ALU SCHOOL OF MATHEMATICS

ALU MATHS NEWS

Volume 1, Issue 3 **News Letter** *Since 04/07/2016*

We are delighted to bring to you this issue of ALU Mathematics News, a monthly newsletter dedicated to the emerging field of Mathematics. This is the first visible —output from the Department of Mathematics, Alagappa University. We are committed to make ALU Mathematics News a continuing and effective vehicle to promote communication, education and networking, as well as stimulate sharing of research, innovations and technological developments in the field. However, we would appreciate your feedback regarding how we could improve this publication and enhance its value to the community. We are keen that this publication eventually grows beyond being a mere —news letter to become an invaluable information resource for the entire Mathematics community, and look forward to your inputs to assist us in this endeavor.

Dr. N. Anbazhagan

MATHEMATICS

Mathematics may be defined as “the study of relationships among quantities, magnitudes, and properties may be deduced” or “ the study of quantity , structure, space and change”.

Historically, it was regarded as the science of quantity, whether of magnitudes(as in geometry) or of numbers (as in arithmetic) or of the generalization of these two fields (as in algebra). Some have seen it in terms as simple as a search for patterns.

During the 19th Century, however, mathematics broadened to encompass mathematical or symbolic logic, and thus came to be regarded increasingly as the science of relations or of drawing necessary conclusions(although some see even this as too restrictive).

The discipline of mathematics now covers-in addition to the more or less standard fields of number theory, algebra, geometry, analysis(calculus), mathematical logic and set theory , and more applied mathematics such as probability theory and statistics- a bewildering array of specialized areas and fields of study , including group theory, order theory, knot theory, sheaf theory, topology, differential geometry, fractal geometry, graph theory, functional analysis, complex analysis, singularity theory, catastrophe theory, chaos theory, measure theory, model theory, category theory, control theory, game theory, complexity theory and many more.

Some Mathematicians list and their achievement

Date	Name	Major Achievements
35000 BCE		First notched tally bones
3100 BCE		Earliest documented counting and measuring system
2700 BCE		Earliest fully-developed base 10 number system in use
2600 BCE		Multiplication tables, geometrical exercises and division problems
2000-1800 BCE		Earliest papyri showing numeration system and basic arithmetic
1800-1600 BCE		Clay tablets dealing with fractions, algebra and equations
1650 BCE		Rhind Papyrus (instruction manual in arithmetic, geometry, unit fractions, etc)
1200 BCE		First decimal numeration system with place value concept
1200-900 BCE		Early Vedic mantras invoke powers of ten from a hundred all the way up to a trillion
800-400 BCE		"Sulba Sutra" lists several Pythagorean triples and simplified Pythagorean theorem for the sides of a square and a rectangle, quite accurate approximation to $\sqrt{2}$
650 BCE		Lo Shu order three (3 x 3) "magic square" in which each row, column and diagonal sums to 15
624-	Thales	Early developments in

546 BCE		geometry, including work on similar and right triangles
570-495 BCE	Pythagoras	Expansion of geometry, rigorous approach building from first principles, square and triangular numbers, Pythagoras' theorem
500 BCE	Hippasus	Discovered potential existence of irrational numbers while trying to calculate the value of $\sqrt{2}$
490-430 BCE	Zeno of Elea	Describes a series of paradoxes concerning infinity and infinitesimals
470-410 BCE	Hippocrates of Chios	First systematic compilation of geometrical knowledge, Lune of Hippocrates
460-370 BCE	Democritus	Developments in geometry and fractions, volume of a cone
428-348 BCE	Plato	Platonic solids, statement of the Three Classical Problems, influential teacher and popularizer of mathematics, insistence on rigorous proof and logical methods
410-355 BCE	Eudoxus of Cnidus	Method for rigorously proving statements about areas and volumes by successive approximations
384-322 BCE	Aristotle	Development and standardization of logic (although not then considered part of mathematics) and deductive reasoning
300 BCE	Euclid	Definitive statement of classical (Euclidean) geometry, use of axioms and postulates, many formulas, proofs and theorems including Euclid's Theorem on infinitude of primes
287-212 BCE	Archimedes	Formulas for areas of regular shapes, "method of exhaustion" for approximating areas and value of π, comparison of infinities
276-195 BCE	Eratosthenes	"Sieve of Eratosthenes" method for identifying prime numbers
262-190 BCE	Apollonius of Perga	Work on geometry, especially on cones and conic sections (ellipse, parabola, hyperbola)
200 BCE		"Nine Chapters on the Mathematical Art", including guide to how to solve equations using sophisticated matrix-based methods
190-120 BCE	Hipparchus	Develop first detailed trigonometry tables
36 BCE		Pre-classic Mayans developed the concept of zero by at least this time
10-70 CE	Heron (or Hero) of Alexandria	Heron's Formula for finding the area of a triangle from its side lengths, Heron's Method for iteratively computing a square root
90-	Ptolemy	Develop even more

168 CE		detailed trigonometry tables
200 CE	Sun Tzu	First definitive statement of Chinese Remainder Theorem
200 CE		Refined and perfected decimal place value number system
200-284 CE	Diophantus	Diophantine Analysis of complex algebraic problems, to find rational solutions to equations with several unknowns
220-280 CE	Liu Hui	Solved linear equations using a matrices (similar to Gaussian elimination), leaving roots unevaluated, calculated value of π correct to five decimal places, early forms of integral and differential calculus
400 CE		"Surya Siddhanta" contains roots of modern trigonometry, including first real use of sines, cosines, inverse sines, tangents and secants
476-550 CE	Aryabhata	Definitions of trigonometric functions, complete and accurate sine and versine tables, solutions to simultaneous quadratic equations, accurate approximation for π (and recognition that π is an irrational number)
598-668	Brahmagupta	Basic mathematical rules for dealing with zero (+, - and x), negative numbers, negative roots of quadratic equations, solution of quadratic equations with two unknowns
600-680 CE	Bhaskara I	First to write numbers in Hindu-Arabic decimal system with a circle for zero, remarkably accurate approximation of the sine function
780-850 CE	Muhammad Al-Khwarizmi	Advocacy of the Hindu numerals 1 - 9 and 0 in Islamic world, foundations of modern algebra, including algebraic methods of "reduction" and "balancing", solution of polynomial equations up to second degree
908-946 CE	Ibrahim ibn Sinan	Continued Archimedes' investigations of areas and volumes, tangents to a circle
953-1029 CE	Muhammad Al-Karaji	First use of proof by mathematical induction, including to prove the binomial theorem
966-1059 CE	Ibn al-Haytham (Alhazen)	Derived a formula for the sum of fourth powers using a readily generalizable method, "Alhazen's problem", established beginnings of link between algebra and geometry
1048-1131	Omar Khayyam	Generalized Indian methods for extracting square and cube roots to include fourth, fifth and

		higher roots, noted existence of different sorts of cubic equations
1114-1185	Bhaskara II	Established that dividing by zero yields infinity, found solutions to quadratic, cubic and quartic equations (including negative and irrational solutions) and to second order Diophantine equations, introduced some preliminary concepts of calculus
1170-1250	Leonardo of Pisa (Fibonacci)	Fibonacci Sequence of numbers, advocacy of the use of the Hindu-Arabic numeral system in Europe, Fibonacci's identity (product of two sums of two squares is itself a sum of two squares)
1201-1274	Nasir al-Din al-Tusi	Developed field of spherical trigonometry, formulated law of sines for plane triangles
1202-1261	Qin Jiushao	Solutions to quadratic, cubic and higher power equations using a method of repeated approximations
1238-1298	Yang Hui	Culmination of Chinese "magic" squares, circles and triangles, Yang Hui's Triangle (earlier version of Pascal's Triangle of binomial co-efficients)
1267-1319	Kamal al-Din al-Farisi	Applied theory of conic sections to solve optical problems, explored amicable numbers, factorization and combinatorial methods
1350-1425	Madhava	Use of infinite series of fractions to give an exact formula for π, sine formula and other trigonometric functions, important step towards development of calculus
1323-1382	Nicole Oresme	System of rectangular coordinates, such as for a time-speed-distance graph, first to use fractional exponents, also worked on infinite series
1446-1517	Luca Pacioli	Influential book on arithmetic, geometry and book-keeping, also introduced standard symbols for plus and minus
1499-1557	Niccolò Fontana Tartaglia	Formula for solving all types of cubic equations, involving first real use of complex numbers (combinations of real and imaginary numbers), Tartaglia's Triangle (earlier version of Pascal's Triangle)
1501-1576	Gerolamo Cardano	Published solution of cubic and quartic equations (by Tartaglia and Ferrari), acknowledged existence of imaginary numbers (based on $\sqrt{-1}$)
1522-1565	Lodovico Ferrari	Devised formula for solution of quartic equations
1550-	John Napier	Invention of natural

1617		logarithms, popularized the use of the decimal point, Napier's Bones tool for lattice multiplication
1588-1648	Marin Mersenne	Clearing house for mathematical thought during 17th Century, Mersenne primes (prime numbers that are one less than a power of 2)
1591-1661	Girard Desargues	Early development of projective geometry and "point at infinity", perspective theorem
1596-1650	René Descartes	Development of Cartesian coordinates and analytic geometry (synthesis of geometry and algebra), also credited with the first use of superscripts for powers or exponents
1598-1647	Bonaventura Cavalieri	"Method of indivisibles" paved way for the later development of infinitesimal calculus
1601-1665	Pierre de Fermat	Discovered many new numbers patterns and theorems (including Little Theorem, Two-Square Thereom and Last Theorem), greatly extending knowlege of number theory, also contributed to probability theory
1616-1703	John Wallis	Contributed towards development of calculus, originated idea of number line, introduced symbol ∞ for infinity, developed standard notation for powers
1623-1662	Blaise Pascal	Pioneer (with Fermat) of probability theory, Pascal's Triangle of binomial coefficients
1643-1727	Isaac Newton	Development of infinitesimal calculus (differentiation and integration), laid ground work for almost all of classical mechanics, generalized binomial theorem, infinite power series
1646-1716	Gottfried Leibniz	Independently developed infinitesimal calculus (his calculus notation is still used), also practical calculating machine using binary system (forerunner of the computer), solved linear equations using a matrix
1654-1705	Jacob Bernoulli	Helped to consolidate infinitesimal calculus, developed a technique for solving separable differential equations, added a theory of permutations and combinations to probability theory, Bernoulli Numbers sequence, transcendental curves
1667-1748	Johann Bernoulli	Further developed infinitesimal calculus, including the "calculus of variation", functions for curve of fastest descent (brachistochrone) and

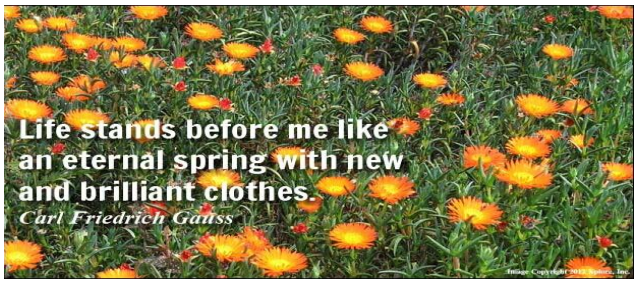
		catenary curve
1667-1754	Abraham de Moivre	De Moivre's formula, development of analytic geometry, first statement of the formula for the normal distribution curve, probability theory
1690-1764	Christian Goldbach	Goldbach Conjecture, Goldbach-Euler Theorem on perfect powers
1707-1783	Leonhard Euler	Made important contributions in almost all fields and found unexpected links between different fields, proved numerous theorems, pioneered new methods, standardized mathematical notation and wrote many influential textbooks
1728-1777	Johann Lambert	Rigorous proof that π is irrational, introduced hyperbolic functions into trigonometry, made conjectures on non-Euclidean space and hyperbolic triangles
1736-1813	Joseph Louis Lagrange	Comprehensive treatment of classical and celestial mechanics, calculus of variations, Lagrange's theorem of finite groups, four-square theorem, mean value theorem
1746-1818	Gaspard Monge	Inventor of descriptive geometry, orthographic projection
1749-1827	Pierre-Simon Laplace	Celestial mechanics translated geometric study of classical mechanics to one based on calculus, Bayesian interpretation of probability, belief in scientific determinism
1752-1833	Adrien-Marie Legendre	Abstract algebra, mathematical analysis, least squares method for curve-fitting and linear regression, quadratic reciprocity law, prime number theorem, elliptic functions
1768-1830	Joseph Fourier	Studied periodic functions and infinite sums in which the terms are trigonometric functions (Fourier series)
1777-1825	Carl Friedrich Gauss	Pattern in occurrence of prime numbers, construction of heptadecagon, Fundamental Theorem of Algebra, exposition of complex numbers, least squares approximation method, Gaussian distribution, Gaussian function, Gaussian error curve, non-Euclidean geometry, Gaussian curvature
1789-1857	Augustin-Louis Cauchy	Early pioneer of mathematical analysis, reformulated and proved theorems of calculus in a rigorous manner, Cauchy's theorem (a fundamental

		theorem of group theory)
1790-1868	August Ferdinand Möbius	Möbius strip (a two-dimensional surface with only one side), Möbius configuration, Möbius transformations, Möbius transform (number theory), Möbius function, Möbius inversion formula
1791-1858	George Peacock	Inventor of symbolic algebra (early attempt to place algebra on a strictly logical basis)
1791-1871	Charles Babbage	Designed a "difference engine" that could automatically perform computations based on instructions stored on cards or tape, forerunner of programmable computer.
1792-1856	Nikolai Lobachevsky	Developed theory of hyperbolic geometry and curved spaces independendly of Bolyai
1802-1829	Niels Henrik Abel	Proved impossibility of solving quintic equations, group theory, abelian groups, abelian categories, abelian variety
1802-1860	János Bolyai	Explored hyperbolic geometry and curved spaces independently of Lobachevsky
1804-1851	Carl Jacobi	Important contributions to analysis, theory of periodic and elliptic functions, determinants
		and matrices
1805-1865	William Hamilton	Theory of quaternions (first example of a non-commutative algebra)
1811-1832	Évariste Galois	Proved that there is no general algebraic method for solving polynomial equations of degree greater than four, laid groundwork for abstract algebra, Galois theory, group theory, ring theory, etc
1815-1864	George Boole	Devised Boolean algebra (using operators AND, OR and NOT), starting point of modern mathematical logic, led to the development of computer science
1815-1897	Karl Weierstrass	Discovered a continuous function with no derivative, advancements in calculus of variations, reformulated calculus in a more rigorous fashion, pioneer in development of mathematical analysis
1821-1895	Arthur Cayley	Pioneer of modern group theory, matrix algebra, theory of higher singularities, theory of invariants, higher dimensional geometry, extended Hamilton's quaternions to create octonions
1826-1866	Bernhard Riemann	Non-Euclidean elliptic geometry, Riemann surfaces, Riemannian geometry (differential geometry in multiple

		dimensions), complex manifold theory, zeta function, Riemann Hypothesis
1831-1916	Richard Dedekind	Defined some important concepts of set theory such as similar sets and infinite sets, proposed Dedekind cut (now a standard definition of the real numbers)
1834-1923	John Venn	Introduced Venn diagrams into set theory (now a ubiquitous tool in probability, logic and statistics)
1842-1899	Marius Sophus Lie	Applied algebra to geometric theory of differential equations, continuous symmetry, Lie groups of transformations
1845-1918	Georg Cantor	Creator of set theory, rigorous treatment of the notion of infinity and transfinite numbers, Cantor's theorem (which implies the existence of an "infinity of infinities")
1848-1925	Gottlob Frege	One of the founders of modern logic, first rigorous treatment of the ideas of functions and variables in logic, major contributor to study of the foundations of mathematics
1849-1925	Felix Klein	Klein bottle (a one-sided closed surface in four-dimensional space), Erlangen Program to classify geometries by their underlying symmetry groups, work on group theory and function theory
1854-1912	Henri Poincaré	Partial solution to "three body problem", foundations of modern chaos theory, extended theory of mathematical topology, Poincaré conjecture
1858-1932	Giuseppe Peano	Peano axioms for natural numbers, developer of mathematical logic and set theory notation, contributed to modern method of mathematical induction
1861-1947	Alfred North Whitehead	Co-wrote "Principia Mathematica" (attempt to ground mathematics on logic)
1862-1943	David Hilbert	23 "Hilbert problems", finiteness theorem, "Entscheidungsproblem" (decision problem), Hilbert space, developed modern axiomatic approach to mathematics, formalism
1864-1909	Hermann Minkowski	Geometry of numbers (geometrical method in multi-dimensional space for solving number theory problems), Minkowski space-time
1872-1970	Bertrand Russell	Russell's paradox, co-wrote "Principia Mathematica" (attempt to ground mathematics on logic), theory of types
1877-	G.H. Hardy	Progress toward solving

1947		Riemann hypothesis (proved infinitely many zeroes on the critical line), encouraged new tradition of pure mathematics in Britain, taxicab numbers
1878-1929	Pierre Fatou	Pioneer in field of complex analytic dynamics, investigated iterative and recursive processes
1881-1966	L.E.J. Brouwer	Proved several theorems marking breakthroughs in topology (including fixed point theorem and topological invariance of dimension)
1887-1920	Srinivasa Ramanujan	Proved over 3,000 theorems, identities and equations, including on highly composite numbers, partition function and its asymptotics, and mock theta functions
1893-1978	Gaston Julia	Developed complex dynamics, Julia set formula
1903-1957	John von Neumann	Pioneer of game theory, design model for modern computer architecture, work in quantum and nuclear physics
1906-1978	Kurt Gödel	Incompleteness theorems (there can be solutions to mathematical problems which are true but which can never be proved), Gödel numbering, logic and set theory
1906-1998	André Weil	Theorems allowed connections between algebraic geometry and number theory, Weil conjectures (partial proof of Riemann hypothesis for local zeta functions), founding member of influential Bourbaki group
1912-1954	Alan Turing	Breaking of the German enigma code, Turing machine (logical forerunner of computer), Turing test of artificial intelligence
1913-1996	Paul Erdös	Set and solved many problems in combinatorics, graph theory, number theory, classical analysis, approximation theory, set theory and probability theory
1917-2008	Edward Lorenz	Pioneer in modern chaos theory, Lorenz attractor, fractals, Lorenz oscillator, coined term “butterfly effect”
1919-1985	Julia Robinson	Work on decision problems and Hilbert's tenth problem, Robinson hypothesis
1924-2010	Benoît Mandelbrot	Mandelbrot set fractal, computer plottings of Mandelbrot and Julia sets
1928-2014	Alexander Grothendieck	Mathematical structuralist, revolutionary advances

		in algebraic geometry, theory of schemes, contributions to algebraic topology, number theory, category theory, etc
1928-2015	John Nash	Work in game theory, differential geometry and partial differential equations, provided insight into complex systems in daily life such as economics, computing and military
1934-2007	Paul Cohen	Proved that continuum hypothesis could be both true and not true (i.e. independent from Zermelo-Fraenkel set theory)
1937-	John Horton Conway	Important contributions to game theory, group theory, number theory, geometry and (especially) recreational mathematics, notably with the invention of the cellular automaton called the "Game of Life"
1947-	Yuri Matiyasevich	Final proof that Hilbert's tenth problem is impossible (there is no general method for determining whether Diophantine equations have a solution)
1953-	Andrew Wiles	Finally proved Fermat's Last Theorem for all numbers (by proving the Taniyama-Shimura conjecture for semistable elliptic curves)
1966-	Grigori Perelman	Finally proved Poincaré Conjecture (by proving Thurston's geometrization conjecture), contributions to Riemannian geometry and geometric topology



MATHEMEMATICS IN LIFE

Success is the problem – but
Failure is the formula
We can't solve the problem
Without knowing the formula.

WHO AM I?

I am an 8 letter word. First 4 is your identity. Last 4 may be average, good or

excellent but the last 2 are ok. 2,3,4 can't be beaten.

Ans:

First 4 is your identity = Face

Last 4 may average, good or excellent } = Book

Last 2 words = ok

2,3,4 can't be be beaten = ace

Therefore, the answer is FACEBOOK.

WHAT COMES AFTER A MILLION?

Billion, Trillion, Quadrillion, Quintillion, Sextillion, Septillion, Octillion, Nonillion, Decillion and Undecillion.

BEAUTY OF MATHEMATICS

98765432 × 9 + 0 = 888888888
9876543 × 9 + 1 = 88888888
987654 × 9 + 2 = 8888888
98765 × 9 + 3 = 888888
9876 × 9 + 4 = 88888
987 × 9 + 5 = 8888
98 × 9 + 6 = 888
9 × 9 + 7 = 88

MATH JOKE

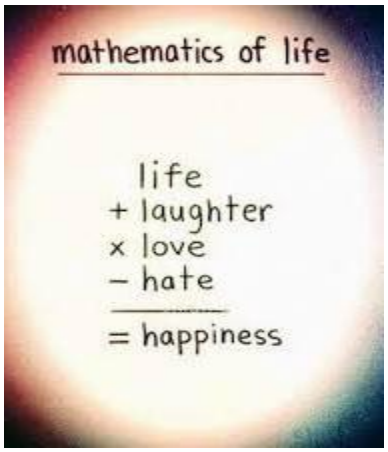
After explaining to a student through various lessons and examples that:

$$\lim_{x \to 8} \frac{1}{x-8} = \infty$$

I tried to check if she really understood that, so I gave her a different example. This was the result:

$$\lim_{x \to 5} \frac{1}{x-5} = \text{in}$$

MATHEMATICS QUOTES



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