MATHEMATICA

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Department of Mathematics
Pragjyotish College, Guwahati

Edited by
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CONTENT

THE BUTTERFLY EFFECT

Mrigen Das, B.Sc. First Semester

Nearly 45 years ago, during the 139th meeting of the American Association for the Advancement of Science, Edward Lorenz posed a question: “Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?”

Lorenz was a mild-mannered Massachusetts Institute of Technology meteorology professor.

The purpose of his provocative question was to illustrate the idea that some complex dynamical systems exhibit unpredictable behaviours such that small variances in the initial conditions could have profound and widely divergent effects on the system’s outcomes. Because of the sensitivity of these systems, outcomes are unpredictable. This idea became the basis for a branch of mathematics known as chaos theory, which has been applied in countless scenarios since its introduction. This idea was later named “the butterfly effect”.

Lorenz’s insight called into question laws introduced as early as 1687 by Sir Isaac Newton suggesting that nature is a probabilistic mechanical system, “a clockwork universe." Similarly, Lorenz challenged Pierre-Simon Laplace, who argued that unpredictability has no place in the universe, asserting that if we knew all the physical laws of nature, then “nothing would be uncertain and the future, as the past, would be present to our eyes.”

Lorenz discovered the butterfly effect when he observed that runs of his weather model with initial condition data that were rounded in a seemingly inconsequential manner. He noted that the weather model would fail to reproduce the results of runs with the unrounded initial condition data. A very small change in initial conditions had created a significantly different outcome.


The phrase “the flap of a butterfly’s wings in Brazil set off a tornado in Texas” refers to the idea that a butterfly's wings might create tiny changes in the atmosphere that may ultimately alter the path of a tornado or delay, accelerate or even prevent the occurrence of a tornado in another location. The butterfly does not power or directly create the tornado, but the term is intended to imply that the flap of the butterfly's wings can *cause* the tornado: in the sense that the flap of the wings is a part of the initial conditions of an inter-connected complex web; one set of conditions leads to a tornado while the other set of conditions doesn't. The flapping wing represents a small change in the initial condition of the system, which cascades to large-scale alterations of events. Had the butterfly not flapped its wings, the trajectory of the system might have been vastly different but it's also equally possible that the set of conditions without the butterfly flapping its wings is the set that leads to a tornado.

Here are some examples of how the butterfly effect has shaped our lives.

- **The bombing of Nagasaki.** The US initially intended to bomb the Japanese city of Kuroko, with the munition's factory as a target. On the day the US planned to attack, cloudy weather conditions prevented the factory from being seen by military personnel as they flew overhead. The airplane passed over the city three times before the pilots gave up. Locals huddled in shelters heard the hum of the airplane preparing to drop the nuclear bomb and prepared for their destruction.

Except Kuroko was never bombed. Military personnel decided on Nagasaki as the target due to improved visibility. The implications of that split-second decision were monumental. We cannot even begin to comprehend how different history might have been if that day had not been cloudy. Kuroko is sometimes referred to as the luckiest city in Japan, and those who lived there during the war are still shaken by the near-miss.

- **The Academy of Fine Arts in Vienna rejecting Adolf Hitler's application, twice.** In the early 1900s, a young Hitler applied for art school and was rejected, possibly by a Jewish professor. By his own estimation and that of scholars, this rejection went on to shape his metamorphosis from an aspiring bohemian artist into the human manifestation of evil. We can only speculate as to how history would have been different. But it is safe to assume that a great deal of tragedy could have been avoided if Hitler had applied himself to water colours, not to genocide.

From these examples it is clear how fragile the world is, and how dire the effects of tiny events can be on starting conditions.

We like to think we can predict the future and exercise a degree of control over powerful systems such as the weather and the economy. Yet the butterfly effect shows that we cannot. The systems around us are chaotic and entropic, prone to sudden change. For some kinds of systems, we can try to create favourable starting conditions and be mindful of the kinds of catalysts that might act on those conditions but that's as far as our power extends. If we think that we can identify every catalyst and control or predict outcomes, we are only deluding ourselves.

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EVERYTHING IS A NUMBER: PYTHAGORAS'S CLAIM AND HYSTORY BEHIND THE FAMOUS "PYTHAGORAS THEOREM"

Madhurjya Borkotoky

B.Sc. 3rd Semester

What is Mathematics? Mathematics is the science that deals with the logic of shape, quantity and arrangement. Math is all around us, in everything we do. It is the building, block for everything in our daily lives, including mobile devices, architecture (ancient and modern), art, money, engineering, and even sports. What is Music? Music is an art form, and a cultural activity, whose medium is sound. General definitions of music include common elements such as pitch (which governs melody and harmony) rhythm (and its associated concepts tempo, meter and articulation), dynamics (loudness and softness), and the sonic qualities of timbre and texture (which are sometimes termed the "color" of a musical sound). Different styles or types of music may emphasize, de-emphasize or omit some of these elements. Music is performed with a vast range of instruments and vocal techniques ranging from singing to rapping; there are solely instrumental pieces, solely vocal pieces (such as songs without instrumental accompaniment) and pieces that combine singing and instruments. The word derives from Greek *mousike*; "art of the Muses". See glossary of musical terminology. So it's pretty much clear that Mathematics and Music are two completely different worlds full of fun and knowledge. Although both are two different worlds with different field of study still these two have a relationship between them.

Pythagoras was intrigued by the link between nature and numbers. He realized that natural phenomena are governed by laws and that these laws could be described by mathematical equations. One of the first links he discovered was the fundamental relationship between the harmony of music and the harmony of numbers. The most important instrument in early Hellenic Music was the tetra chord or four-stringed lyre. Once he was engrossed in the thought of whether he could devise a mechanical aid for the sense of hearing which would prove both certain and ingenious. Such an aid would be similar to the compasses, slues and optical instruments designed for the sense of sight. Likewise the sense of touch had seals and the concepts of weights and measures. By some divine stroke of luck he happened to walk past the forge of a blacksmith and listened to the hammers pounding iron and producing a variegated harmony of reverberations between them, except for one combination of sounds. Pythagoras immediately ran into the forge to investigate the harmony of the hammers. He noticed that most of the hammers could be struck simultaneously to generate a harmonious sound, whereas any combination containing one particular hammer always generated an unpleasant noise. He analyzed the hammers and realized that those which were harmonious with each other had a simple mathematical relationship their masses were simple ratios or fractions of each other. That is to say that hammers half, two-thirds or three-quarters the weight of a particular hammer would all generate harmonious sounds. On the other hand, the hammer which was generating disharmony when struck along with any of the other hammers had a weight which bore no simple relationship to the other weights. . Pythagoras had discovered that simple numerical ratios were responsible for harmony in music. Scientists have cast some doubt on how Pythagoras applied his new theory of musical ratios to the lyre by examining the properties of a single string.

Simply plucking the string generates a standard note or tone which is produced by the entire length of the vibrating string. By fixing the string at particular points along its length, it is possible to generate other vibrations and tones, as illustrated in crucially, harmonious tones only occur at very specific points. For example by fixing the string at a point exactly half - way along il, plucking generates a tone which is one octave higher and in harmony with the original tone. Similarly, by fixing the string at points which are exactly a third, a quarter or a fifth of the way along it, other harmonious notes are produced. However, by fixing the string at a point which is not a simple fraction along the length of the whole string, a tone is generated which is not in harmony with the other tones. Pythagoras had uncovered for the first time the mathematical rule which governs a physical phenomenon and demonstrated that there was a fundamental relationship between mathematics and science. Ever since this discovery scientists have searched for the mathematical rules which appear to govern every single physical process and have found that numbers crop up in all manner of natural phenomena. For example, one particular number appears to guide the lengths of meandering rivers. Professor Hans -Henrik Stolum, an earth scientist at Cambridge University, has calculated the ratio between the actual length of rivers from source to mouth and their direct length as the crow flies. . Although the ratio varies from river to river, the average value is slightly greater than 3, it means the actual length is roughly three times greater than the direct distance. In fact the ratio is approximately 3.14, which is close to the value of the numbers, the ratio between the circumference of a circle and its diameter. The number it was originally derived from the geometry of circles and yet it reappears over and over again in a variety of scientific circumstances.

In the case of the river ratio, the appearance of t is the result of a battle between order and chaos. Einstein was the first to suggest that tivers have a tendency towards an ever loopier path because the slightest curve will lead to faster currents on the outer side, which will in turn result in more Crosio and a sharper bend. The sharper the bend, the faster the current on the outer edge, the more the Crosio, the more the river will twist, and so on. However, there is a natural process which will curs tail the chaos: increasing loopiness will result in rivers doubling back on themselves and effectively short - circuiting. The river will become straighter and the loop will be left to one side forming an ox - bow lake. The balance between these two opposing factors leads to an average ratio of between the actual length and the direct distance between source and mouth. The ratio mention above is most commonly found for rivers flowing across very gently sloping plains, such as those found in Brazil or the Siberian tundra. Pythagoras realized that numbers were hidden in from the harmonies of music the orbits of planets, and this led him to proclaim that 'Everything is Number'. By exploring the meaning of mathematics, Pythagoras was developing the language which would enable him and others to describe the nature of the universe. Henceforth each breakthrough in mathematics would give scientists the vocabulary they needed to better explain the phenomena around them. In fact developments in mathematics would inspire revolutions in science. As well as discovering the law of gravity, Isaac Newton was a powerful mathematician. His greatest contribution to mathematics was his development of calculus, and in later years physicists would use the language of calculus to better describe the laws of gravity and to solve gravitational problems.

Newton's classical theory of gravity survived intact for centuries until it was super seeded by Albert Einstein's general theory of relativity, which developed a more detailed and alternative explanation of gravity. Einstein's own ideas were only possible because of new mathematical concepts which provided him with a more sophisticated language for his more complex scientific ideas. Today the inter pretention of gravity is once again being influenced by breakthrough in mathematics. The very latest quantum theories of gravity are tied to the development of mathematical strings, a theory in which the geometrical and topological properties of tubes seem to best explain the forces of nature. Or all the links between numbers and nature studied by the Brotherhood, the most important was the relationship which bears their founder's name. Pythagoras' theorem provides us with an equation which is true of all right - angled triangles and which therefore also defines the right angle itself. In turn, the right angle defines the perpendicular that is the relation of the vertical to the horizontal, and ultimately the relation between the three dimensions of our familiar universe.

Mathematics, via the right angle, defines the very structure of the space in which we live. It is a profound realization and yet the mathematics required to grasp Pythagoras's theorem is relatively simple. To understand it, simply begin by measuring the length of the two short sides right - angled triangle (x and y), and then square each one Then add the two squared numbers (x + y) to give you a number. The remarkable result is that this number is identical to the one you just calculated. That is to say, in a right - angled triangle the square on the hypotenuse is equal to the sum of the squares on the other two sides.

What remarkable is that Pythagoras' theorem is true for every right - angled triangle you can possibly imagine? It is a universal law of mathematics, and you can rely on it whenever you come across any triangle with a right angle. Conversely if you have a triangle which obeys Pythagoras' theorem, then you can be absolutely confident that it is a right - angled triangle. At this point it is important to note that, although this theorem will forever be associated with Pythagoras, it was actually used by the Chinese and the Babylonians one thousand years before However, these cultures did not know that the theorem was true for every right - angled triangle. It was certainly true for the IT angles they tested, but they had no way of showing that it was true for all the right - angled triangles which they had not tested. The first demonstrated its universal truth.

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FIBONACCI SEQUENCE

Mondip Shiwakoti

B.Sc. 1st Semester

In Maths, the sequence is defined as an ordered list of numbers which follows a specific pattern. The numbers present in the sequence are called the terms. The different types of sequences are arithmetic sequence, geometric sequence, harmonic sequence and Fibonacci sequence. In this article, we will discuss the Fibonacci sequence definition, formula, list and examples in detail.

What is Fibonacci Sequence?

The Fibonacci sequence, also known as Fibonacci numbers, is defined as the sequence of numbers in which each number in the sequence is equal to the sum of two numbers before it. The Fibonacci Sequence is given as:

Fibonacci Sequence = 0, 1, 1, 2, 3, 5, 8, 13, 21, ….

Here, the third term "1" is obtained by adding first and second term. Similarly,

"2" is obtained by adding the second and third term (1+1 = 2)

"3" is obtained by adding the third and fourth term (1+2) and so on.

For example, the next term after 21 can be found by adding 13 and 21. Therefore, the next term in the sequence is 34. Fibonacci Sequence Formula

The Fibonacci sequence of numbers "F_n" is defined using the recursive relation with the seed values $F_0 = 0$ and $F_1=1$: $F_n = F_{n-1}+F_{n-2}$

Here, the sequence is defined using two different parts, such as kick-off and recursive relation. The kick-off part is $F_0=0$ and $F_1=1$

The kick-off part is F0=0 and F1=1.

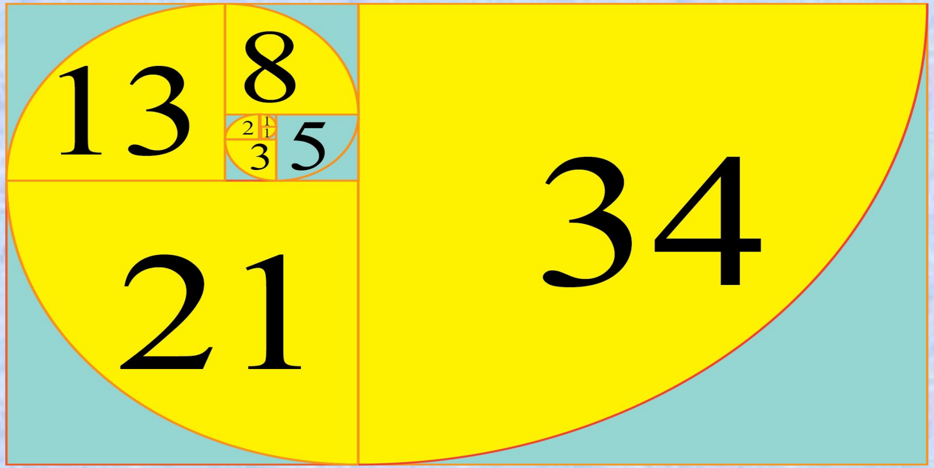
The recursive relation part is Fn = Fn-1+Fn-2.

It is noted that the sequence starts with 0 rather than 1. So, F5 should be the 6th term of the sequence.

Sequence List

The list of first 20 terms in the Fibonacci Sequence is:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181.



Golden Ratio to Calculate Fibonacci Numbers:

The Fibonacci Sequence is closely related to the value of the Golden Ratio. We know that the Golden Ratio value is approximately equal to 1.618034. It is denoted by the symbol “φ”. If we take the ratio of two successive Fibonacci numbers, the ratio is close to the Golden ratio. For example, 3 and 5 are the two successive Fibonacci numbers.

The ratio of 5 and 3 is: $5/3 = 1.6666$

Take another pair of numbers, say 21 and 34, the ratio of 34 and 21 is:
$34/21 = 1.619$

It means that if the pair of Fibonacci numbers are of bigger value, then the ratio is very close to the Golden Ratio.
So, with the help of Golden Ratio, we can find the Fibonacci numbers in the sequence.

The formula to calculate the Fibonacci numbers using the Golden Ratio is:
$Xn = [\varphi n – (1-\varphi)n]/\sqrt{5}$
Where,
φ is the Golden Ratio, which is approximately equal to the value 1.618
n is the nth term of the Fibonacci sequence.

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HISTORY OF REAL NUMBERS

Gyanashree Sharma

B.Sc. 1st Semester

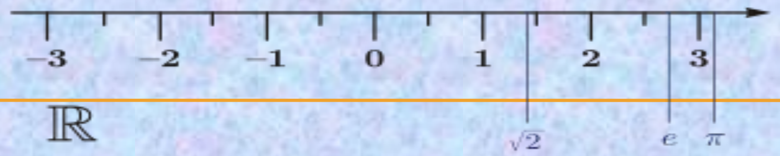
Around 500 BC, the Greek mathematicians led by Pythagoras realized the need for irrational numbers, In particular the irrationality of the square root of 2. Arabic mathematicians merged the concepts of ‘’number‘’ and ‘’magnitude‘’ into a more general idea of real numbers.

Real number, in Mathematics, a quantity that can be expressed as an infinite decimal expansion. Real numbers used in measurements of continuously varying quantities such as size and time, in contrast to the natural numbers 1, 2, 3,…, arising from counting. The word real distinguishes them from the complex numbers involving the symbol i , or -1, used to simplify the mathematical interpretation of effects such as those occurring in electrical phenomena. The real numbers include the positive and negative integers and fractions (or rational numbers) and also the irrationals numbers. The rational numbers have decimal expansions that do not repeat themselves , in contrast to the rational numbers , the expansions of which always content a digit or group of digits that repeat itself, as 1/6 = 0.1666… or 2/7 = 0.285714… The decimal formed as 0.42442444244442… has no regularly repeating group and is does irrational.

The real numbers can be characterized by the important mathematical property of completeness, meaning that every non empty set that has upper bound has smallest such bound, a property not possessed by the rational numbers. For example , the set of all rational numbers the squares of which are less than 2 has no smallest upper bound , because , 2 is not a rational number.

In the 16th century, Simon Stevin created the basis for modern decimal notation, and insisted that there is no difference between rational and irrational **numbers** in this regard. In the 17th century, Descartes introduced the term "**real**" to describe roots of a polynomial, distinguishing them from "imaginary" ones.

In mathematics, a **real number** is a value of a continuous quantity that can represent a distance along a line (or alternatively, a quantity that can be represented as an infinite decimal expansion). The adjective *real* in this context was introduced in the 17th century by René Descartes, who distinguished between real and imaginary roots of polynomials. The real numbers include all the rational numbers, such as the integer −5 and the fraction 4/3, and all the irrational numbers, such as √2 (1.41421356..., the square root of 2, an irrational algebraic number). Included within the irrationals are the transcendental numbers, such as *π* (3.14159265...). In addition to measuring distance, real numbers can be used to measure quantities such as time, mass, energy, velocity, and many more. The set of real numbers is denoted using the symbol **R** or {\displaystyle \mathbb {R} } .
Real numbers can be thought of as points on an infinitely long line called the number line or real line, where the points corresponding to integers are equally spaced. Any real number can be determined by a possibly infinite decimal representation, such as that of 8.632, where each consecutive digit is measured in units one tenth the size of the previous one. The real line can be thought of as a part of the complex plane, and the real numbers can be thought of as a part of the complex numbers.
Real numbers can be thought of as points on an infinitely long number line



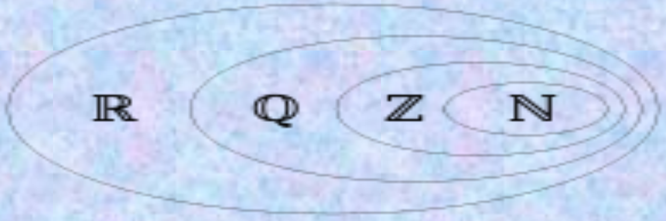
Real numbers can be thought of as points on an infinitely long number line

These descriptions of the real numbers are not sufficiently rigorous by the modern standards of pure mathematics. The discovery of a suitably rigorous definition of the real numbers—indeed, the realization that a better definition was needed—was one of the most important developments of 19th-century mathematics. The current standard axiomatic definition is that real numbers form the unique Dedekind-complete ordered field ({\displaystyle \mathbb {R} } ; + ; · ; <), up to an isomorphism, whereas popular constructive definitions of real numbers include declaring them as equivalence classes of Cauchy sequences (of rational numbers), Dedekind cuts, or infinite decimal representations, together with precise interpretations for the arithmetic operations and the order relation. All these definitions satisfy the axiomatic definition and are thus equivalent.

The set of all real numbers is uncountable, in the sense that while both the set of all natural numbers and the set of all real numbers are infinite sets, there can be no one-to-one function from the real numbers to the natural numbers. In fact, the cardinality of the set of all real numbers, denoted by {\displaystyle {\mathfrak {c}}} and called the cardinality of the continuum, is strictly greater than the cardinality of the set of all natural numbers (denoted {\displaystyle \aleph _{0}} , 'aleph-naught').

The statement that there is no subset of the reals with cardinality strictly greater than {\displaystyle \aleph _{0}} and strictly smaller than {\displaystyle {\mathfrak {c}}} is known as the continuum hypothesis (CH). It is known to be neither provable nor refutable using the axioms of Zermelo–Fraenkel set theory including the axiom of choice (ZFC)—the standard foundation of modern mathematics. In fact, some models of ZFC satisfy CH, while others violate it.

Real numbers fabricated from a rational and irrational number within the mathematical notation. They will be either positive or negative. These denoted by the letter R All the natural numbers, decimals, and fractions come back beneath this class. All arithmetic operations performed on these ranges and that they will be portrayed within the number line, as well. At the identical time, the fanciful numbers are the un-real numbers that cannot be expressed within the range line and usually represent a posh range.



The set of real numbers incorporates different types of numbers, such as natural and whole numbers, integers, rational and irrational numbers. Within the table given below, all these numbers with examples.

Types of Numbers	Meaning	Example
Natural Numbers	Contain all numbers that begin from 1. N = {1,2,3, 4,}	All numbers mean 1, 2, 3, 4,5, 6.
Whole Numbers	Consist of zero and natural numbers. W = {0,1,2, 3,}	All numbers are inclusive of 0 as such 0, 1, 2, 3, 4, 5, 6.
Integers	Are represented by whole numbers and negative of all-natural numbers.	Include: -infinity (-∞), -4, -3, -2, -1, 0, 1, 2, 3, 4, ……+infinity. (+∞)
Rational Numbers	All numbers that are in the form of p/q, where q≠0.	Examples of rational numbers are ½, 5/4, and 12/6, etc.
Irrational Numbers	All the numbers that do not seem to be a rational number and are not in the form of p/q.	Irrational numbers are non-terminating and non-repeating like √2

Properties of real numbers:

There are four main properties of real numbers. They are commutative property, associative property, distributive property, and identity property. Place confidence in, m, n, and r area unit three real numbers. Then the on the highest of properties area unit generally depicted practice m, n, and r as shown below:

Commutative Property

If m and n are the numbers, then the general form will be m + n = n + m for addition and m.n = n.m for multiplication.

Addition: m + n = n + m. For example, 6 + 3 = 3 + 6, 1 + 4 = 4 + 1

Multiplication: m × n = n × m. For example, 5 × 4 = 4 × 5, 2 × 3 = 4 × 3

Associative Property

If m, n and r are the numbers. The general form will be m + (n + r) = (m + n) + r for addition(m n) r = m (nr) for multiplication.

Addition: m + (n + r) = (m + n) + r. An example of an additive associative property is 5 + (3 + 2) = (5 + 3) +2.

Multiplication: (m n) r = m (nr). An example of a multiplicative associative property is (3 × 2) 4 = 3(2 × 4). **Distributive Property**

For three numbers m, n and r, which are real in nature, the distributive property is represented as: m (n + r) = m n + m r and (m + n) r = m r + nr.

Example of distributive property is: 10(2+3) = 10×2 + 10 × 3. Here, both sides will yield 50.

Identity Property

There are additive and multiplicative identities. For addition: m + 0 = m. (0 is the additive identity.) For multiplication: m × 1 = 1 × m = m. (1 is the multiplicative identity.)

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Why Learn Algebra?

Bihung Basumatary
B.Sc. 1st Semester

After all, all of the math leading up to algebra that we learned growing up such as addition, multiplication, decimals, fractions, and the like, seem to have a concrete meaning. These concepts all deal with numbers in some way or another and because of this we can wrap our brains more easily around the concepts. After all, I can pick up six pencils and give two to a friend and by using math I can figure out how many pencils I am left holding in my hand. We can all imagine situations where basic math serves us well - calculating your change in the grocery store for instance.

In short, basic math deals with numbers. Since we are all taught how to count at a young age the concepts of basic math, even though challenging at first, seem to have a practical value - even to children. At the very beginning you are asked to learn certain rules on how to calculate things in algebra. You must learn which steps are legal to do before others, and if you do them in the reverse order you get the wrong answer! This leads to frustration. With frustration, despair follows in short order. And so the thoughts begin: "Why do I need to learn this?" "When would I ever use Algebra in real life?"What you have to remember, though, is that basic math is riddled with special rules and symbols as well. For example, the symbols "+" and "=" were at one time foreign to us all. In addition the concept of adding fractions, as a single example, is filled with special rules that we must learn. When adding 1/3 to 1/3, for example, you keep the common denominator and add the numerators, so that 1/3 + 1/3 = 2/3. The point here is that when you begin to learn algebra it may seem overwhelming with the rules that you must learn, but this is no different from the multitude of rules that you had to learn that dealt with basic math such as addition and subtraction.

Learning Algebra is achievable for all, you just need to take things one step at a time and learn the basic rules before moving on to more advanced topics. But this does not answer the question of "Why should I learn Algebra?" This is a difficult question, but the simplest answer is that Algebra is the beginning of a journey that gives you the skills to solve more complex problems.

What types of problems can you solve using only the skills you learned in Algebra? I suggest you to take a journey with me back to your childhood. We've all been to the playground and had a great time on the see-saw and the slide. Algebra can help you understand them. The physics of all of these playground toys can be completely understood using only Algebra. No Calculus required. For example, if you knew the weight of a person at the top of the slide and you knew the height of the slide you could roughly calculate how fast you would be traveling as you exited the bottom of the slide. On the see-saw, let's say that a person was sitting at one end and you knew that person's weight. You'd like to sit on the other side of the see-saw, but not at the very end - you'd like to sit opposite your partner in the middle between the seat and the pivot point. Using algebra, you could calculate how heavy you'd have to be to exactly balance the see-saw. As children we were all fascinated with the magical way that magnets attract each other. Using algebra, you could calculate how much force a given magnet would pull on another magnet.

Now, you might be thinking, "I never learned how to calculate things such as this in my algebra class!" This is in fact true. All of the applications we have been talking about here are known as the study of Physics. If you had to boil the word Physics down to one sentence it would be: "Physics is all about studying the world around us using math as a tool.“

Simply put all the math that you ever learn is really a tool for understanding the world around us. Algebra is a stepping stone to learning about this wonderful universe that we live in. With it you have the tools to understand a great many things and you also have the skills needed to continue on and learn Trigonometry and Calculus which are essential for exploring other types of problems and phenomena around us. So, try not to think of Algebra as a boring list of rules and procedures to memorize. Consider algebra as a gateway to exploring the world around us all.

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INDIAN MATHEMATICIAN, SRINIVASA RAMANUJAN

KOUSTAV MANI DEKA

B. Sc 1st Semester

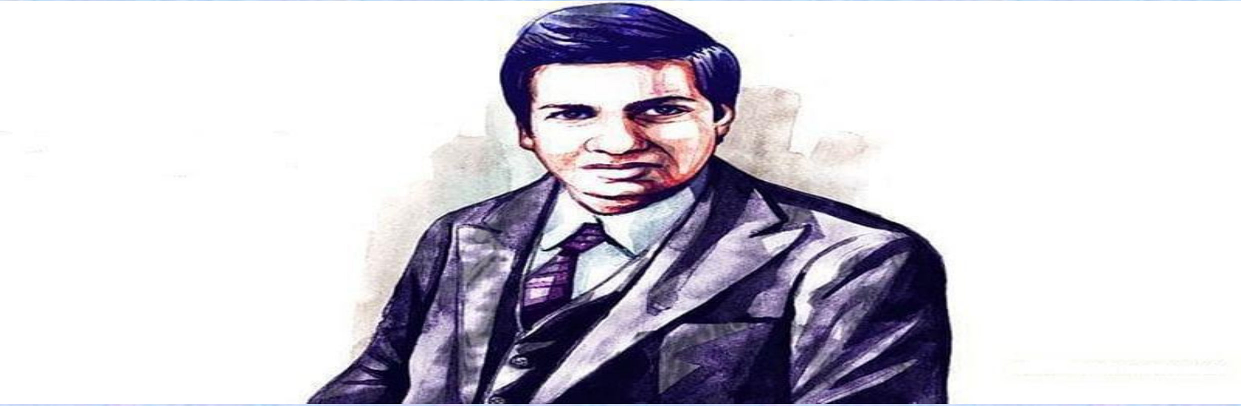
Srinivasa Ramanujan Aiyangar (December 22, 1887 – April 26, 1920) was an Indian mathematician. He is considered to be one of the most talented mathematicians in recent history. His father's name was Kuppuswami and mother's name was Komalatammal. On 1st October 1892 Ramanujan was enrolled at local school. He did not like school so he tried to avoid attending. He had no formal training in mathematics. However, he has made a large contribution to number theory, infinite series and continued fractions.

Srinivāsa Rāmānujan (1887-1920) Born December 22, 1887 Erode, Tamil Nadu, India Died April 26, 1920 (cause His death was most likely caused by hepatic amoebiasis caused by liver parasites common in Madras. His body was cremated. Sadly, some of Ramanujan's Brahmin relatives refused to attend his funeral because he had traveled overseas . He died afterwards. Chetput, (Chennai), Tamil Nadu, India Nationality: Indian Alma mater: University of Cambridge Known for: Landau-Ramanujan constant Ramanujan-Soldner constant Ramanujan theta function Rogers-Ramanujan identities Ramanujan prime Mock theta functions Ramanujan's Number that is 1729 Ramanujan's sum

SCIENTIFIC CAREER

Fields: Mathematician

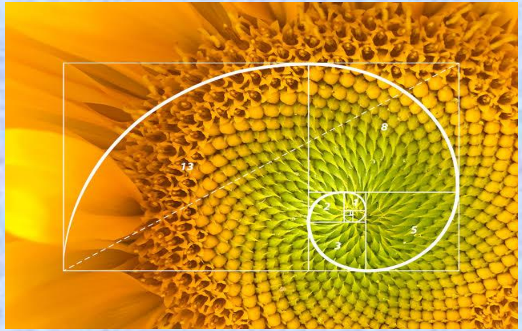
Doctoral advisor: G. H. Hardy and J. E. Littlewood He was mentored by G. H. Hardy in the early 1910s. After getting his degree at Cambridge, Ramanujan did his own work. He compiled over 3500 identities and equations in his life. Some of the identities were found in his "lost notebook". When the notebook was discovered, mathematicians proved almost all of Ramanujan's work. His discoveries have led to many advancements in mathematics. His formulas are now being used in crystallography and string theory. In 2011, Ramanujan's birthday was made an annual "National Mathematics Day" by Prime Minister Manmohan Singh.



THE REPEATING PATTERN

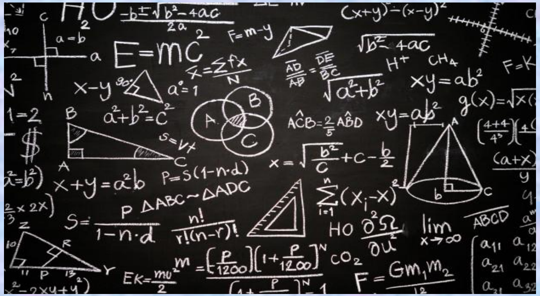
Rajat Debnath
B.Sc. 1st Semester

I wonder with what the nature is embedded
The blooming flowers
The aligning stars,
The flying vultures
And the indefinite numbers.



All follows its own definite pattern.

The current that flows
the energy that rolls
and time that goes
are stored in the universe where we belong
having laws of its own.



The laws that govern them,
Are well explained by math and physics
We are here to feel the nature
And to learn mathematics

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ANALYTIC GEOMETRY

Vivek Jha

B.Sc 1st semester

Analytic Geometry is a branch of algebra, a great invention of Descartes and Fermat, which deals with the modelling of some geometrical objects, such as lines, points, curves, and so on. It is a mathematical subject that uses algebraic symbolism and methods to solve the problems. It establishes the correspondence between the analytic and the geometric curves. The alternate term which is used to represent the analytic geometry is "coordinate Geometry".

It covers some important topics such as midpoints and distance, parallel and perpendicular lines on the coordinate plane, dividing line segments, distance between the line and a point, and so on. The study of analytic geometry is important as it gives the knowledge for the next level of mathematics. It is the traditional way of learning the logical thinking and the problem solving skills. In this article, let us discuss the terms used in the analytic geometry, formulas, cartesian plane, analytic geometry in three dimensions, its applications, and some solved problems.

What is Analytic Geometry?

Analytic geometry is that branch of Algebra in which the position of the point on the plane can be located using an ordered pair of numbers called as Coordinates. This is also called coordinate geometry or the cartesian geometry. Analytic geometry is a contradiction to the synthetic geometry, where there is no use of coordinates or formulas. It is considered axiom or assumptions, to solve the problems Coordinate geometry has its use in both two dimensional and three-dimensional geometry. It is used to represent geometrical shapes

. Let us learn the terminologies used in analytic geometry, such as;

- Plane
- Coordinates

PLANES

To understand how analytic geometry is important and useful, First, We need to learn what a plane is? If a flat surface goes on infinitely in both the directions, it is called a Plane. So, if you find any point on this plane, it is easy to locate it using Analytic Geometry. You just need to know the coordinates of the point in X and Y plane. Coordinates Coordinates are the two ordered pair, which defines the location of any given point in a plane. Let's understand it with the help of the box below.

	A	B	C
1			
2	x		
3			

In the above grid, The columns are labelled as A, B, C, and the rows are labelled as 1, 2, 3.

The location of letter x is B2 i.e. Column B and row 2. So, B and 2 are the coordinates of this box, x.

As there are several boxes in every column and rows, but only one box has the point x, and we can find its location by locating the intersection of row and column of that box.

There are different types of coordinates in analytical geometry. Some of them are as follows:

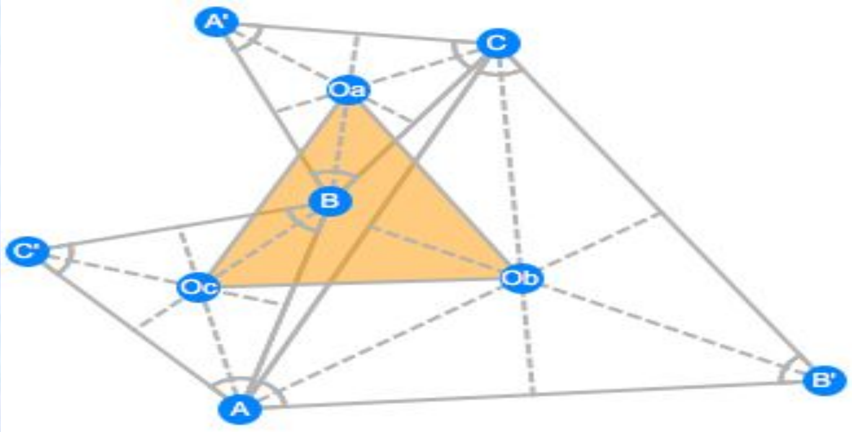
- Cartesian Coordinates
- Polar Coordinates
- Cylindrical Coordinates
- Spherical Coordinates

Analytic Geometry Application

Analytic geometry is widely used in the fields such as Engineering and Physics. Also, it is widely used in the fields such as space science, rocket science, aviation, space flights and so on.

Analytical geometry has made many things possible like the following:

- We can find whether the given lines are perpendicular or parallel.
- We can determine the mid-point, equation, and slope of the line segment.
- We can find the distance between the points.
- We can also determine the perimeter of the area of the polygon formed by the points on the plane.
- Define the equations of ellipse, curves, and circles.



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VEDIC MATHEMATICS

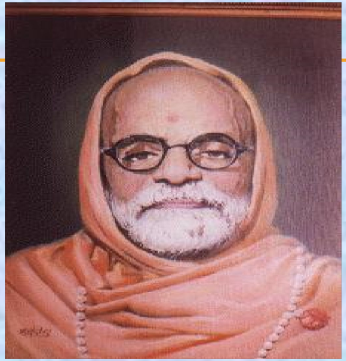
Nitushree Ray

B.Sc. 1st Semester

The astonishing system of calculation originally born in the Vedic Age and was deciphered during the start of the 20th century, is what we know as Vedic Mathematics. It is the ancient system of Indian Mathematics which was rediscovered from the Vedas between 1911 and 1918 by Sri Bharati Krishna Tirthaji (1884-1960).

According to his research all of mathematics is based on sixteen Sutras, or word-formulae. It is a super fast way of calculation whereby you can do supposedly complex calculations like 12121232 x 11 in less than five seconds flat. It is highly beneficial for school and college students and students who are appearing for their entrance examinations. Vedic Mathematics is far more systematic, simplified and unified than the conventional system. It is a mental tool for calculation that encourages the development and use of intuition and innovation, while giving the student a lot of flexibility, fun and satisfaction. Gives you a competitive edge, a way to optimize your performance and gives you an edge in mathematics and logic that will help you to shine in the classroom and beyond. It complements the Mathematics curriculum conventionally taught in schools by acting as a powerful checking tool and goes to save precious time in examinations. There are just 16 Jaw-Dropping Sutras or Word Formulae which solve all known mathematical problems in the branches of Arithmetic, Algebra, Geometry and Calculus. They are easy to understand, easy to apply and easy to remember.

Father of Vedic Mathematics



Sri Bharati Krishna Tirthaji

It was founded by Swami Sri Bharati Krishna Tirthaji Maharaja who was the Sankaracharya (Monk of the Highest Order) of Govardhan Matha in Puri. They are called “Vedic” as because the sutras are said to be contained in the Atharva Veda – a branch of mathematics and engineering in the Ancient Indian Scriptures. 16 Sutras and 13 Upasutras.

Significance of Vedic Mathematics

- Vedic Mathematics is 10-15 times faster than normal Maths.
- Better and Much Improved Academic Performance in school and Instant Results.

- Sharpens your mind, increases mental agility and intelligence.
- A Complete System comprising all the benefits of Mental Maths.
- Increases visualization and concentration abilities.
- Vedic Mathematics cultivates an interest for numbers and eliminates the math-phobia present in the students.
- Vedic Maths is easy to understand, easy to apply and easy to remember.
- Increases your speed and accuracy. Become a Mental Calculator yourself.
- Improves memory and boosts self confidence. t reduces the burden of remembering large amount of stuff because it requires you to learn tables up to 9 only.
- It enables faster calculations when compared to the conventional method. Thus, the time that gets saved in the process can be used to answer more questions
- It acts as a tool for reducing finger counting and scratch work.
- It plays an important role in increasing concentration as well as improving confidence.
- It is very simple, direct, totally unconventional, original and straight forward.
- It encourages mental calculations.

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Where is Maths ?

Bikash Mahaseth

B.Sc. 3rd Semester

Maths is in my heart,
In my brain in my vein.
……….
We can see it in a triangle ,
In a circle , in a plain…
In a vehicle , in a train,
In an empty vessel or in a crane.
……..
Maths is everywhere
In my heart in my brain.
……..
Teacher taught us maths,
Maths taught us life,

A life full of number ,

And numbers with no end,

Pi has a beginning but it never goes to end.

..

Mean is the average ,

Everest is the highest,

Highest mean 1st ,

Aryabhatta was the only one who give 0 very fast.

…….

I is imaginary.

This world full of lies ,

People asked , where we use maths?

Everywhere , we see from our naked eyes.

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The Fibonacci Sequence: When Maths Turns Golden

Komal Kumari

B.Sc. 5th Semester

Fibonacci Sequence has captivated Mathematicians, artists, designers, and scientists for centuries. Wondering what's so special about it?

Let us begin with the history. The original problem that Leonardo Fibonacci investigated (in the year 1202) was about how fast rabbits could breed in ideal circumstances. Suppose a newly-born pair of rabbits, one male, and one female are put in a field. Rabbits are able to mate at the age of one month so that at the end of its second month, a female can produce another pair of rabbits. Suppose that our rabbits never die and that the female always produces one new pair (one male, one female) every month from the second month on. The puzzle that Fibonacci posed was...How many pairs will there be in one year?

At the end of the first month, they mate, but there is still one only 1 pair. At the end of the second month, the female produces a new pair, so now there are 2 pairs of rabbits in the field. At the end of the third month, the original female produces a second pair, making 3 pairs in all in the field. At the end of the fourth month, the original female has produced yet another new pair, the female born two months ago produces her first pair also, making 5 pairs.

Can you see the pattern here? 1, 1, 2, 3, 5, 8, 13, 21, 34……

The solution, generation by generation, was a sequence of numbers later known as Fibonacci numbers. Fibonacci Sequence is a set of numbers that start with a one, followed by a one, and proceeds based on the rule that each number is equal to the sum of the preceding two numbers.

The Fibonacci numbers can be thought of as Nature's numbering system. They appear everywhere in Nature, from the leaf arrangement in plants to the pattern of the florets of a flower, the bracts of a pinecone, or the scales of a pineapple. The Fibonacci numbers are therefore applicable to the growth of every living thing, including a single cell, a grain of wheat, a hive of bees, and even all of mankind. In the seeming randomness of the natural world, we can find many instances of a Mathematical order involving the Fibonacci numbers themselves and the closely related "Golden" elements.

Let's add one more interesting thing here: If we take the ratio of two successive numbers in Fibonacci's series, (1, 1, 2, 3, 5, 8, 13, ..) and we divide each by the number before it, we will find the following series of numbers:

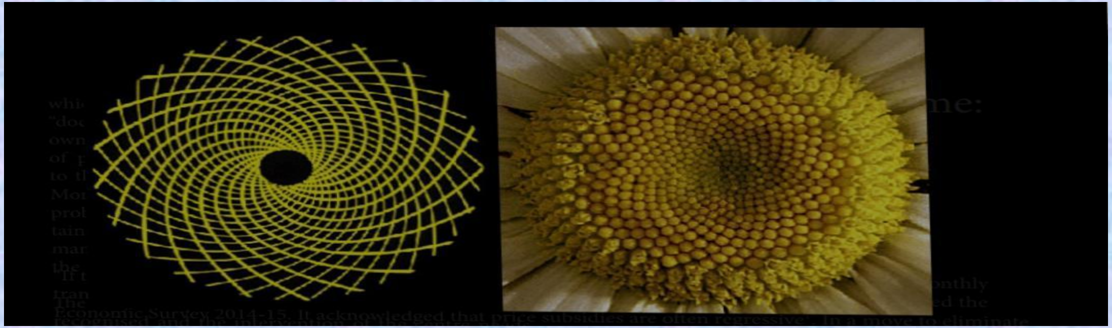
1/1 = 1, 2/1 = 2, 3/2 = 1·5, 5/3 = 1·666..., 8/5 = 1·6, 13/8 = 1·625, 21/13 = 1·61538...

The ratio seems to be settling down to a particular value, which we call the 'golden ratio' or 'the golden number'. It has a value of approximately 1·618034 and we denote it by "Phi".

Now, let's get acquainted with some of the endless examples that make Fibonacci a wonder or 'Golden' sequence.

Flower petals: The number of petals in a flower consistently follows the Fibonacci sequence. Famous examples include the lily, which has three petals, buttercups, which have five, the chicory's 21, the daisy's 34, and so on. Each petal is placed at 0.618034 per turn (out of a 360° circle) allowing for the best possible exposure to sunlight and other factors.

Seed heads: The head of a flower is also subject to Fibonaccian processes. Typically, seeds are produced at the centre and then migrate towards the outside to fill all the space. Sunflowers provide a great example of these spiraling patterns.



Likewise, similar spiraling patterns can be found on fruits and vegetables like pineapples and cauliflower. Snail shells and nautilus shells follow the Fibonacci pattern, as does the cochlea of the inner ear. It can also be seen in the horns of certain goats, and the shape of certain spider’s webs.

Not surprisingly, spiral galaxies also follow the familiar Fibonacci pattern. Faces, both human and nonhuman, abound with examples of the Golden Ratio. The mouth and nose are each positioned at golden sections of the distance between the eyes and the bottom of the chin for a supposedly perfect face. Also, looking at the length of our fingers, each section — from the tip of the base to the wrist — is larger than the preceding one by roughly the ratio of phi.

Speaking of honey bees, they follow Fibonacci in other interesting ways. The male bees develop from unfertilised eggs of the queen bee. The male bee technically has only a mother and no father. The first generation has one member (the male). One generation back also has one member (the mother). Two generations back are two members (the mother and father of the mother). Three generations back are three members. Four back are five members. That is, the numbers in each generation going back are 1, 1, 2, 3, 5, 8...

Hence, we see that the ubiquity and astounding functionality of Fibonacci in nature suggests its importance as a fundamental characteristic of the Universe.

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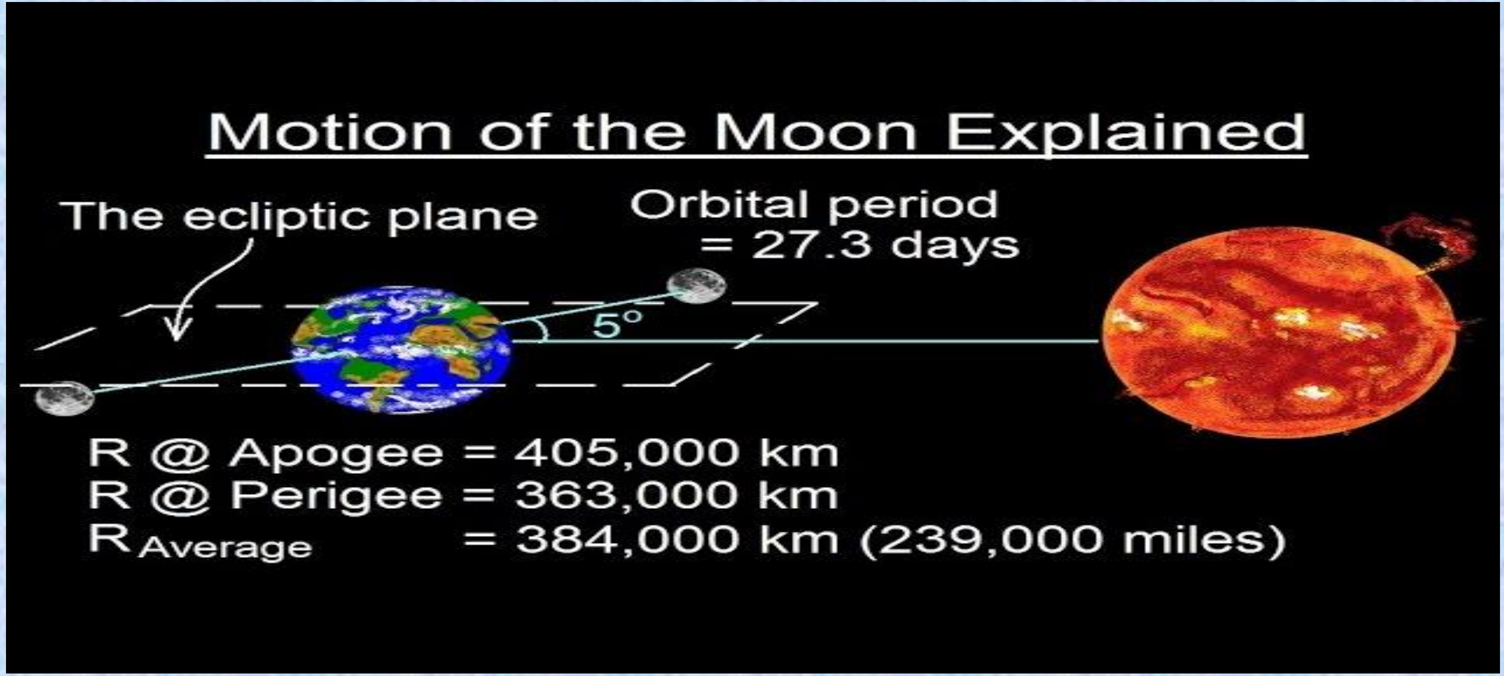
Moon, the Earth's Satellite

Smita Rani Bhuyan
B.Sc. 5TH Semester

Moon, Earth's sole natural satellite and nearest large celestial body. Known since prehistoric times, it is the brightest object in the sky after the Sun. It is designated by the symbol ☽. Its name in English, like that of Earth, is of Germanic and Old English derivation. The Moon's desolate beauty has been a source of fascination and curiosity throughout history and has inspired a rich cultural and symbolic tradition. In past civilizations the Moon was regarded as a deity, its dominion dramatically manifested in its rhythmic control over the tides and the cycle of female fertility. Ancient lore and legend tell of the power of the Moon to instill spells with magic, to transform humans into beasts, and to send people's behaviour swaying perilously between sanity and lunacy .Centuries of observation and scientific investigation have been centred on the nature and origin of the Moon.

Early studies of the Moon's motion and position allowed the prediction of tides and led to the development of calendars. Moreover, given its nearness to Earth, its rich potential as a source of materials and energy, and its qualifications as a laboratory for planetary science and a place to learn how to live and work in space for extended times, the Moon remains a prime location for humankind's first settlements beyond Earth orbit.



Facts about the moon:

1) Scientists have calculated that Moon is 4.53 billion years old .

2) Moon profile:

   Mass- 7.35*1022kg.

   Equatorial diameter- 1,737.5km.

   Equatorial circumference -10917km.

3) It takes 8.53 minutes for sunlight to reach The earth.

4) The moon orbits the earth every 27.3 days.

5) Neil Armstrong was the first person to walk on the moon.

6) A 10 foot jump on earth would be almost 60 foot jump on the Moon.

7) The moon surface area is about 38 million square km.

8) The first landing was completed Apollo 11 mission in 1969.

9) The gravitation of the moon causes the Earth we only see about 60% of the Earths surface.

10) The Moons temperature range between 107 C during the day to -153 C at night.

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THE ABEL PRIZE

Manashi Sarma
B.Sc. 5TH Semester

There is no Nobel Prize for mathematics, but many mathematicians have won the prize, most commonly for physics but occasionally for economics, and in one case for literature.

The Abel Prize is intended to give the mathematicians their own equivalent of a Nobel Prize. Such an award was first proposed in 1902 by King Oscar II of Sweden and Norway, just a year after the award of the first Nobel Prizes. However, plans were dropped as the union between the two countries was dissolved in 1905. As a result, mathematics has never had an international prize of the same dimensions and importance as the Nobel Prize.

Plans for an Abel Prize were revived in 2000, and in 2001 the Norwegian Government granted NOK 200 million (about $22 million) to create the new award. Niels Henrik Abel (1802-1829), after whom the prize is named, was a leading 19th-century Norwegian mathematician whose work in algebra has had lasting impact despite Abel's early death aged just 26. Today, every mathematics undergraduate encounters Abel's name in connection with commutative groups, which are more commonly known as "abelian groups".

As it happens, Abel's own field of group theory plays a role in the Atiyah-Singer Index Theorem, but this is not a condition for the award of the Abel Prize.

The Abel Prize is awarded annually, and is intended to present the field of mathematics with a prize at the highest level. Laureates are appointed by an independent committee of international mathematicians.

As a result of Norway's action, made in part to celebrate the 200th anniversary of Abel's birth in 2002, mathematicians now too have an award equivalent to the Nobel Prize. In addition to honouring outstanding mathematicians, the abel prize shall contributes towards raising the status of mathematics in society and stimulating the interest of children and young people in mathematics.

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Million dollar Prize for the Solution to a Maths Problem

Durgesh sah

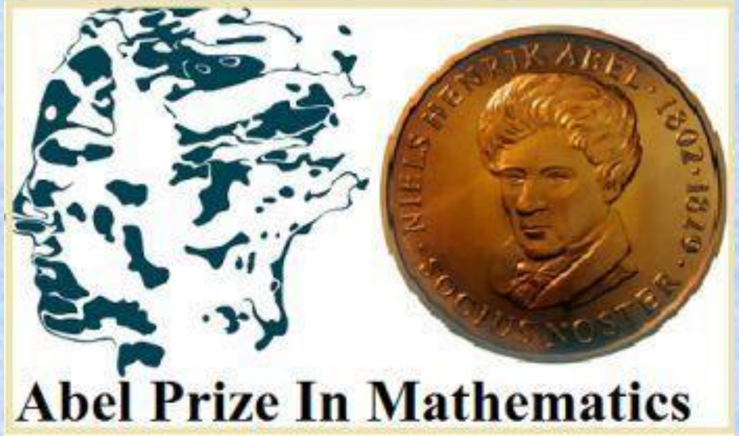
B.Sc 5th Semester

Take a standard chessboard and try to place two queens on it so that they aren't attacking each other. Easy, right? You just have to make sure they aren't in the same row, column or diagonal. Now try to place another queen on said board. Keep adding queens till you have placed 8 such pieces, that conform to the given constraint. If you have just found a method to achieve this, how many more methods can you find? How many methods exist? This is an example of a puzzle from 1850, called the eight-queen completion problem. In spite of it being more than a century old, we have only recently discovered the inherent complexity of the riddle when it was scaled up allowing boards of any size with any number of queens pre-placed on them – giving us a much harder version of the puzzle known as n-queens completion. A paper by Chris Jefferson, Peter Nightingale and Ian P Gent published in the Journal of Artificial Intelligence Research are what brought this to the world's attention. Sadly, the solution to this isn't the one up for a million dollars.

The n-queens completion puzzle is a type of Mathematical problem that is common in computer science and known as "NP-Complete". These are an interesting bunch because if we can find a solution to one NP-Complete problem we can use it to find all of them. That is simply their nature. Lucky for us, the n-queens complete is one of the simplest NP-complete problems to explain, especially to people familiar with the rules of chess. The others are not so easily ingrained into the minds of laymen.

The underlying issue though, is that nobody knows, even roughly, just how difficult NP-Complete problem is. To put it simply, they could be as easy as alphabetically organizing a list of names or exponentially harder. Figuring out which of the two it is, is the “P vs. NP” problem – one of the greatest Mathematical problems that have been left unsolved. The significance of this problem is mirrored in the fact that the Clay Mathematics Institute is offering a prize of 1 million dollars for the solution of P vs. NP.

The paper by Chris J, Peter N, and Ian P.G shows that the n-queens completion problem is NP-complete. Anyone able to show whether it’s an easy or difficult problem could then in turn potentially win a million dollars. Try not to be under the impression that the difficulty of P vs. NP problem is less than or equal to the n-queens one. P vs. NP is far harder and potentially unsolvable. We can have hope though because the word ‘impossible’ has never stuck quite right with humankind.



Did You Know?

Among all shapes with the same perimeter a circle has the largest area.

Among all shapes with the same area circle has Abacus is considered the origin of the calculator.
12,345,678,987,654,321 is the product of 111,111,111 x 111,111,111. Notice the sequence of the numbers 1 to 9 and back to 1.
Plus (+) and Minus (-) sign symbols were used as early as 1489 A.D.
An icosagon is a shape with 20 sides. From 0 to 1,000, the letter "A" only appears in 1,000 ("one thousand"). A 'jiffy' is an actual unit of time for 1/100th of a second.
FOUR' is the only number in the English language that is spelt with the same number of letters as the number itselF
In a group of 23 people, at least two have the same birthday with the probability greater than 1/2 .
the shortest perimeter .
In 1995 in Taipei, citizens were allowed to remove ‘4’ from street numbers because it sounded like ‘death’ in Chinese. Many Chinese hospitals do not have a 4th floor.
The word "FRACTION" derives from the Latin " fractio - to break".

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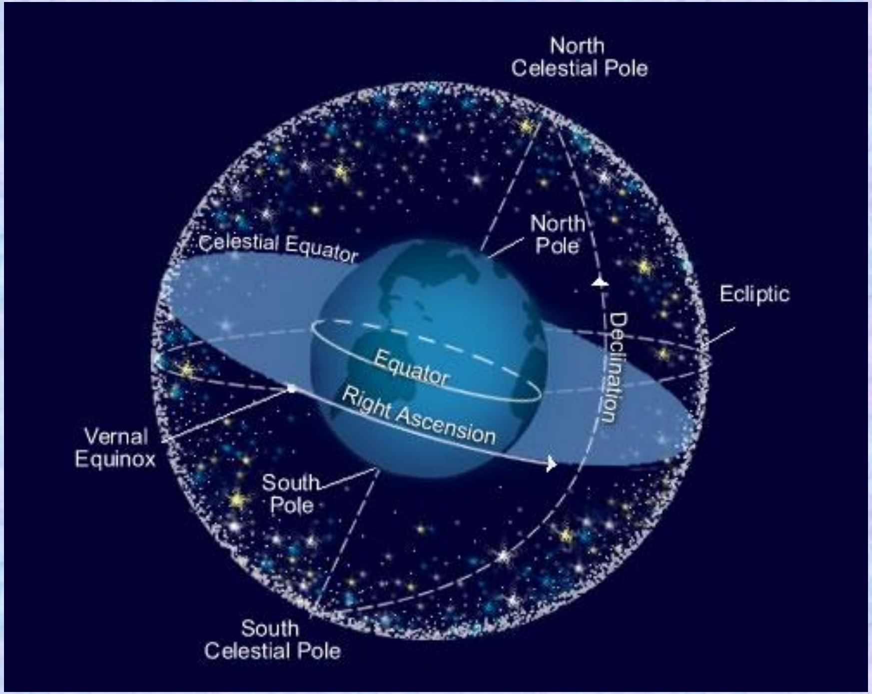
CELESTIAL SPHERE
Violina Das
B.Sc. 5TH Semester

An imaginary sphere of infinite radius with the earth at it's center and other celestial bodies studded on its inside surface is known as celestial sphere.



- Zenith : The point on celestial sphere directly overhead. On the above fig. ‘Z’ denotes the zenith.
- Nadir: The point on celestial directly beneath observer. On the above fig, ‘Na’ denotes the nadir.
- Horizontal plane through the centre of the celestial sphere out surface in a great circle , called the celestial horizon.(NWSE)
- The section of the surface of sphere by a plane is called a great circle if the circular plane passes through the centre of the sphere. The great circles passing through the zenith and nadir are called Vertical circles .
- The vertical circle which is passes through the poles P and Q is called principal vertical circle.
- The four points N,S,E and W are called cardinal points.
- Vertical circle which passes through the east and west point is called the prime vertical.
- The great circle passing through the zenith of a place and celestial north pole P is called celestial meridian of the place .
- The principal vertical circle is also known as observer meridian.
- The principal vertical circle (observer meridian) and the horizon meet each other at two points N and S.
- The section of the celestial sphere by the plane of the earth’s equator is a great circle (TR) called the celestial equator .

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PHOTO GALLERY

Inauguration of Departmental Wall Megazine-2021

Participation in Cultural Procession of College Week

Co-curricular Activities

FIRST CLASS HOLDERS

Pranjal Saikia
(2014)

Jyoti Prasad Adhikary
2014

Dharmendra Sarma
(2016)

Jagadish Patowary
(2016)

FIRST CLASS HOLDERS

Punam Kumari Saini (2017)

Punam Kumari Saini (2017)

Pradyut Acharjee (2017)

Hiranya Choudhury (2018)

FIRST CLASS HOLDERS

Kakali Patowary (2019)

Manoj Kr. Nath (2020)

Rajashree Nath (2020)

Rushna Begum (2020)

FIRST CLASS HOLDERS

Mayukh Kakati
(2020)

Jyotirmoy Deka
(2020)

Jyotirmoy Deka
(2020)

Jiaur Rahman
(2020)

FIRST CLASS HOLDERS

Silpa Buragohain (2020)

Mominur Rahman (2020)

Nikumoni Baishya (2020)