aug 2010–Aug 2011 **Assistant Professor**, *Department of Mathematics, C.V. Raman College of Engineering, Bhubaneaswr, India.*
Teaching: Under Graduate and Post Graduate Students

Sep 1993–Aug 2010 **lecturer**, *College of Arts Science and Technology, Bondomunda, Rourkela.*
Teaching: Undergraduate Students

Nov 1991– Sep 1993 **lecturer**, *Dalmia College, Rajgangpur, Odisha.*
Teaching: Undergraduate Students

Professional Activities

Guest faculty, *Institute of Mathematics and Applications Bhubaneswar, India.*
Teaching: Number Theory

• *Sambalpur University, Jyoti Vihar, Burla, India 768019*
☎ *+91 8455045300* • ✉ *prasantamath@suniv.ac.in*

Visiting Professor, *Xavier Institute of Management Bhubaneswar (XIMB), Bhubaneswar, India.*
Teaching: Mathematics

Members of Professional Bodies

, *Life member of Indian Mathematical Society.*

, *Life member of Orissa Mathematical Society.*

Computer skills

Mathematica, Matlab, Latex

Programming Languages: C, C++

Project undertaken

Minor Research Project (MRP) sponsored by University Grant Commission (UGC), *Completed on 2010.*

PhD scholars supervised/supervising

Guided one research scholar of IIIT Bhubaneswar (Awarded 2018), Supervising three research scholar of Sambalpur University (UGC/CSIR fellowship). .

Conferences in abroad

• Attended and presented the paper "On balancing non-Wieferich primes" in the international conference "Integers Conference-2018" organized by Department of Mathematics, Augusta University, Augusta, Georgia, USA from 03-10-2018 to 06-10-2018, Sponsored by Science and Technology Department, Odisha and Conference Organizors

• Attended and presented the paper "Abrief remark on balancing Wieferich primes" in the international conference "Number Theory Down Under-5" organized by Department of Mathematics, La Trobe University, Bendigo, Australia from 29-9-2017 to 2-10-2017, Sponsored by DST, India

• Attended and presented the paper "Certain Diophantine equations involving balancing and Lucas-balancing numbers" in the international conference "DART 2016" organized by school of Mathematics and Statistics, Wuhan University, China from December 10-13, 2016.

• Attended and presented the paper "Application of some recurrence relations to cryptography using finite state machine" in the international conference "ICCEIT'14" organized by ISAET held in Thailand from December 16-17, 2014.

• Attended and presented the paper "Diophantine equations involving balancing and their related sequences" in the international conference "THUE 150" held in Institut de Mathématiques de Bordeaux, Université Bordeaux 1, France from September 30 to October 4, 2013, Sponsored by DST, India

Selected Conferences/ Workshops in India

• Attended in the international conference "International Conference on Class Groups of Number Fields and Related Topics-2017 (ICCGNFRT-2017 " organized by Harish Chanda Research Institute, Allahabad from September 4-7, 2017.

• Attended in the international conference "Automorphic forms on metaplectic groups and related topics" organized by Boston College USA and IISER, Pune from July 4-9, 2016.

• Attended and presented the paper " Certain Diophantine equations involving balancing and their related numbers" in the international conference "MSAST 2014" organized by IMBIC, Sweden, held in Kolkata, India from December 21-23, 2014.

• Attended and presented a paper "On the Hadamard product of balancing Q_B^n matrix and balancing Q_B^{-n} matrix" in the Instructional Workshop in Applied Mathematics held at South Assian University, New Delhi during May 6-10, 2013.

• Attended and presented a paper entitled "New identities for the common factors of both balancing and Lucas-balancing numbers" in the international conference "The Legacy of Srinivasa Ramanujan" held in University of Delhi, New Delhi from December 17-22, 2012.

• Attended in Pan Asian Number Theory conference (PANT 2012) held in Indian Institute of Science Education and Research(IISER), Pune from July 23-27, 2012.

• Attended and presented a paper entitled "A trigonometric approach to balancing numbers and its related sequences" in the 12th conference of the International Academy of Physical Sciences (CONIAPS XII) held in Rajasthan University, Jaipur, Rajasthan from December 22-24, 2010.
• Attended the Instructional Workshop on Applied Mathematics for University/College teachers organized under the auspices of the centre of advanced study in applied mathematics (SAP-UGC), Kolkata University in academic collaboration with North Bengal University, Darjeeling during 24th February to 4th march, 1997 at North Bengal University, West Bengal.

Refresher Courses

• Participated in the Refresher Course in Human values and Indian ethos held at the Department of Mathematics, Himachal Pradesh University, Shimla from 03-03-2010 to 23-03-2010.
• Participated in the Refresher Course in Mathematics held at the Department of Mathematics, Aligarh Muslim University, Aligarh from 02-02-1998 to 28-02-1998.

Other Interests

I also enjoy travel, listening and singing soft music and reading books.

Publications: Accepted Papers

- N. Irmak and P. K. Ray, The order of appearance of the product of two Fibonacci and Lucas numbers, Appeared in Acta Mathematica Hungarica, 2020.
- U.K. Dutta and P. K. Ray,On the finite alternating sums of reciprocal of balancing and Lucas-balancing numbers, To be appeared in *Discussiones mathematicae-general algebra and applications*,2020.

Publications: Published Papers

2020

- 2. P. K. Ray and U. K. Dutta, Analytic continuation of Apostol-Vu multiple balancing zeta functions, Integers, 20A, 2020, A12.
- 3. U. K. Dutta and P. K. Ray, Analytic properties of the Apostol-Vu multiple Fibonacci zeta functions, Discussiones Mathematicae-General Algebra and Applications, 40, 2020, 37-48.
- A Behera and P. K. Ray,Determinantal and permanental representations of convolved (U, V)-Lucas first kind P- polynomials, *AIMS Mathematics*, 5(3),2020, 1843-1855.
- P. K. Ray, A Cryptography method based on hyperbolic balancing and Lucas-balancing functions, *Proyecciones journal of mathematics*,39 (1), 2020, 135-152.

2019

- U. K. Dutta and P. K. Ray, On the finite reciprocal sums of Fibonacci and Lucas polynomials, *AIMS Mathematics*, 4(6), 2019, 1569-1581.
- P. K. Ray, Analytic properties of Euler-Zagier multiple Lucas-balancing zeta functions, *Trans. Natl. Acad. Sci. Azerb. Ser. Phys. Tech. Math. Sci.*, 39(1), 2019, 38-53.
- U. K. Dutta and P. K. Ray, On arithmetic functions of balancing and Lucas-balancing numbers, *Mathematical Communications*, 24, 2019, 77-81.
- P. K. Ray, Identities concerning k-balancing and k-Lucas-balancing numbers of arithmetic indexes, *AIMS Mathematics*, 4(2), 2019, 308-315.
- U. K. Dutta, B. K. Patel and P. K. Ray, Balancing non-Wieferich primes in arithmetic progressions, *Proceedings: Mathematical Sciences*, 2019.
- B. K. Patel, and P.K. Ray, On the properties of (p, q) Fibonacci and (p, q) Lucas quaternions, *Mathematical Reports*, 21(1), 2019, 1-10.

2018

- T Komatsu, B.K. Patel and P.K. Ray, Higher order identities for second order sequences, *An. Stint. Univ. Al. I. Cuza Lasi Mat. (N.S)*, LXIV, f.2, 2018, 357-368.
- P. K. Ray, N. Irmak and B. K. Patel, The rank of apparition of powers of Lucas sequence, *Turkish Journal of Mathematics*, 42, 2018, 1566-1570.

- U K Dutta, P K Ray and S S Pradhan, Regularized product of balancing and Lucas-balancing numbers, *Indian Journal of Mathematics*, 60 (2), 2018, 171-179.
- D. Behera, U K Dutta and P K Ray, On Lucas-balancing zeta function, *Acta et Commentationes Universitatis Tartuensis de Mathematica*, 22(1), 2018, 65-74.
- B. K. Patel, P.K. Ray and M Sahukar, Positive integers solutions of certain Diophantine equations, *Proceedings: Mathematical Sciences*, 128(1), 2018, 1-9.
- B K Patel, S K Sunanda and P K Ray, The period of balancing numbers modulo product of consecutive Lucas-balancing numbers, *Mathematica*, 60 (83), 2018, 181-185.
- U.K Dutta, B.K. Patel and P.K. Ray, A brief remark on balancing Wieferich primes, *Mathematica*, 60 (3), 2018.
- B.K. Patel, N. Irmak and P.K. Ray, Incomplete balancing and Lucas-balancing Numbers, To be appeared in *Mathematical Reports*, 20 (1) 2018.

2017

- B.K. Patel, U.K Dutta and P.K. Ray, Period of balancing sequence modulo powers of balancing and Pell numbers, *Annales Mathematicae et Informaticae*, 47 (3), 2017.
- P.K. Ray, Balancing polynomials and their derivatives, *Ukrainian Mathematical Journal*, 69 (4), 2017.
- P.K. Ray and S S Pradhan, Greatest common divisors for shifted balancing numbers, *Boletim da Sociedade Paranaense de Mathmatica*, 35, 2017.
- P.K. Ray, On the properties of k-balancing and k-Lucas balancing numbers, *Acta et Commentationes Universitatis Tartuensis de Mathematica*., 21, 2017.

2016

- P.K. Ray and B. K. Patel, The period, rank and order of the sequence of balancing numbers modulo m, *Mathematical Reports*, 18 (3), 2016.
- P.K. Ray, Certain diophantine equations involving balancing and Lucas-balancing numbers, *Acta et Commentationes Universitatis Tartuensis de Mathematica*,, 20, 2016.
- B. K. Patel and P.K. Ray, Uniform distribution of balancing numbers modulo m, *Uniform Distribution Theory*, 11 (1), 2016.
- S. Swain, C. Pratihary and P.K. Ray, Balancing and Lucas-balancing numbers and their application to cryptography, *Computer Engineering and Application Journal*, 5(1), 2016.
- P.K. Ray and Juli Sahu, Generating functions for certain balancing and Lucas-balancing numbers, *Palestine Journal of Mathematics*, 5(2), 2016.
- S.M. Zahid and P. K. Ray, On closure properties of irrational and transcendental numbers under addition and multiplication, *American Journal of Under Graduate Research*, 13(3), 2016.
- P.K. Ray, On the properties of k-balancing numbers, Article in press, *Ains Shaam Engineering Journal*, 2016.

2015

- P. K. Ray and G..K. Panda, Tridiagonal matrices related to subsequences of balancing and Lucas-balancing numbers, *Notes on Number Theory and Discrete Mathematics*, 21(3), 2015.
- S.M. Zahid and P. K. Ray, Approximation of Euler number using gamma function, *American Journal of Under Graduate Research*, 12(3), 2015.
- P.K. Ray and S. Swain, On the Hadamard product of balancing Q_B^n matrix and balancing Q_B^{-n} matrix, *TWMS journal of applied and engineering mathematics*, 5(2), 2015.
- P.K. Ray, Balancing and Lucas-balancing sums by matrix methods, Mathematical Reports, 17(2), 2015, 225-233.

2014

- P. K. Ray and K. Parida, Generalization of Cassini formula for balancing and Lucas-balancing numbers, *Matematychni Studii*, 42(1), 2014, 9-14.
- P. K. Ray, Balancing sequence of matrices with application to algebra of balancing numbers, *Notes on Number Theory and Discrete Mathematics*, 20(1), 2014, 49-58.

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- P. K. Ray, Some congruences for balancing and Lucas-balancing numbers and their applications, *INTEGERS*, 14, 2014, #A8.

2013

- P. K. Ray, New identities for the common factors of balancing and Lucas-balancing numbers, *International Journal of Pure and Applied Mathematics*, 85(3), 2013, 487-494.
- P. K. Ray, Factorization of negatively subscripted balancing and Lucas-balancing numbers, *Boletim da Sociedade Paranaense de Matemática*,31 (2), 2013, 161-173.

2012

- P. K. Ray, Certain matrices associated with balancing and Lucas-balancing numbers, *Matematika*, 28 (1), 2012, 15-22.
- P. K. Ray, Curious congruences for balancing numbers, *International Journal of Mathematics and Mathematical Sciences*, 7 (18), 2012, 881-889.
- P. K. Ray, Application of Chybeshev polynomials in factorization of balancing and Lucas-balancing numbers, *Boletim da Sociedade Paranaense de Matemática*, 30 (2), 2012, 49-56.

2011

- G. K. Panda and P. K. Ray, Some links of balancing and cobalancing numbers with Pell and associated Pell numbers, *Bulletin of the Institute of Mathematics, Academia Sinica (New Series)*, 6(1), 2011, 41-72.

2010

- G.K. Panda and P. K. Ray, Some important properties of balancing and related number sequences, *Journal of the Orissa Mathematical Society*, 29(2) (2010), 27-38.

2005

- G. K. Panda and P. K. Ray , Cobalancing numbers and cobalancers, *International Journal of Mathematics and Mathematical Sciences*, 2005(8), 2005, 1189-1200.

• *Sambalpur University, Jyoti-Vihar, Burla, India 768019*
☎ *+91 8455045300* • ✉ *prasantamath@suniv.ac.in*

Personal Profile of Dr. Tarakanta Nayak

भारतीय प्रौद्योगिकी संस्थान भुवनेश्वर
Indian Institute of Technology Bhubaneswar

Dr. Tarakanta Nayak

Title	:	Associate Professor
School	:	Basic Sciences
Office (Room No.)	:	329, SBS Building
Phone No. (Office)	:	674-713-5166
Email	:	tnayakATiitbbsDOTacDOTin
Research Scholars	:	**PhD** Completed: 1 (Tarun Kumar Chakra) Continuing: 2 (Subhasis Ghora and Soumen Pal) **MSc projects for students of IIT Bhubaneswar** Completed: 12 Continuing: 2 **MSc and BTech projects for other students** Completed: 4
Personal Web Page	:	[Click Here]

Courses Taught

Math-I, Math-II, Transform Calculus, Probability, Statistics & Stochastic Processes, Complex Analysis, Fractals, Advanced Complex Analysis, Complex Dynamics, Linear Algebra, Discrete Mathematics

Research Interests

Complex Dynamics; Fractals; Independence polynomials and Independent fractals of graphs

Degree	Discipline	Year	School
Ph.D.	Mathematics	2007	Indian Institute of Technology Guwahati

Recent Publication (International Journals)	Author(s)/Speaker(s)
Graphs whoseindependent fractals are line segments, Bulletin of Malayasian Math Soc. 2020	Sasmita Barik, Tarakanta Nayak and Ankit Pradhan
Herman rings with small periods and omitted values, Acta Mathematica Scientia Ser. B(Engl. Ed.) 38 (2018), no. 6, 1951—1965, Elsevier.	Tarun Kumar Chakra, Gorachand Chakraborty and Tarakanta Nayak
Iteration of the translated tangent, Bulletin of the Malaysian Mathematical	Tarun Kumar Chakra and

Sciences Society, Springer, 42 (2018), no. 5, 1993-2008, DOI 10.1007/s40840-017-0588-3.	Tarakanta Nayak
Iteration of certain exponential-like meromorphic functions, Proceedings of Indian Academy of Sciences (Mathematical Sciences), Springer, 128 (2018), no. 5, Art. 64, 18 pp	Tarun Kumar Chakra, Tarakanta Nayak and Kedarnath Senapati
Baker Omitted value, Complex Variables and Elliptic Equations, An International Journal, 61 (2016), no. 10, 1353 - 1361	Tarun Kumar Chakra, Gorachand Chakraborty and Tarakanta Nayak
Herman rings of meromorphic maps with an omitted value, Proceedings of the American Mathematical Society, 144 (2016), no. 2, 587 - 597	Tarakanta Nayak
On Fatou components and Omitted values, Contemporary Mathematics, Geometry, groups and dynamics, 349 - 358, Contemporary Mathematics, 639, American Mathematical Society, Providence, RI, 2015.	Tarakanta Nayak
Julia sets of Joukowski-exponential maps, Complex Analysis and Operator Theory, 8 (2014), no.5, 1061--1076.	Tarakanta Nayak and M. G. P. Prasad
Omitted values and dynamics of meromorphic functions, Journal of London Mathematical Society, 83 (1), (2011), 121-136	Tarakanta Nayak and Jian-Hua Zheng
Iteration of certain meromorphic functions with unbounded singular values, Ergodic Theory & Dynamical Systems, 30, (2010), 877-891	Tarakanta Nayak and M. Guru Prem Prasad
Dynamics of tanh e^z, Discrete and Continuous Dynamical Systems-Series A 19, (September 2007), 1, 121-138	M. Guru Prem Prasad and Tarakanta Nayak
Bifurcation and chaotic burst in the dynamics of e^az+be^z, Journal of Combinatorics, Information and System Sciences 28-29 (2003-2004), 211-227	Tarakanta Nayak and M. Guru Prem Prasad
Exploding Julia sets in the dynamics of f ?(z) = ?J1(iz)/iz, Proceedings of The Third National Conference on Non-linear Systems and Dynamics, (NCNSD-2006), 171-174, Allied Publishers Pvt. Ltd.	M. Guru Prem Prasad, Tarakanta Nayak and Ashis Kumar Roy

Conferences (International)

Baker omitted value, Invited talk in 34 th Annual Conference of the Ramanujan Mathematical Society, 1-3 August 2019, Pondicherry University, Puducherry, India

Independence fractal of a graph, Invited talk in 83rd Annual Conference of Indian Mathematical Society, 12-15 Dec 2017, Sri Venkateswar University, Tirupati, Andhra Pradesh, India

Completely invariant domains, Complex Analysis: Geometric and Dynamical Aspects, Non 14-19, 2016, Centre of Excellence in Mathematical Sciences, Almora, India

Herman rings, Frontiers in Complex Dynamics, Dec 19 -- 20, 2012, University of Barcelona, Spain

Conferences (National)

Complex Dynamics of some simple maps, National Workshop on Topological Dynamics Dec 10 -- 12, 2015, National Institute of Technology, Karnataka, Surathkal, India

Academic Honors & Awards

- Ramanujan Prize for 2018 given by Ramanujan Institute for Advanced Study in Mathematics, University of Chennai
- Member of INYAS (Indian National Young Academy of Science), 2018-2022
- Junior Associate of International Centre for Theoretical Physics, Italy for the period 2012-2017

Professional Activities

- Reviewer, Mathematical Reviews (Published by American Mathematical Society)
- Regional Coordinator (Odisha), Madhava Mathematics Competition (since 2015)
- Acted as supervisor for Joint Science Academies' Summer Research Fellowship Programme
- Member, Board of studies, Salipur Autonomous College, Salipur (2014-2016)
- Zonal coordinator, Indian National Mathematical Olympiad for Utkal University zone
- Member in the interview board for selection of Trained Graduate Teachers in Kendriya Vidyalaya Sangathan on 30 April, 2011

Student Supervision

PhD: Tarun Kumar Chakra, 2018 (Thesis: Iteration of meromorphic functions with an omitted value)

Post Doc: Dr Kedarnath Senapati , 2014-2016

MSc:

12. *Fixed points and their multipliers for a polynomial*, Rajen Kumar, 2018-19.
11. *Graphs whose independence fractals are line segments*, Sanjoy Mondal, 2018-19
10. *Quasiconformal mapping and No wandering theorem*, Abhisek Pandey, 2018-19
9. *Fractal Transformation using Iterated Function System*, Chavan Ratan, 2017-18
8. *Quasiconformal mappings*, Garima Gupta, 2016-17
7. *A study of roots of Independence polynomials*, Vijay Kumar Meena, 2016-17
6. *The Independence fractal of a graph*, Kartik Pandey, 2016-17
5. *Finding all roots of a polynomial by Newton's Method*, Soumen Pal, 2015-16
4. *A study on palindromic polynomials*, Priti Prasanna Mondal, 2015-16
3. *Polynomial root finding*, Anudeep Nain, 2014-15
2. *The Julia sets of relaxed Newton method for polynomials with two roots*, Satyabrata Jana, 2014-15
1. *Dynamical behaviour of multiply connected Fatou components of transcendental entire functions*, Jogender Singh, 2014-15.

Summer and Winter projects:

4. *Roots of Chromatic Polynomials*, winter project by Labhansh Gemini, NIT Hamirpur, 11-31 Dec 2018
3. *The independence polynomial of a graph*, summer project by Satyabrat Rath, NIT Rourkela, 2018

2. *On Herman rings of transcendental meromorphic functions*, summer project by Pranav Kumar Upadrasta, IIT Kharagpur (under SRF Programme - 2014, jointly sponsored by IASc-Bangalore, INSA-New Delhi and NSAI-Allahabad).
1. *When two fractals are the same,* summer project by Prashant Kumar Ojha, NIT Rourkela during May 15 -- July 15, 2011.

Sponsored projects

1. Project title and duration: Independence polynomials of graphs and associated fractals, 14 March 2019-13 March 2022. Supported by the Department of Science & Technology, Govt. of India. Amount: Rupees 6.6 Lakhs
2. Project title and duration:Omitted values in complex dynamics, 2014-17. Supported by the Department of Science & Technology, Govt. of India. Amount: Rupees 13.44 Lakhs.
3. Project title and duration: Julia sets of transcendental meromorphic functions, 21/07/2010 - 30/06/2012. Supported by IIT Bhubaneswar. Amount: Rupees 5 Lakhs
4. Project title and duration: Topological aspects of transcendental dynamics, 2009-2010. Supported by the China Postdoctoral Science Foundation (Grant no. 20090450420). Amount: RMB 30,000.

Musings on Möbius Maps

Tarakanta Nayak[1]

National Webinar on
NUMBER SEQUENCES & MUSINGS ON MÖBIUS MAPS

10 November 2020
Pattamundai College, Pattamundai, Kendrapara

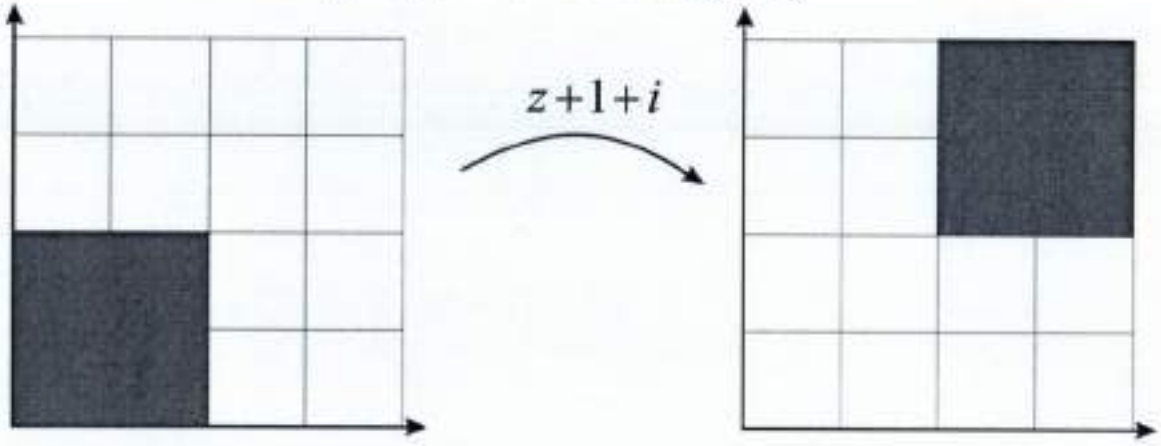
[1]Under Scientific Social Responsibility- MTR/2018/000498 and INYAS Science Outreach.

Sketch of the Talk

Translation

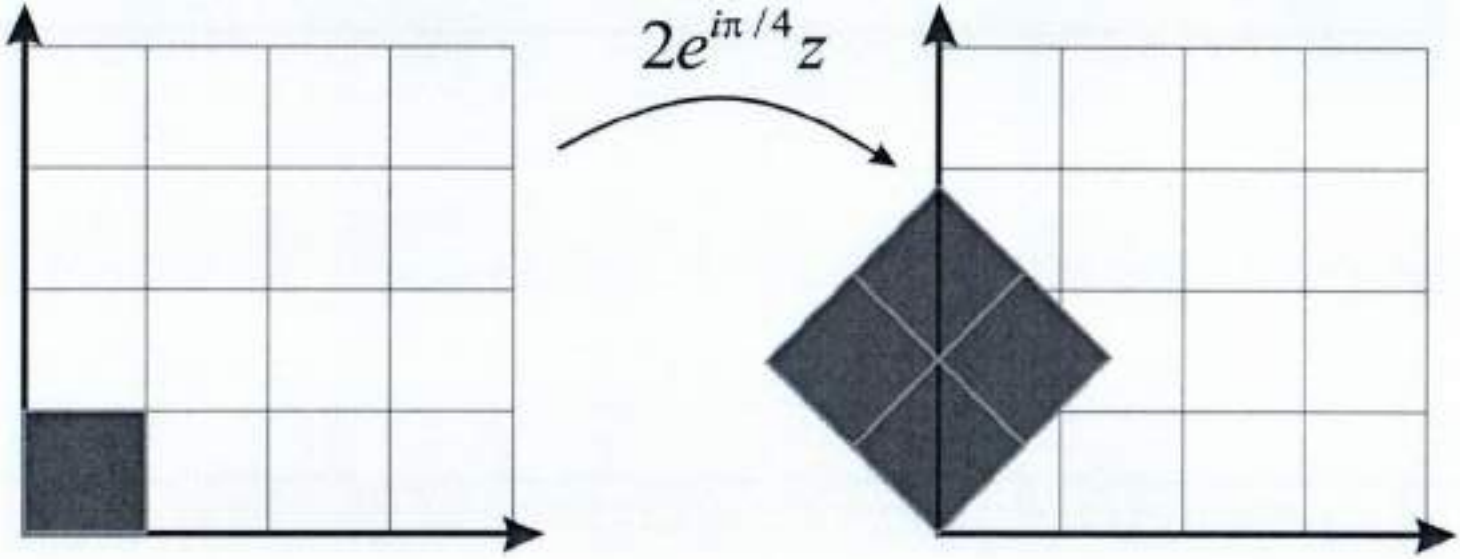
The Complex plane:$\mathbb{C} = \{z = x + iy : x, y \in \mathbb{R}\}$

- $T_a : \mathbb{C} \to \mathbb{C}$ given by $T_a(z) = z + a$
- $T_a^{-1}(z) = T_{-a}(z) = z - a$
- T_a takes circles to circles (radius unchanged), and lines to lines(slope unchanged)



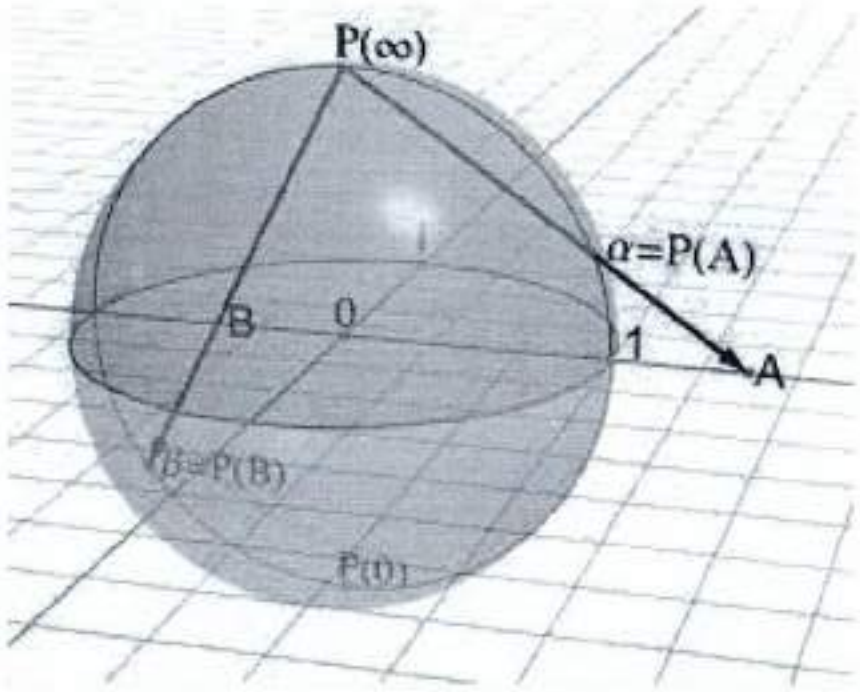
Scaled rotation

- $R_a(z) = az$
- $R_a^{-1}(z) = R_{1/a}(z) = \frac{z}{a}$
- R_a takes circles to circles (radius and center changes), and lines to lines(slope changes)



The Riemann Sphere

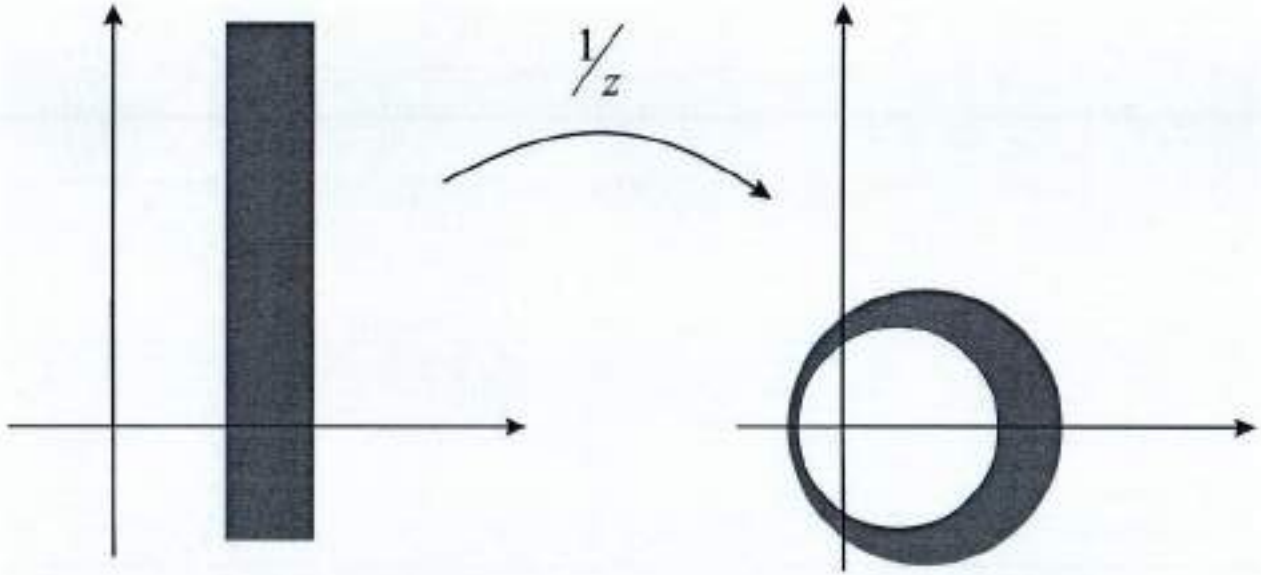
$$\widehat{\mathbb{C}} = \mathbb{C} \bigcup \{\infty\}$$



Also called the *Celestial Sphere* in astronomy!

Inversion

- $I(z) = \frac{1}{z}: I^{-1}(z) = I(z)$
- $z = re^{i\theta}, I(z) = \frac{1}{r}e^{-i\theta}$; Unit circle is preserved
- Only $1, -1$ are fixed



Geometry of Inversions

- $C_{a,r} : |z - a| = r$ and $w = \frac{1}{z}$
- $|\frac{1}{w} - a| = r$
- $|w|^2(|a|^2 - r^2) + 1 - aw - \overline{aw} = 0$
- $0 \in C_{a,r} \Longrightarrow |a| = r$
- $2\Re(aw) = 1$
- $a_1w_1 - a_2w_2 = \frac{1}{2}$: This is a straight line
- I takes circles passing through 0 to lines not passing through 0
- $I(C_{1,1})$ is the vertical line passing through $\frac{1}{2}$

Geometry of Inversions

- $0 \notin C \Longrightarrow |a| \neq r$
- $|w|^2 - \frac{aw+a\bar{w}}{|a|^2-r^2} + \frac{1}{|a|^2-r^2} = 0$
- $|w - \frac{\bar{a}}{|a|^2-r^2}|^2 = (\frac{r}{|a|^2-r^2})^2$: A circle with center at $\frac{\bar{a}}{|a|^2-r^2}$ and radius $\frac{r}{|a|^2-r^2}$
- Center is NOT always mapped to the center !
- I takes circles not passing through 0 to circles not passing through 0

Geometry of Inversions

- $L_{m,c} = \{x + i(mx + c) : x \in \mathbb{R}\}$: m is the slope and c is the $y-$intercept
- $0 \in L_{m,c} \iff c = 0$
- $z = \frac{1}{w} = \frac{w_1}{w_1^2+w_2^2} + i\frac{-w_2}{w_1^2+w_2^2}$; $\frac{-w_2}{w_1^2+w_2^2} = m\frac{w_1}{w_1^2+w_2^2} + c$
- $\infty \in L_{m,c} \implies 0 \in f(L_{m,c})$: Assume $w_1^2 + w_2^2 \neq 0$
- $c = 0 \implies -w_2 = mw_1$; Line with slope $-m$
- I takes lines passing through 0 to lines
- $c \neq 0 \implies cw_1^2 + cw_2^2 + w_2 + mw_1 = 0$
- $w_1^2 + w_2^2 + \frac{w_2}{c} + \frac{mw_1}{c} = 0$
- $(w_1 - (-\frac{m}{2c}))^2 + (w_2 - (-\frac{1}{2c}))^2 = (\frac{\sqrt{m^2+1}}{2c})^2$
- I takes lines not passing through 0 to circles

Möbius maps

August Ferdinand Möbius, a German Mathematician Astronomer (17 Nov 1790–26 Sept 1868)

- $f : \widehat{\mathbb{C}} \to \widehat{\mathbb{C}}$ defined by $f(z) = \frac{az+b}{cz+d}, \quad ad - bc \neq 0$
- $f(\frac{-d}{c}) = \infty, \quad f(\infty) = \frac{a}{c}$
- f is bijection
- $c = 0 : f(z) = T_{\frac{b}{d}} R_{\frac{a}{d}}(z)$
- $c \neq 0 : f(z) = T_{\frac{a}{c}} R_{\frac{bc-ad}{c}} I T_d R_c(z)$
- $f^{-1}(z) = \frac{-dz+b}{cz-a}$

Fixed points and implications

- $az + b = cz^2 + dz$ has at most two solutions
- At most two fixed points in $\widehat{\mathbb{C}}$ unless it is identity
- If $f(\infty) = \infty$ then
  $\frac{a}{c} = \infty \implies c = 0 \implies f(z) = \frac{az}{d} + \frac{b}{d}$
- Each möbius map is determined completely by its action on any 3 distinct points in $\widehat{\mathbb{C}}$
- Let f, g be such that $f(z_i) = w_i$ and $g(z_i) = w_i$
- Then $fg^{-1}(w_i) = w_i$ and it is a möbius map with three fixed points
- $fg^{-1}(z) = z$; $f(z) = g(z)$ for all z

Cross ratio

$z_2, z_3, z_4 \in \widehat{\mathbb{C}}$ be distinct

- $(z, z_2, z_3, z_4) = \frac{(z-z_2)(z_3-z_4)}{(z-z_4)(z_3-z_2)}$ is the möbius map taking $z_2 \to 0, z_3 \to 1,\ and\ z_4 \to \infty$
- Cross ratio is preserved under each möbius map
  $z_2, z_3, z_4 \in \widehat{\mathbb{C}}$; T Möbius
  $\implies (z_1, z_2, z_3, z_4) = (Tz_1, Tz_2, Tz_3, Tz_4)\ \forall z_1$
- Four points z_1, z_2, z_3, z_4 are on a circle if and only if (z_1, z_2, z_3, z_4) is a real number or ∞
- Used to answer : Find a möbius map taking $z_i\ to\ w_i, i = 1, 2, 3.$

Orientation: Respecting symmetry

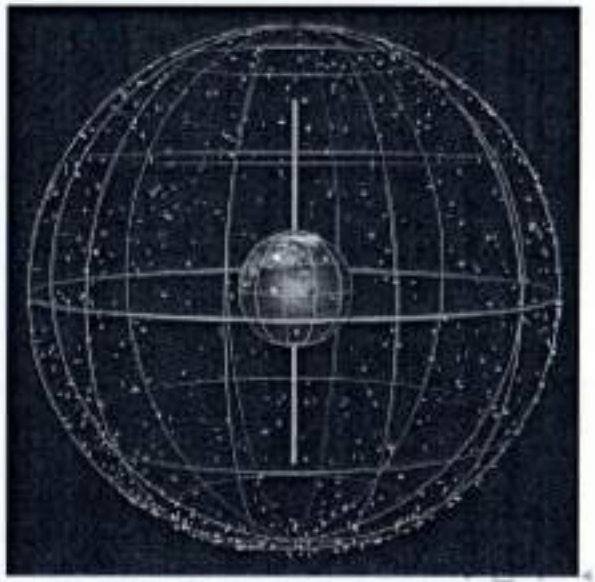
- $(z, 1, i, -1) = \frac{(z-1)(i+1)}{(z+1)(i-1)} = \frac{i(1+z)}{1-z}$ is the möbius map taking the unit circle onto the real line
- The *left hand side* of a circle/line is mapped to *left hand side* of the image circle/line by each Möbius map
- It takes the unit disk onto the upper half plane, as $0 \to i$

Isometries and Automorphisms

- $X \subset \widehat{\mathbb{C}}$ is a nonempty set with a metric d
- Metric is a notion of distance
- $f : X \to X$
- f is an isometry if $d(f(x), f(y)) = d(x, y)$ for all x, y
- f is an automorphism if it is an analytic bijection
- $Aut(X)$ is the set of all automorphisms of X
- $Isom(X)$ is the set of all isometries of X
- How $Aut(X)$ and $Isom(X)$ are related?
- Our concern: $X = \widehat{\mathbb{C}}, \mathbb{C}, \mathbb{D}$

Automorphisms of the sphere

- $f(z) = \infty$: f is analytic at z
- $f(\infty) = \infty$: f is analytic at ∞ if $\frac{1}{f(\frac{1}{z})}$ is analytic at 0
- $f(\infty) \in \mathbb{C}$: f is analytic at ∞ if $f(\frac{1}{z})$ is analytic at 0
- $Aut(\widehat{\mathbb{C}})$ contains precisely the non-constant möbius maps
- Spherical metric: Distance along great circles
- $Isom(\widehat{\mathbb{C}}) \subsetneq Aut(\widehat{\mathbb{C}})$

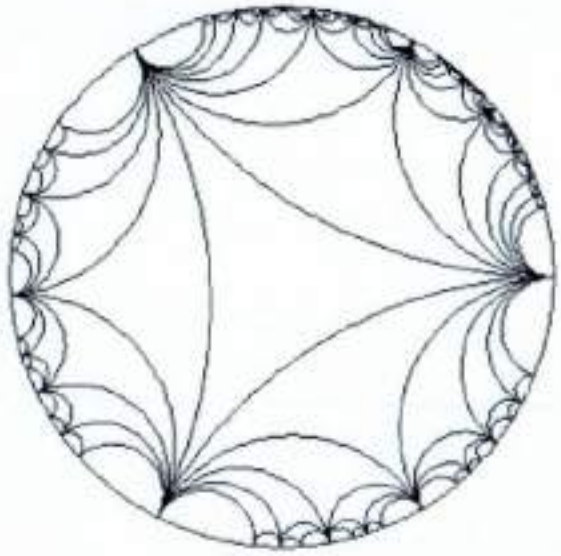


Automorphisms of the plane

- $f \in Aut(\mathbb{C}) \iff f(z) = az + b, a \neq 0$
- Rigid motion: f: $w_i = f(z_i) \Longrightarrow |w_1 - w_2| = |z_1 - z_2|$
- These are the Euclidean isometries
- $g(z) = f(z) - f(0)$ is also a rigid motion and $g(0) = 0$
- $|g(z)| = |z|$ for all z
- $g(z) = e^{i\theta}z$ for some θ
- $f(z) = g(z) + f(0) = e^{i\theta}z + f(0)$
- Every rigid motion of the plane is an automorhism $az + b, |a| = 1$, and vice versa
- $Isom(\mathbb{C}) \subsetneq Aut(\mathbb{C})$

Automorphisms of the unit disk

- $\mathbb{D} = \{z : |z| < 1\}$ is the unit disk
- $f \in Aut(\mathbb{D}) \iff f(z) = e^{i\theta}\frac{z-a}{1-\bar{a}z}, a \in \mathbb{D}, \theta \in \mathbb{R}$
- Poincare distance; $ds = \frac{dz}{1-|z|^2}$
- Distance along geodesics
- $Aut(\mathbb{D}) = Isom(\mathbb{D})$



Through Matrices

- $\frac{az+b}{cz+d}$, $ad - bc = 0$ leads to a constant map
- $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \mapsto \frac{az+b}{cz+d}$
- $\begin{pmatrix} ka & kb \\ kc & kd \end{pmatrix}$ gives the same möbius map
- Choose k such that $det(kA) = 1$
- Further $det(A) = -det(A)$
- $\mathcal{M}(\hat{\mathbb{C}}) \cong PSL_2(\mathbb{C})$, the set of all 2×2 matrices with determinant 1
- $PSL_2(\mathbb{C})$ is a subgroup/closed topological subspace of $\mathbb{C}^4$: It is a Lie group !

THANK YOU ALL

NUMBERS & NUMBER SEQUENCES: EVERYDAY; EVERYWHERE

National Webinar on Number Sequences & Mappings on Mobius Maps

Organised by

Pattamundai College, Pattamundai

On

10.11.2020

PRASANTA KUMAR RAY
PROFESSOR
SCHOOL OF MATHEMATICAL SCIENCES
SAMBALPUR UNIVERSITY
SAMBALPUR, INDIA

SOME INTERESTING NUMBERS

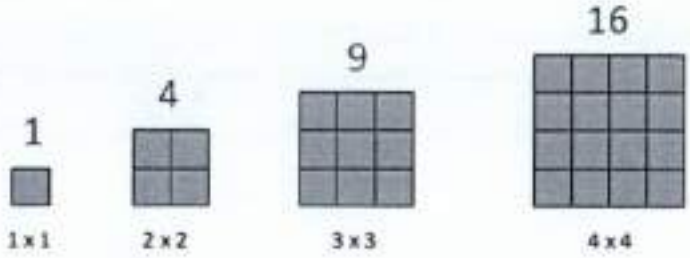
Figurate Numbers:

A figurate number, also known as a figural number or polygonal number, is a number that can be represented by a regular geometrical arrangement of equally spaced points.

Example:

Triangular Numbers:

Square Numbers:



INTERESTING FACTS ABOUT TRIANGULAR AND SQUARE NUMBERS

- Every whole number is the sum of three or less triangular numbers.

Example:

$17 = 1 + 6 + 10$		$26 = 1 + 10 + 15$	
$46 = 10 +$	36	$150 = 6 +$	$66 + 78$
$64 = 28 +$	$21 + 15$	$25 = 10 +$	15

- Every whole number is the sum of four or less square numbers.

Example: $56 = 36 + 16 + 4 = 6^2 + 4^2 + 2^2$

$150 = 100 + 49 + 1 = 10^2 + 7^2 + 1^2$

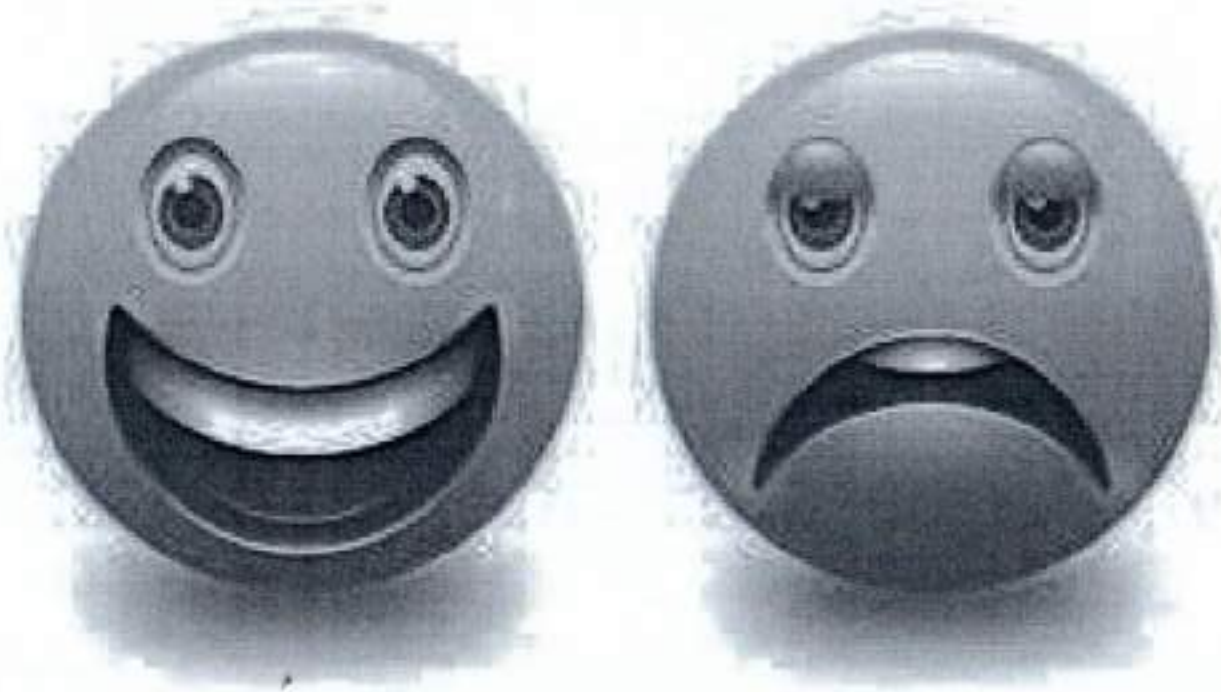
- Eight (8) times any triangular number add 1 is a square.

Example: $(8 \times 1) + 1 = 9 = 3^2$

$(8 \times 3) + 1 = 25 = 5^2$

$(8 \times 6) + 1 = 49 = 7^2$

HAPPY & SAD NUMBERS



DEFINITION

A happy number is defined by the following process: Starting with any positive integer, replace the number by the sum of the squares of its digits in base-ten, and repeat the process until the number either equals 1 or it loops endlessly in a cycle that does not include 1. Those numbers for which this process ends in 1 are happy numbers, while those that do not end in 1 are unhappy numbers (or sad numbers).

PALINDROME NUMBERS

- A palindrome number is a number that is the same when written forwards or backwards.
- The year **2002** is a palindrome. So was the year **1991**.

The next such pair will be **2992** and **3003**.

So this happens about once every 1000 years. The next normal palindromic year will be **2112**.

- **Universal Day of Symmetry**

8:02 P.M. on Feb. 20, 2002 is a very unique time and date.

It may be written as **20:02, 20/02, 2002**

2002 2002 2002

10:01 AM, on January 10, 1001.

1001 1001 1001

PALINDROME NUMBERS

$$121 = \frac{22 \times 22}{1+2+1}$$

$$12321 = \frac{333 \times 333}{1+2+3+2+1}$$

$$1234321 = \frac{4444 \times 4444}{1+2+3+4+3+2+1}$$

$$123454321 = \frac{55555 \times 55555}{1+2+3+4+5+4+3+2+1}$$

$$12345654321 = \frac{666666 \times 666666}{1+2+3+4+5+6+5+4+3+2+1}$$

$$1234567654321 = \frac{7777777 \times 7777777}{1+2+3+4+5+6+7+6+5+4+3+2+1}$$

$$123456787654321 = \frac{88888888 \times 88888888}{1+2+3+4+5+6+7+8+7+6+5+4+3+2+1}$$

$$12345678987654321 = \frac{999999999 \times 999999999}{1+2+3+4+5+6+7+8+9+8+7+6+5+4+3+2+1}$$

PALINDROME NUMBERS

Palindrome Triangular numbers

n	n(n+1)/2
11	66
1111	617716
111111	6172882716

These are 3 of the 40 palindromic triangular numbers with n < 10,000,000.

Unfortunately, the next number in the above series (11111111) is not palindromic.

Palindromic Squares of Palindromes

$$10001^2 = 100020001$$
$$11011^2 = 121242121$$
$$11111^2 = 123454321$$
$$11211^2 = 125686521$$

PALINDROME NUMBERS

Interesting Palindromic Triangular Numbers

539593131395935, 8208268228628028, 2664444662

First one consists only of the odd digits 1, 3, 5,9.

The second consists only of the even digits 0, 2, 6, 8

2664444662 = 2 x 11 x 121111121

Three prime palindromic factors !

KAPREKAR NUMBERS

- The *Kaprekar numbers* were introduced by the Indian mathematician D.R. Kaprekar (1905-88) in 1980 who worked as aschool teacher in a small town Devlali in Maharashtra. They have been the subject of several articles, and are mentioned in David Wells's *Dictionary of Curious and Interesting Numbers.*

Here are some further examples:

$9^2 = 81$, $1+8=9$;

$45^2 = 2025$, $25+20=45$;

$297^2 = 88209$, $209+88=297$;

$4879^2 = 23804641$, $4641+238=4879$;

$17344^2 = 300814336$, $14336+3008=17344$;

$538461^2 = 289940248521$, $248521+289940=538461$.

Formally, an *n*-Kaprekar number $k >= 1$ (for $n = 1, 2, ...$) satisfies the pair of equations

$$k = q + r,\ k^2 = q * 10^n + r\ ;$$

where $q >= 1$ and $0 <= r < 10^n$.

MYSTERIOUS NUMBER 22

Let us play another game:

- Select any 3-digit number with all digits different from one another.
- Write all possible 2-digit numbers that can be formed from the 3-digits selected earlier.
- Divide their sum by the sum of the digits in the original 3-digit number.

You should *always* get the same answer 22,

For example, consider the three-digit number 365.

sum of all the possible two-digit numbers that can be formed from 365

36+35+63+53+65+56 = 308.

3+6+5=14.

308/14 =22.

MYSTERIOUS NUMBER 22

Mathematics behind this

General representation of the 3 digit number: $100x + 10y + z$.

We now take the sum of all the two-digit numbers taken from the three digits:

$(10x+y)+ (10y+x) + (10x+z) + (10z+x) + (10y+z) + (10z+y)$

$=10(2x+2y+2z) + (2x+2y+2z)$

$=11(2x+2y+2z)$

$=22(x+y+z)$

When divided by the sum of the digits, $(x + y + z)$, is 22.

Fibonacci Numbers & Golden Ratio

The sequence begins with one. Each subsequent number is the sum of the two preceding numbers.

$$F(n) = F(n-1) + F(n-2)$$

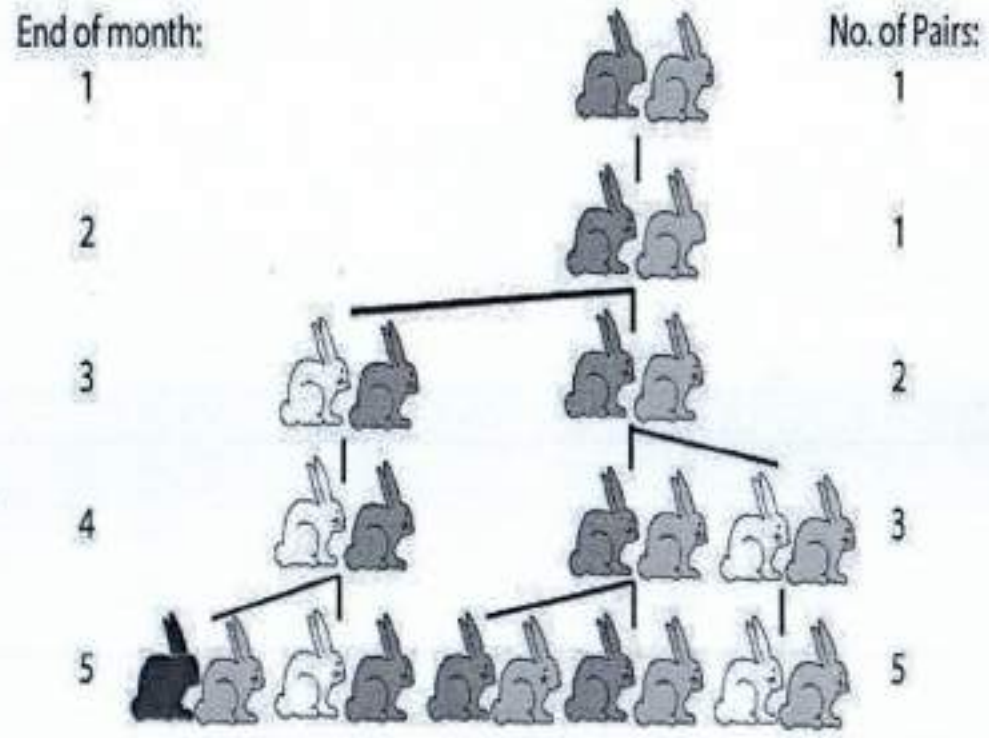
Thus the sequence begins as follows:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144

Famous Rabbit problem

Suppose there are two newborn rabbits , one male and other female. Find the number of rabbits produced In a year if

- Each pair takes one month to become mature.
- Each pair produces a mixed pair every month from the second month.
- All rabbits are immortal.



Nature → *Petals on flowers*

On many plants, the number of petals is a Fibonacci number:

white calla lily
1 petal

Euphorbia
2 petals

Trillium
3 petals

Columbine
5 petals

Bloodroot
8 petals

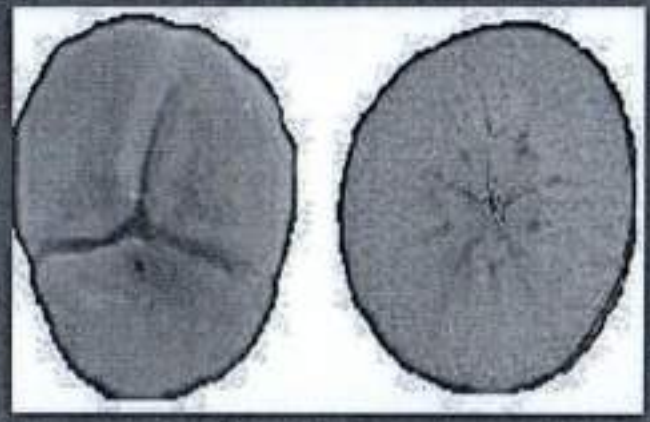
black-eyed susan
13 petals

shasta daisy
21 petals

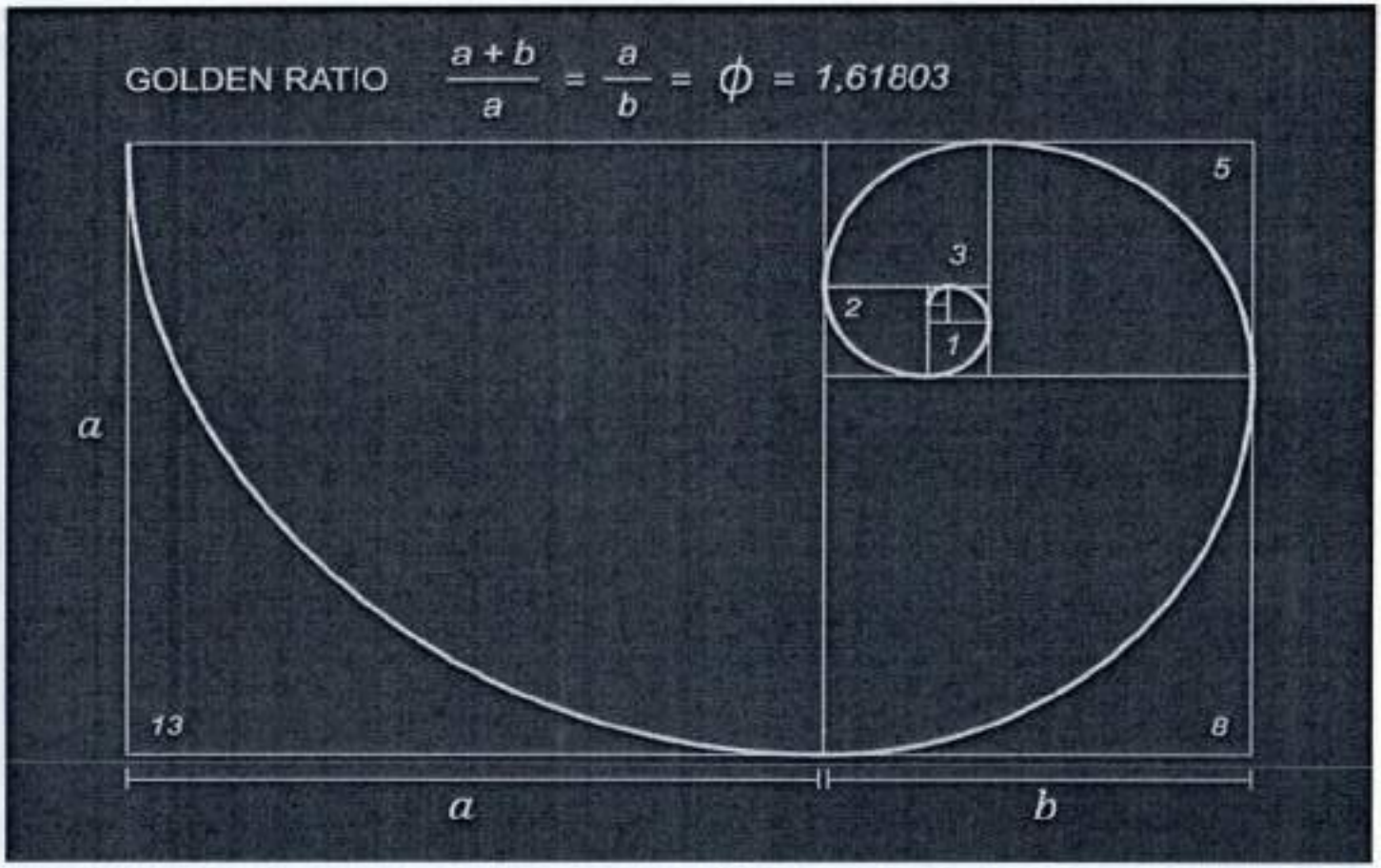
field daisies
34 petals

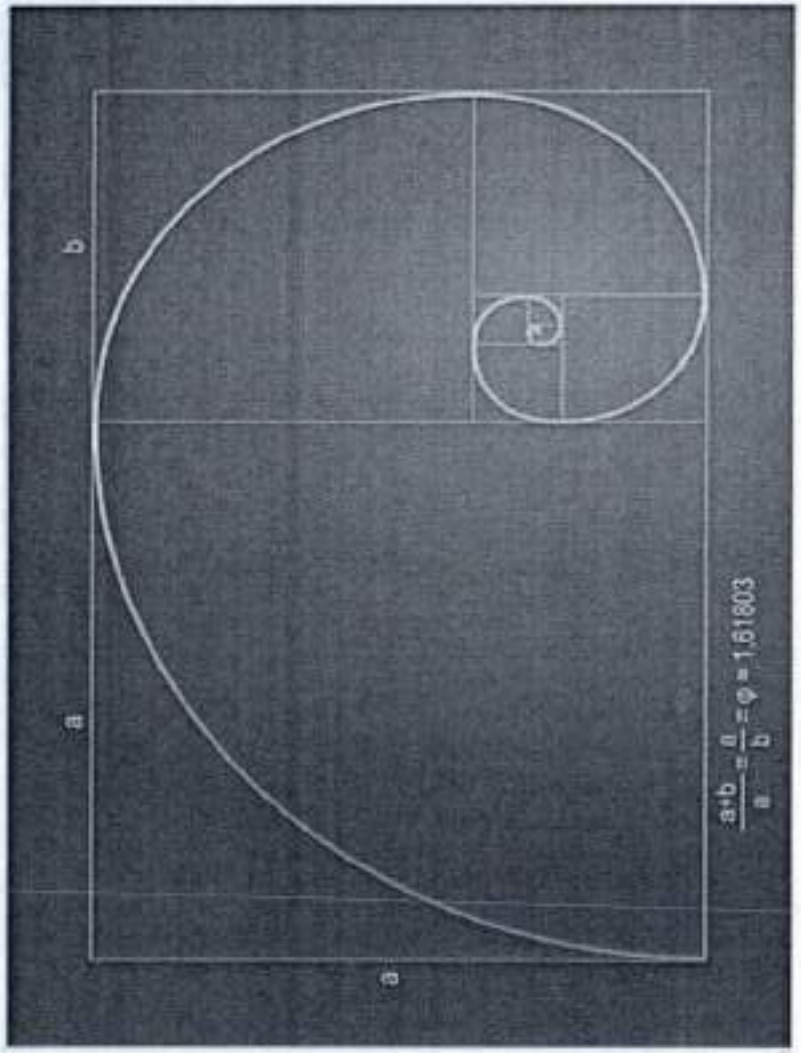
Fibonacci food!

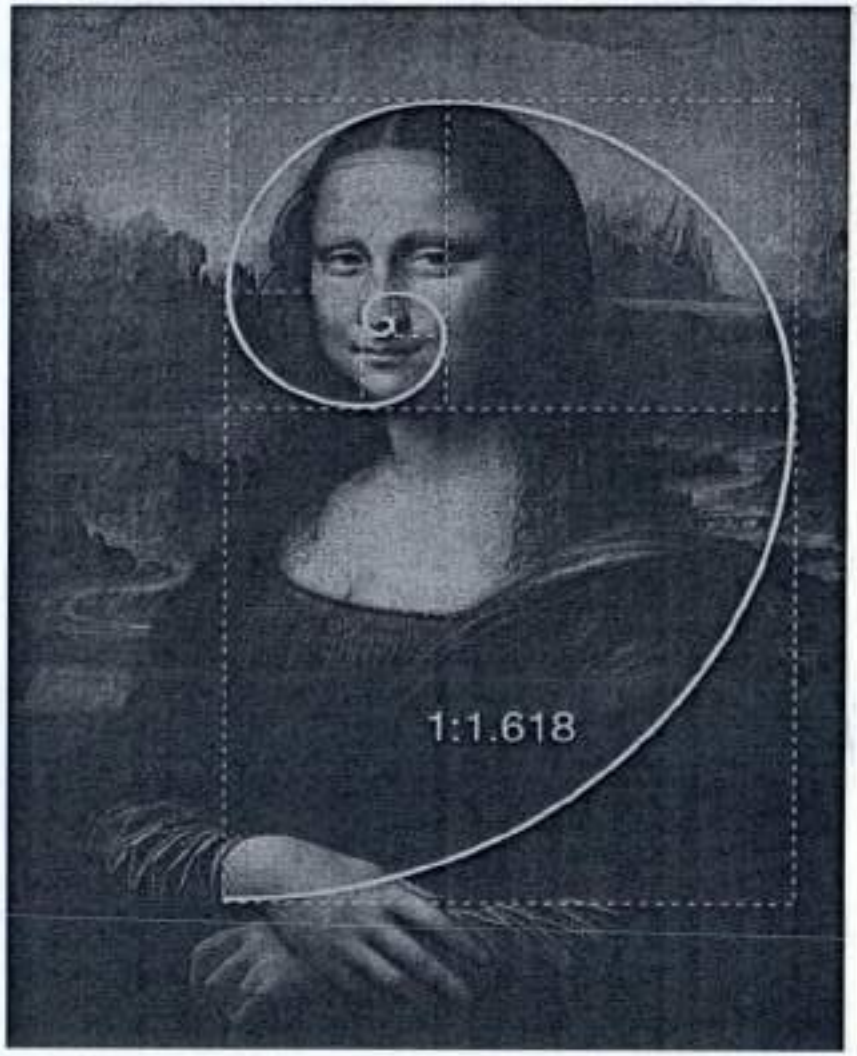
- As you can see a banana has 3 sections which is a Fibonacci number. An apple has 5 sections which is also a Fibonacci number.



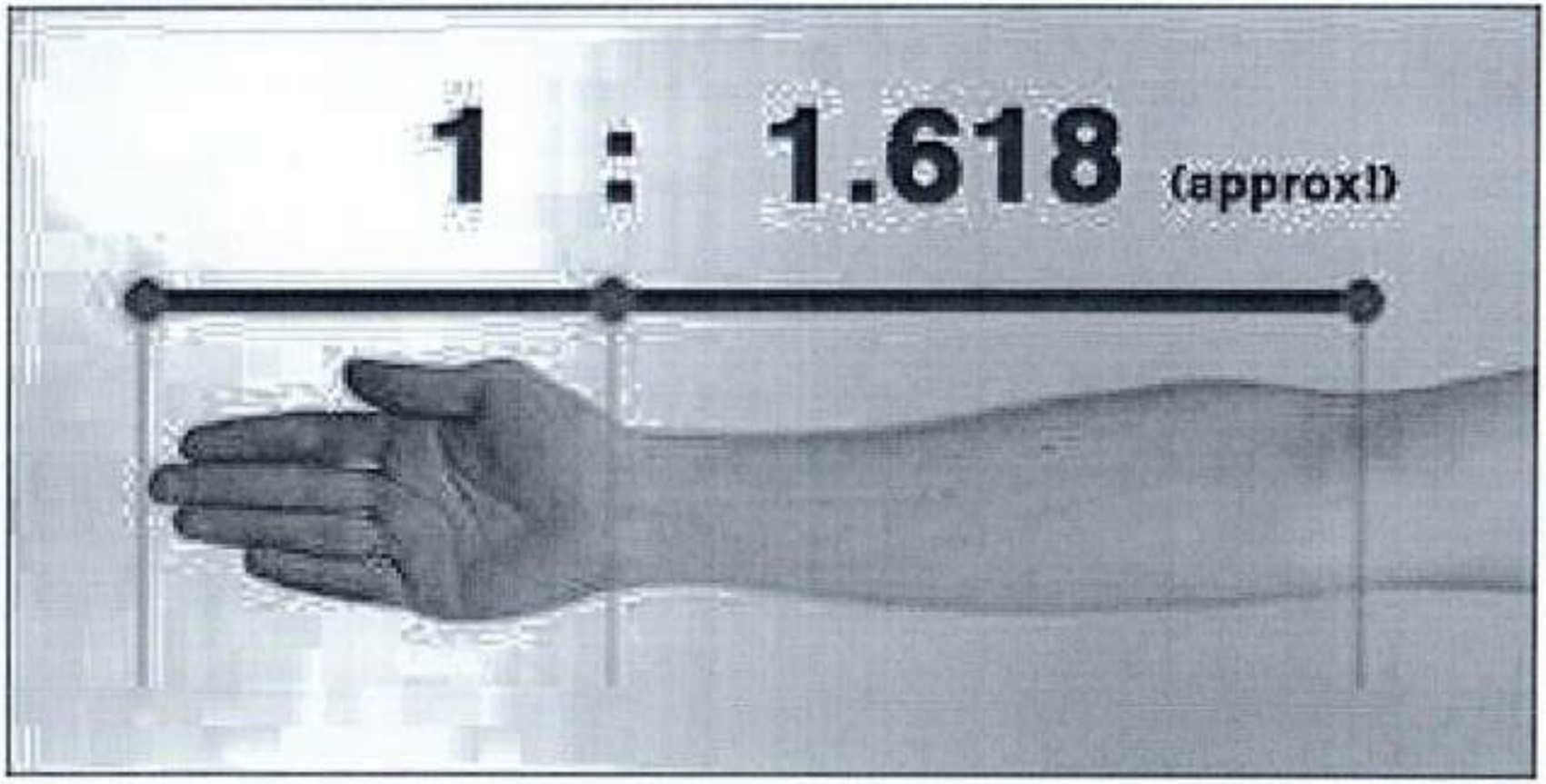
GOLDEN RATIO




b
a
a
$\frac{a+b}{a} = \frac{a}{b} = \varphi = 1.61803$

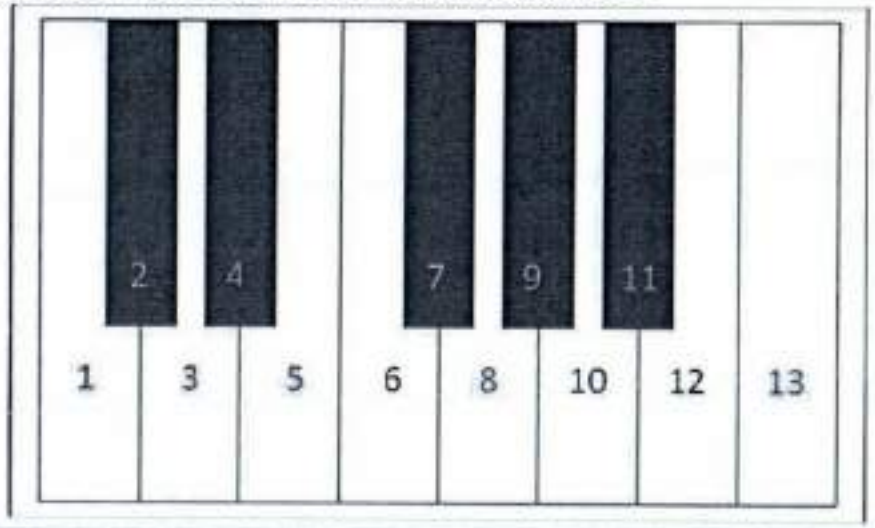

1:1.618

GOLDEN RATIO



FIBONACCI NUMBERS & MUSIC

▪Octave scale: An octave is the interval between a note and the next instance of that same note name on the piano. In the following Fig. an octave interval is from the C on the left to the C on the right of the keyboard. An octave spans 13 notes. For example, an octave starting on C would include C, C#, D, D#, E, F, F#, G, G#, A, A#, B, C. This is called a "chromatic" scale. The interval between two consecutive notes in a chromatic scale is a "semitone" interval. A "whole-tone" interval is twice a semitone interval. The interval between F and G in Fig. 1 is a whole-tone. "Major" and "minor" scales span 8 notes in one octave, with a mixture of semitones and whole-tones.



DEPARTMENT OF MATHEMATICS
PATTAMUNDAI COLLEGE
PATTAMUNDAI

Affiliated to Utkal University, Bhubaneswar,Odisha

Certificate of Participation

This is to certify that Mr./Ms./Mrs. Lisa Simpson of Springfield Elementary has actively participated in the National Webinar on **'NUMBER SEQUENCES & MUSINGS ON MOBIUS MAPS'** organized by Department of Mathematics, Pattamundai College, Pattamundai, Kendrapara, Odisha.

Date:10th November 2020, Certificate No-CE0123456

Sri A. Pandab	Prof. P. K. Ray	Dr T. Nayak	Prof. A.L.N. Dash
Convenor	Resource Person	Resource Person	Principal

Participants present in the National Webinar on " Number Sequences and Musings on Mobius Maps" at 10.00 am on 10.11.20

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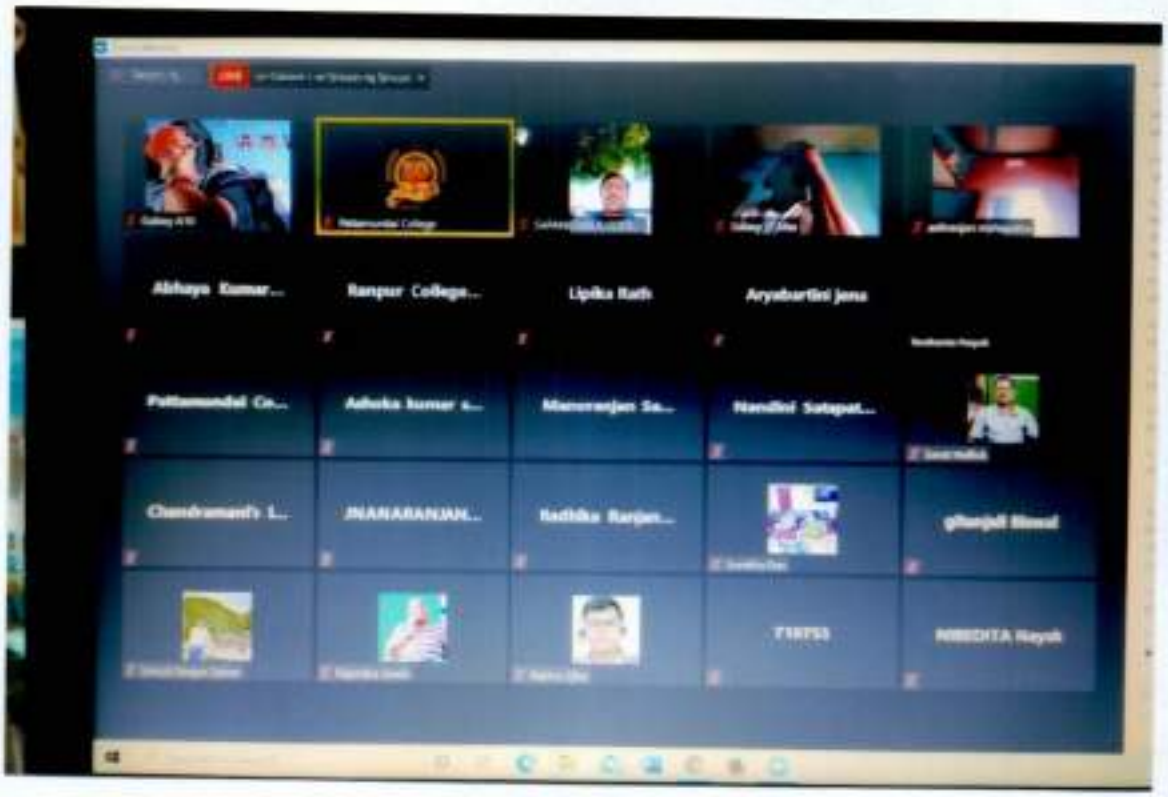
Abhaya Kumar...
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Aryadarsini Jena
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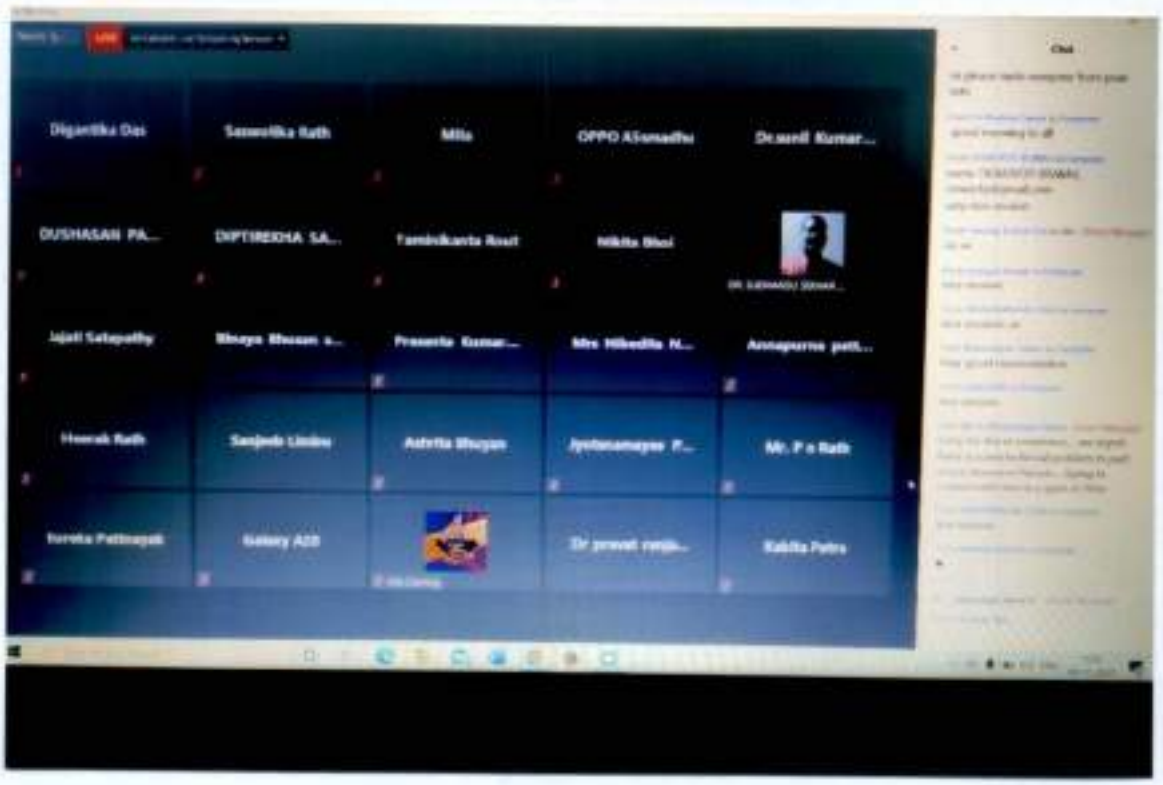
Digantika Das
Saswatika Rath
Mita
OPPO A5smadhu
Dr.sunil Kumar...
DUSHASAN PA...
DIPTIREKHA SA...
Tamishkanta Rout
Nikita Bisi
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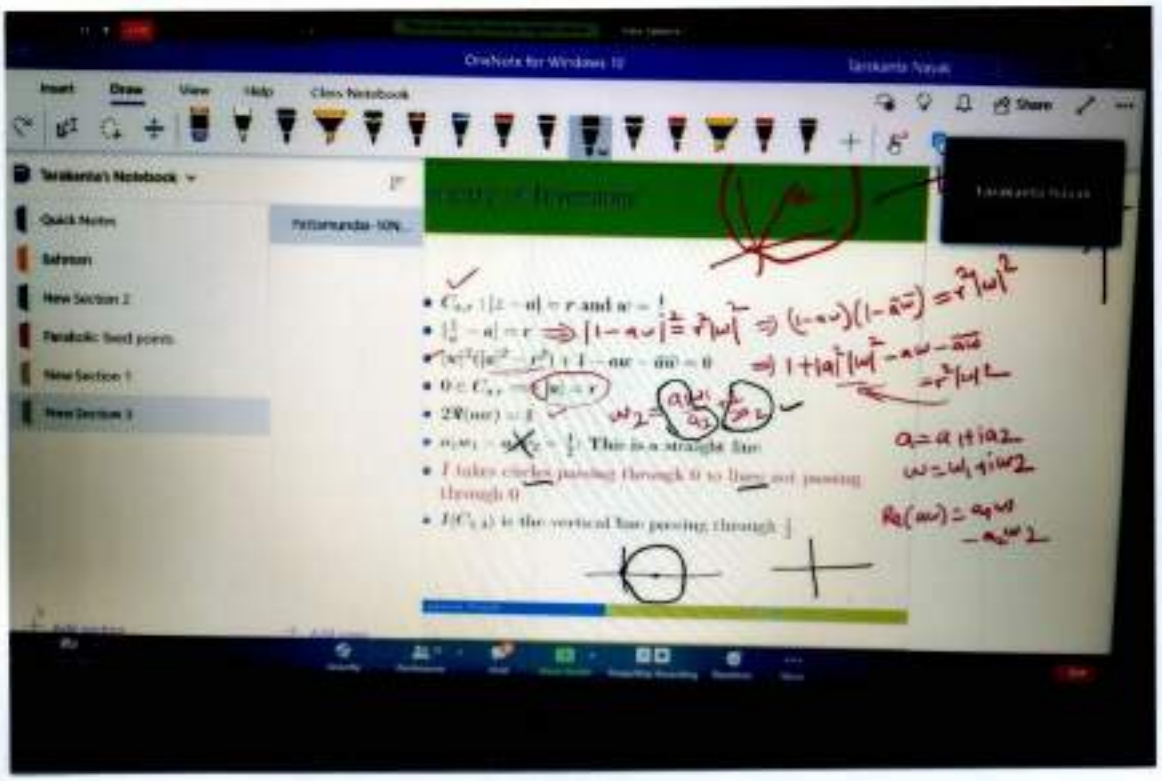
Galaxy A20
Rakita Patra

Technical Session –I

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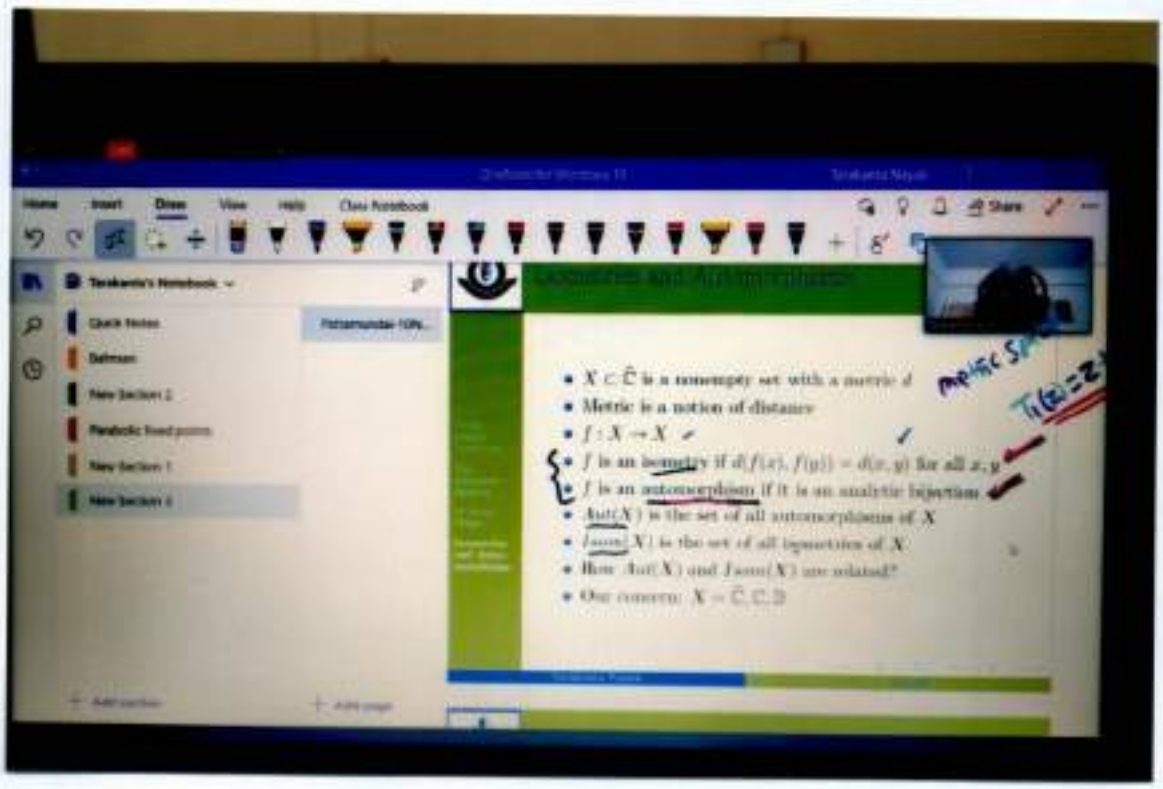
Möbius maps
August Ferdinand Möbius, a German Mathematician
Astronomer (17 Nov 1790–26 Sept 1868)
$f : \hat{\mathbb{C}} \to \hat{\mathbb{C}}$ defined by $f(z) = \frac{az+b}{cz+d}$, $ad - bc \neq 0$
$f(\frac{-d}{c}) = \infty$, $f(\infty) = \frac{a}{c}$
f is bijection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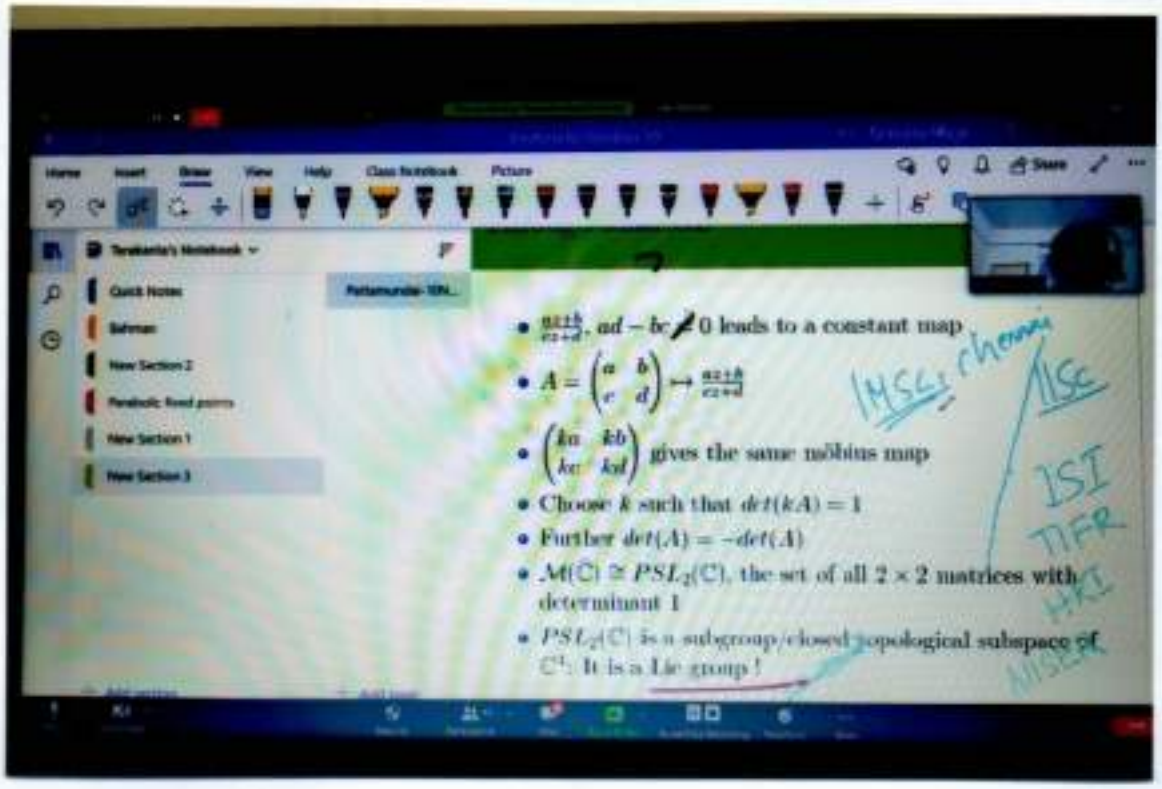
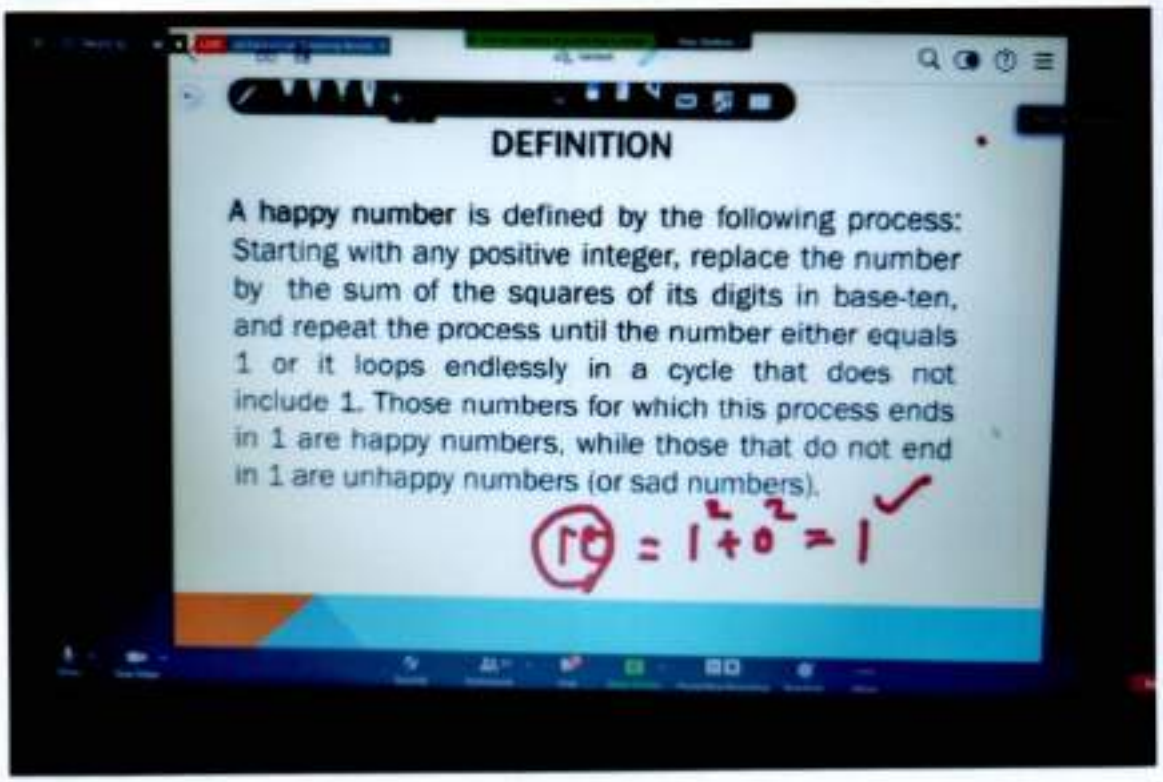
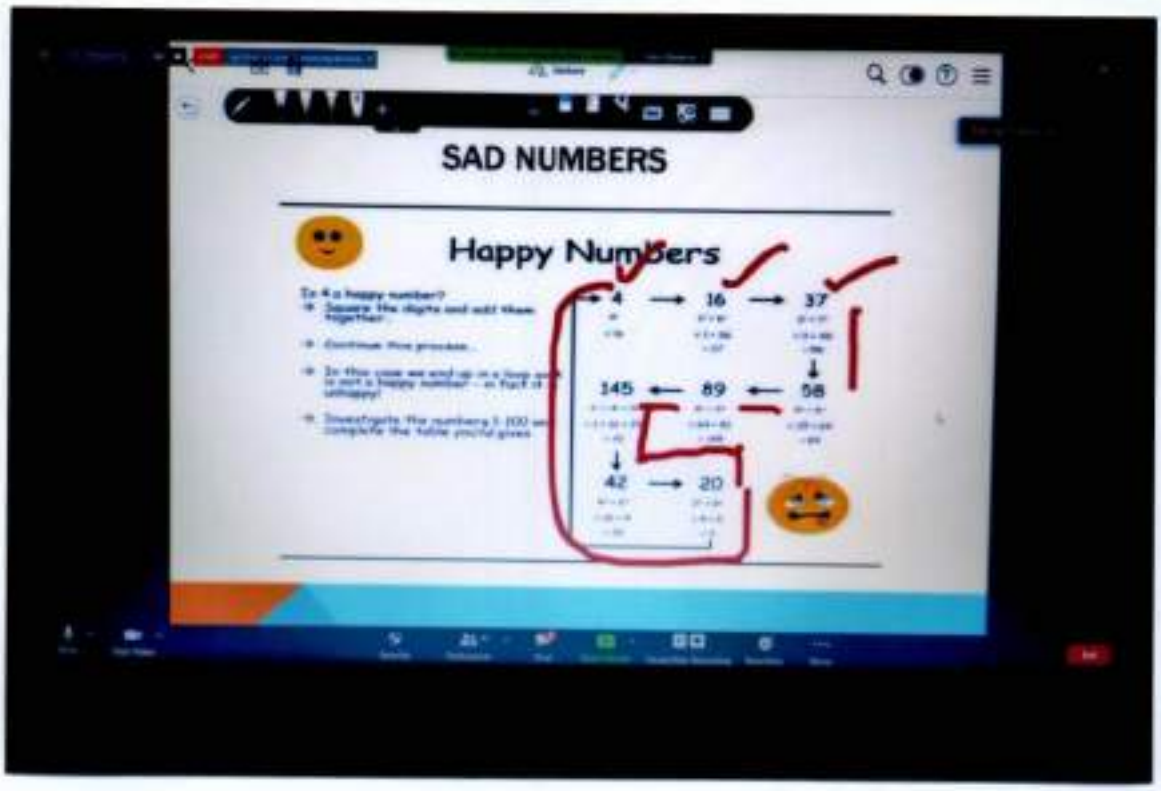
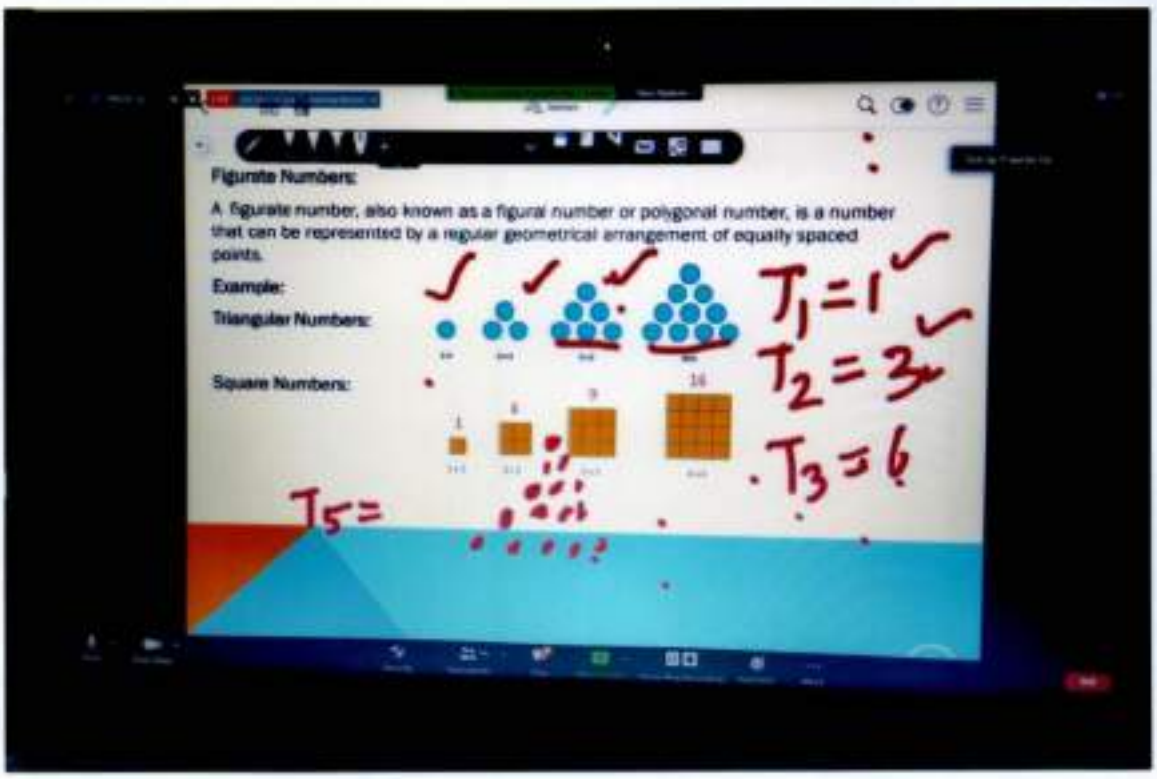
New Section 3
$X \subset \hat{\mathbb{C}}$ is a nonempty set with a metric d
Metric is a notion of distance
$f : X \to X$
f is an isometry if $d(f(x), f(y)) = d(x, y)$ for all x, y
f is an automorphism if it is an analytic bijection
$Aut(X)$ is the set of all automorphisms of X
$Isom(X)$ is the set of all isometries of X
How $Aut(X)$ and $Isom(X)$ are related?
One concern: $X = \hat{\mathbb{C}}, \mathbb{C}, \mathbb{D}$

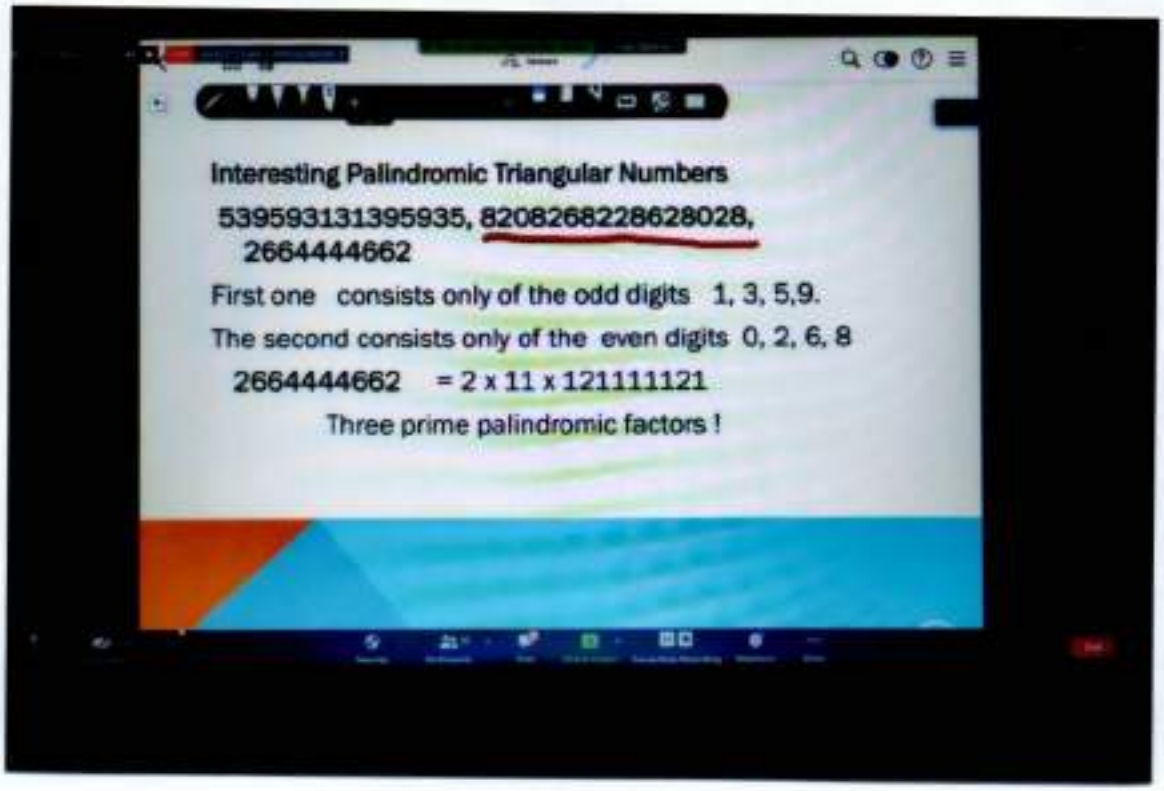


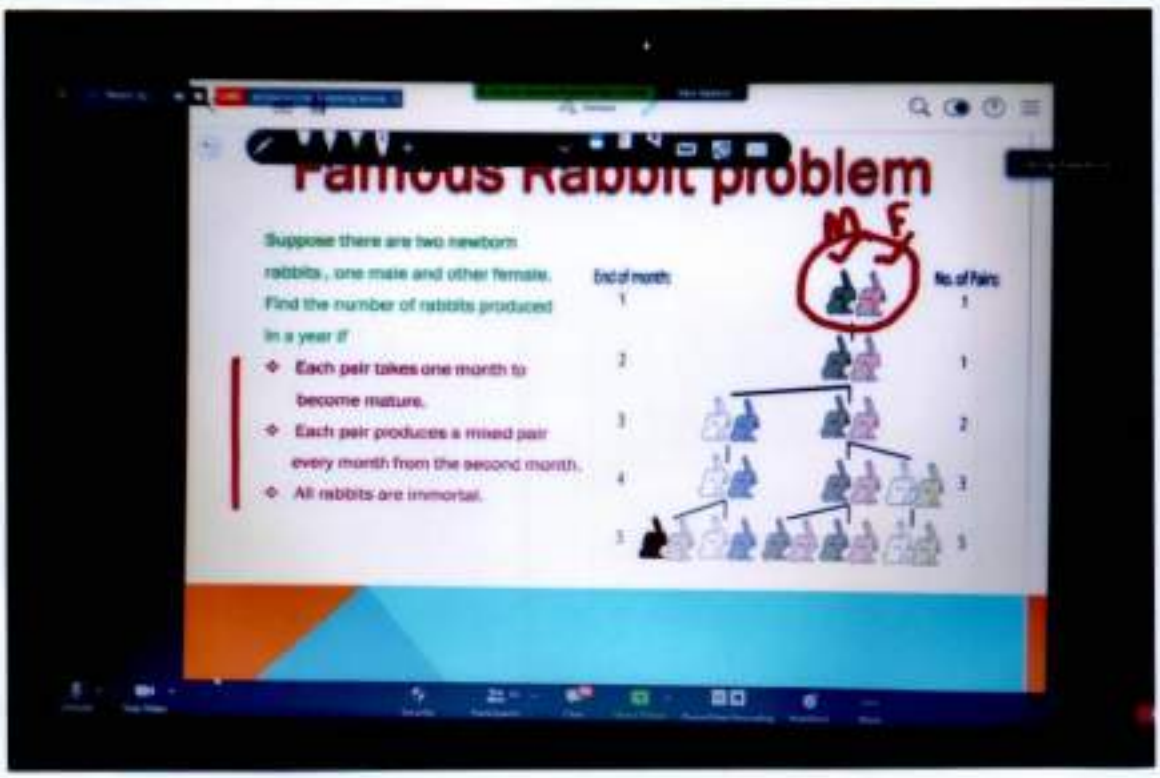
Technical Session –II




SAD NUMBERS
Happy Numbers
4 → 16 → 37
145 ← 89 ← 58
42 → 20


Figurate Numbers:
A figurate number, also known as a figural number or polygonal number, is a number that can be represented by a regular geometrical arrangement of equally spaced points.
Example:
Triangular Numbers:
Square Numbers:
$T_1 = 1$
$T_2 = 3$
$T_3 = 6$
$T_5 =$


Interesting Palindromic Triangular Numbers
539593131395935, 8208268228628028,
2664444662
First one consists only of the odd digits 1, 3, 5,9.
The second consists only of the even digits 0, 2, 6, 8
2664444662 = 2 x 11 x 121111121
Three prime palindromic factors !


Famous Rabbit problem
Suppose there are two newborn rabbits , one male and other female.
Find the number of rabbits produced in a year if
Each pair takes one month to become mature.
Each pair produces a mixed pair every month from the second month.
All rabbits are immortal.
End of month
No. of Pairs
M
F

ପଟାମୁଣ୍ଡାଇ କଲେଜ ଗଣିତ ବିଭାଗ ୱେବିନାର

ପଟାମୁଣ୍ଡାଇ, ୧୦।୧୧ (ନି.ପ୍ର.): ପଟାମୁଣ୍ଡାଇ କଲେଜ ଗଣିତ ବିଭାଗ ପକ୍ଷରୁ ନମ୍ରତା ବିହ୍ୟୁଏବ୍ଲ ଏବଂ ମୁସିଙ୍ଗଅନ ମୁଭିଅସ ମ୍ୟାପ ଶୀର୍ଷକ ଜାତୀୟ ୱେବିନାର ଉପରେ ଅଧ୍ୟକ୍ଷ ପ୍ରଫେସର ଅନୁକୂଳ ଚନ୍ଦ୍ରାକାର ମହାଶୟଙ୍କ ଅଧ୍ୟକ୍ଷତାରେ ଅନୁଷ୍ଠିତ ହୋଇଯାଇଛି । ଏଥିରେ ସମ୍ବଲପୁର ବିଶ୍ୱବିଦ୍ୟାଳୟର ପ୍ରଫେସର ପ୍ରଶାନ୍ତକୁମାର ନାୟକ ଓ ଭୁବନେଶ୍ୱର ଆଇଆଇଟି ଗବେଷଣା ପ୍ରଫେସର ଜଗାନାନ୍ତ ନାୟକ ପ୍ରମୁଖ ଗଣିତରେ ନମ୍ରତା ବିହ୍ୟୁଏବ୍ଲର ବୈନଇନ ଜାଦନର ପ୍ରୟୋଗ ଉପରେ ଆଲୋକପାତ କରିଥିଲେ । ଏଥିସହିତ ସୂଚ୍ଚ ଜଟଯୋଗୀ ଗଣିତ ମୁସିଙ୍ଗଅ ଅନ ମୁଭିଅସ ମ୍ୟାପ ଫଂପର୍କରେ ବିଶ୍ଳେଷଣ କରିବା ସହିତ ଏହାର ଗ୍ରାଫ ପ୍ରଦର୍ଶନ ବିଜ୍ଞାନର ଉପଯୋଗିତା ସମ୍ପର୍କରେ ତୋଲି ପ୍ରକାଶ କରିଥିଲେ । ପଟାମୁଣ୍ଡାଇ କଲେଜ ଗଣିତ ବିଭାଗ ମୁଖ୍ୟ ଅଧ୍ୟାପକ ଅରବିନ୍ଦ ପାଣ୍ଡବ ସ୍ୱାଗତ ଭାଷଣ, କାର୍ଯ୍ୟକ୍ରମ ସଂପର୍କରେ ସୂଚନା ତେତା ସହିତ ଅତିଥିପରିଚୟ ପ୍ରଦାନ କରିଥିଲେ । ଅଧ୍ୟାପକ ଡା. ନିର୍ମଳକୁମାର ସାହୁ ଧନ୍ୟବାଦ ଦେଇଥିଲେ । ଏହି କାର୍ଯ୍ୟକ୍ରମକୁ ଅଧ୍ୟାପିକା ନିରୁପମା ସାହୁ, ଅଧ୍ୟାପକ ଶୁଭାଶୀଷ ମିଶ୍ର, ସରୋଜକୁମାର ସାହୁ ଓ ରାଜନକୁମାର ବେହୁରା ପ୍ରମୁଖ ପରିଚାଳନା କରିଥିଲେ । ଏହି ଜାତୀୟ ୱେବିନାରରେ ବିଭିନ୍ନ ରାଜ୍ୟର ପ୍ରଫେସର, ପ୍ରଧ୍ୟାପକ/ପ୍ରଧ୍ୟାପିକା, ଅଧ୍ୟାପକ/ଅଧ୍ୟାପିକା, ଛାତ୍ରଛାତ୍ରୀ ଯୋଗଦେଇଥିଲେ ।

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ପଞ୍ଚାମୁଣ୍ଡାଇ କଲେଜ ଗଣିତ ବିଭାଗ ପକ୍ଷରୁ ଜାତୀୟ ୱେବିନାର୍

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ଗଣିତ ବିଭାଗର ୱେବିନାର

• ଢେଙ୍କାନାଳ,ଡିସେମ୍ବର ଢେଙ୍କାନାଳର ନବଜୀବନ ମହିଳା ବିଜ୍ଞାନ ମହାବିଦ୍ୟାଳୟ ଜମ୍ମୁର ସିଦ୍ଧାର୍ଥ ଏବଂ ମୁଖିଜାପନ ମୁଦିତାସ ମହାବିଦ୍ୟାଳୟ ଗାର୍ଡିଲ ଜାତୀୟ ୱେବିନାର ଜରୋଜ ଅଧ୍ୟକ୍ଷ ପ୍ରଫେସର ଅଜୁକୁମାର ଲକ୍ଷ୍ମିନାରାୟଣ ସାହୁଙ୍କ ଘୋଗଦିଜ୍ୟରେ ଅନୁଷ୍ଠିତ ହୋଇଯାଇଛି । ଏଥିରେ ଜମ୍ମୁସ୍ଥିତ ବିଶ୍ୱବିଦ୍ୟାଳୟର ପ୍ରଫେସର ପ୍ରଶାନ୍ତ କୁମାର ଓ ଭୁବନେଶ୍ୱର ଥାଇଆଇଟି ସହଯୋଗୀ ପ୍ରଫେସର ଡାରାକାନ୍ତ କୁମାର ପ୍ରମୁଖ ଯୋଗଦେଇ ଗଣିତରେ ଜମ୍ମୁର ବିଜ୍ଞାନଗତ ଦୈନନ୍ଦିନ ଜୀବନର ପ୍ରୟୋଗ ଉପରେ ଆଲୋକପାତ କରିଥିଲେ । ଏଥି ସହ ଯୁକ୍ତ ଗଣଯୋଗୀ ଗଣିତ ମୁଖିଜାପ ଅନ୍ତ ମୁଦିତାସ ମହାବିଦ୍ୟାଳୟ ବିଭାଗରେ ବିଶ୍ୱେଷଣ ହରିଦ୍ୟା ସହିତ ଏହାର ଗ୍ରାଫ ପ୍ରୟୋଗ ବିଜ୍ଞାନର ଉପଯୋଗିତା ମାପଯାଇ ବୋଲି ପ୍ରକାଶ କରିଥିଲେ । ଢେଙ୍କାନାଳ ନବଜୀବନ ଗଣିତ ବିଭାଗ ମୁଖ୍ୟ ଅଧ୍ୟାପକ ଅରବିନ୍ଦ ପାଣ୍ଡବ ସ୍ୱାଗତଭାଷଣ ଦେଇଥିଲେ। ଅଧ୍ୟାପକ ଡ. ନିର୍ମଳକୁମାର ସାହୁ ଧନ୍ୟବାଦ ଦେଇଥିଲେ। ଏହି ଜାତୀୟସ୍ତରୀୟ ଅଧିବେଶନକୁ ଅଧ୍ୟାପିକା ନିହାରିକା ସାହୁ, ଅଧ୍ୟାପକ ଶୁଭାଶୀଷ ମିଶ୍ର, ସରୋଜ ସାହୁ ଓ ଗଣେଶ ବେହୁରା ପ୍ରମୁଖ ପରିଚାଳନା କରିଥିଲେ । ଏହି ଜାତୀୟ ୱେବିନାରରେ ବିଭିନ୍ନ ରାଜ୍ୟର ପ୍ରଫେସର, ପ୍ରାଧ୍ୟାପକ/ପ୍ରାଧ୍ୟାପିକା, ଅଧ୍ୟାପକ/ଅଧ୍ୟାପିକା, ଛାତ୍ରଛାତ୍ରୀ ଯୋଗଦେଇଥିଲେ।

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