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Math√oot

Essential for Every Science

E-Magazine

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Department of Mathematics

Chief Editor: Dr. Prameela Kolake

Sub Editor: Dr. Prashanthi K S

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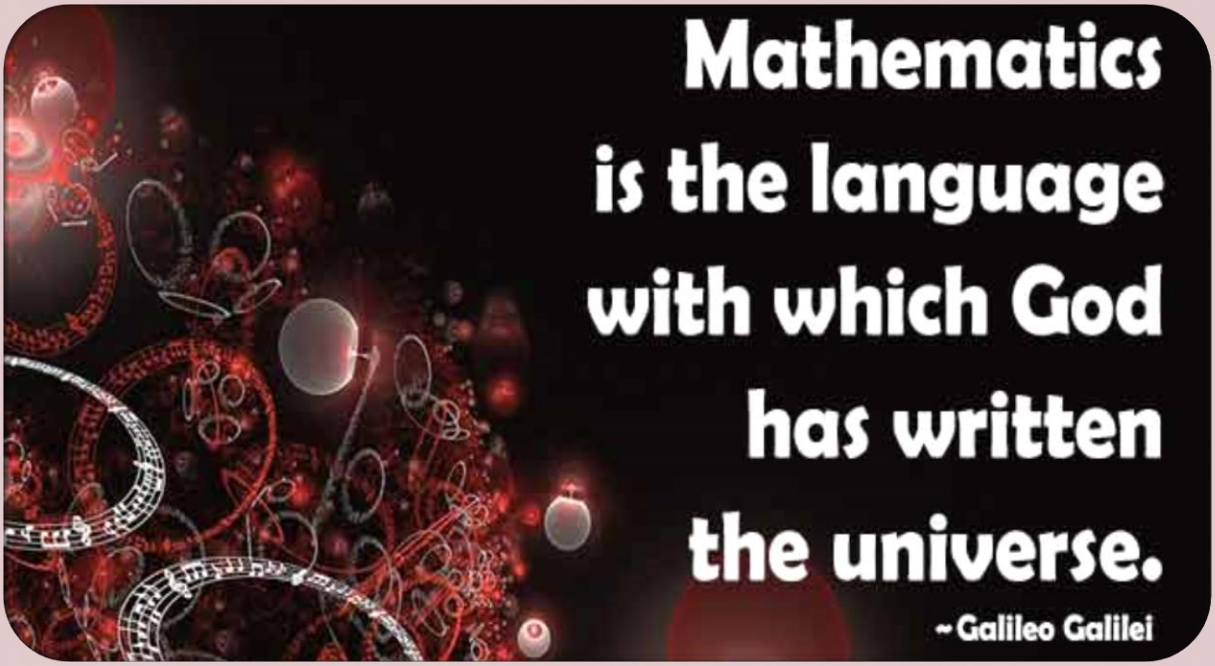


From Chief Editor's Desk:

Dear Reader,

True words by a famous astronomer Galileo Galilei. Every single structure in nature involves mathematics, whether it be a honeycomb, a flower's petal arrangement, a spider web, or a geographical pattern. Mathematics is now employed as a vital tool in many sectors around the world, including natural science, engineering, medical, and the social sciences. Every real life problem when explored, develops into a Mathematical problem and can be solved with accuracy.

Mathroot is indeed an e–magazine published by the Department of Mathematics with the goal of raising awareness about the use of mathematics in various fields. This magazine will also include some interesting facts about Mathematics and Mathematicians, which will inspire the reader. Every AITEIAN can contribute to the magazine in their own way and make it more attractive and meaningful. Thank you.

- Dr. Prameela Kolake

Dept. of Mathematics

BEAUTY OF MATHS.....

Maths, simple word,
But changed the whole world,
From zero to infinity,
It attended eternity,
Easy to understand,
But solves the complex problems,
But when we apply in real life,
It solves all the problems,
Maths is the creator or creators,
But without it, life is just like crater,
Wherever you look you will find it,
Cause the whole world runs behind it,
It's just the perspective of someone,
Which changed into theorem, rule or
terminology,
Whereas maths changed the whole world.

---- Akhilesh Herkal
CSE Branch

ICTP RAMANUJAN AWARD

- SANKET R DURGEKAR
- 3RD SEM

HISTORY OF RAMANUJAN

Srinivasa Ramanujan Aiyangar (December 22, 1887 – April 26, 1920) is regarded as one of history's most gifted mathematicians. K.Srinivasa Iyengar was his father's name, and Komalatammal was his mother's. Ramanujan enrolled in a local school on October 1, 1892. He despised school and made every effort to avoid it. He had no formal Mathematics education. He did, however, contribute much to number theory, infinite series, and continuing fractions.

In the early 1910s, he was mentored by G. H. Hardy. Ramanujan pursued his own research after graduating from Cambridge. Throughout his life, he accumulated almost 3500 identities and equations. His "lost notepad" revealed some of the identities. Mathematicians were able to prove practically all of Ramanujan's work when the notebook was discovered. Many advances in mathematics have resulted from his discoveries. His formulae are now employed in crystallography and string theory, Researcher believe that his deathbed discovery “Mock Thetha Function” would explain the behavior of Black Holes.

Ramanujan, a devout Hindu, attributed his considerable mathematical abilities to divinity, claiming that his family goddess Namagiri Thayar imparted his mathematical knowledge to him. "An equation for me has no validity unless it represents an idea of God".

After getting tuberculosis, the mathematician recovered enough to travel to India in 1919. On April 26, 1920, Srinivasa Ramanujan died (aged 32).

The mathematical community, on the other hand, regarded him as an unrivalled brilliance.

The brilliant mathematician left behind three notebooks and a massive bundle of papers containing unpublished results that were being confirmed by mathematicians several years after his death.

For all his tremendous contribution for the future generation Prime Minister Manmohan Singh declared Ramanujan's birthday an annual "National Mathematics Day" in 2011.

HISTORY OF AWARD

The ICTP Ramanujan Prize is a prominent award granted yearly by the International Centre for Theoretical Physics in Italy to Young Mathematicians from Developing Countries. It was established in 2004 and received its first award in 2005. The prize is given to a researcher under 45 years old from a developing country who has done remarkable research in that country.

The prize is funded by the Indian Ministry of Science and Technology and the Norwegian Academy of Science and Letters through the Abel Fund, with the International Mathematical Union's assistance. The reward was formerly known as the International Center for Theoretical Physics (ICTP) Ramanujan Prize, but it was later renamed the "DST-ICTP-IMU Rumanujan Prize." The prize was first given to Brazilian mathematician Marcelo Viana in 2005, and is named after Indian mathematician Srinivasa Ramanujan.

INDIANS WHO RECEIVED RAMANUJAN AWARD

Three Indian researchers earned this coveted prize for their outstanding achievements. This prize has been given to Ramdorai Sujatha in 2006, Amalendu Krishna in 2015, and Neena Gupta most recently for their extensive study in their mathematical field.

1. **Sujatha Ramdorai**

In 2006, Dr. Sujatha Ramdorai became the first Indian to receive the coveted ICTP Ramanujan Prize. In 2004, she was also given the Shanti Swarup Bhatnagar Award, India's highest honour in scientific subjects. She is also the 2020 Krieger–Nelson Prize winner for her outstanding contributions to mathematics research.

Dr. Ramdorai began his career in algebraic theory of quadratic forms and arithmetic geometry of elliptic curves. Together with Coates, Fukaya, Kato, and Venjakob, she developed a non-commutative version of Iwasawa theory's core conjecture, which serves as the foundation for most of this vital subject. The Iwasawa hypothesis derives from the work of a prominent Japanese mathematician, Kenkichi Iwasawa. Her work earned her the prestigious Ramanujan award. She is an adjunct professor at the Indian Institute of Science Education and Research in Pune.

Sujatha Ramdorai thought of and largely funded the Ramanujan Math Park in Chittoor, Andhra Pradesh, with her husband Srinivasan Ramdorai and Indian mathematics writer V.S. Sastry. The park celebrates the eminent Indian mathematician Srinivasa Ramanujan and is dedicated to mathematics education (1887-1920).

She serves on the Scientific Committees of various international research organisations, including the Indo-French Centre for Advanced Research, the Banff International Research Station, and the International Centre for Pure and Applied Mathematics. From 2007 to 2009, she served on the National Knowledge Commission. She has been a member of the Prime

Minister's Scientific Advisory Council since 2009, as well as the National Innovation Council. She also serves on the Gonit Sora advisory board.

2. **Amalendu Krishna**

Amalendu Krishna is from Madhubani, Bihar, where he attended school. He left out of IIT Kanpur after becoming disillusioned with the engineering students' job-oriented concentration. In Kolkata, he joined the Indian Statistical Institute. He joined TIFR to pursue PhD studies after completing post-graduate studies there in 1996. In 2001, he received his PhD from TIFR under the mentorship of Vasudevan Srinivas. From 2001 to 2004, he was the Hedrick Assistant Professor at the University of California, Los Angeles, and from 2004 to 2005, he was at Princeton University's Institute for Advanced Study. He returned to TIFR as a faculty member in 2005. He became a Professor at the Indian Institute of Science in 2020.he was given the ICTP Ramanujan Prize for his contributions to computer science. This prize is given in honour of Krishna's remarkable contributions to algebraic K-theory, algebraic cycles, and motive theory.

Krishna's work demonstrates a remarkable knowledge of a highly technical subject, employing recent ideas of algebraic K-theory and Voevodsky's theory of motives to investigate concrete situations. His work on 0-cycles on algebraic varieties with isolated singularities essentially simplifies their study to the comparable study on desingularization, as well as information regarding multiples of the exceptional divisors. In many circumstances, such as the case of rational varieties or cones, this allows for the entire calculation of the Chow group of 0-cycles on an algebraic variety.

3. **Neena Gupta**

Neena Gupta was born in Kolkata and raised there. She is graduated from Khalsa High School in Dunlop and went on to pursue BSc Maths at Bethune College. She received her master's and doctorate degrees in mathematics from the Indian Statistical Institute.

Neena Gupta, a mathematician and professor at the Indian Statistical Institute in Kolkata, has been awarded the 2021 DST-ICTP-IMU Ramanujan Prize for developing-country young mathematicians. She was honoured for her remarkable contributions to affine algebraic geometry and commutative algebra, particularly her solution to the Zariski cancellation problem for affine spaces. Neena stated that while receiving the award is an honour, there is still much work to be done in the subject of commutative algebra. Her solution to the Zariski cancellation problem earned her the Indian National Science Academy's Young Scientists Award in 2014. In 2006, Gupta graduated from Bethune College with honours in Mathematics. She received her Post Graduate Diploma in Mathematics from the Indian Statistical Institute in 2008 and her Ph.D. in 2011 with commutative algebra as her specialisation, both under the supervision of Amartya Kumar Dutta. Her dissertation was titled "Some results on Laurent polynomial fibrations and Quasi A*-algebras."

MATHEMATICS IN DAILY LIFE

- AMISHA SHETTY
- 5th SEM, CSE

IMPORTANCE OF MATHS IN DAILY LIFE

Math isn't just boring tasks in school. Some scientists consider mathematics to be the most important science and one of the first to appear in the world.

Our whole life is about calculations and calculations, people just rarely think about it. Mathematics is studied at school, institute, it helps IT specialists write codes for programs and even fly into space. It is called an interdisciplinary science because it is closely related to physics, geography, geology, chemistry. If we go beyond the school curriculum, it is worth noting that mathematics is “friendly” with economics: scientists have even introduced an unspoken term - “mathenomics”, which means science at the junction of mathematics and economics.

The world has changed and become more technologically advanced, so many options for professional development are open for lovers of mathematics. It can even become a non-standard way to get to know each other: ask the person about his attitude to mathematics, where he uses it, and whether he remembers how to extract the square root of a number.

WHERE IS MATHS NEEDED?

Without knowledge of mathematics, all modern life would be impossible. We wouldn't have good houses because builders have to be able to measure, count, and construct. There would be no railways, no ships, no planes, no big industry. There would be no radio, television, cinema, telephone, and thousands of other things that make up a part of our civilization. Mathematics allows us to see the world without the so-called rose-colored glasses. The curriculum is structured in such a way that it seems that mathematics is just calculations. But no. Calculations are always present in solving real problems, but mathematics is rather what formulates and composes these expressions for calculation.

Mathematics is all around us. It is everywhere we go. Its in our kitchen, in our houses and in our surroundings. Mathematics is used in running shops, business, cooking and in every single activity we do in our daily life.

- Mathematics in our home

Mathematics is an important factor for decoration. For white washing in rooms of the house, we measure the total surface area of walls. For placing tiles on the floor, we measure area of floor. We use different geometrical pattern on walls for decoration. To setup furniture in our houses, we measure area of rooms and furniture.

- Mathematics in Kitchen

In cooking, idea of proportionality is the most important factor for perfection. Without this we cannot make exact quantity of food that we want. For example: - If we want to make a cake of 1kg but in recipe book there is a recipe of 2kg of cake, then idea of proportionality is important. Geometry is used in kitchen, for kitchen accessories and utensils like hemispherical bowls, cuboidal shelves, circular pans and cylindrical tumblers.

- Shopping

Going out for shopping is most interesting thing to do. Sale in a shop is the pleasant thing to see. Sale and calculation both require maths. Example: - if u need to calculate the rate of a material you are buying in the sale and if you went wrong somewhere you need to do a false paying of the bill

- Business and Market

A business person should be good in Mathematics and need to have a sharp brain. Dealing with money without mathematics is not possible. A person who is illiterate starts dealing then he is definitely going to be in loss. In business, the main thing is to find your profit first.

A person who doesn't know mathematics and going to market will obviously loose his money unnecessarily because he doesn’t know the calculation of money

- Use of geometry

Geometry is used to build buildings. It is used in designing sports grounds as well as equipment. Yoga also uses various kinds of geometrical shapes. We also use geometrical shapes in Traffic signals like line segments, triangles etc.

Earth is perfect shape for minimizing the pull of gravity on its outer edges – a sphere. Geometry is the branch of mathematics that describes such shapes

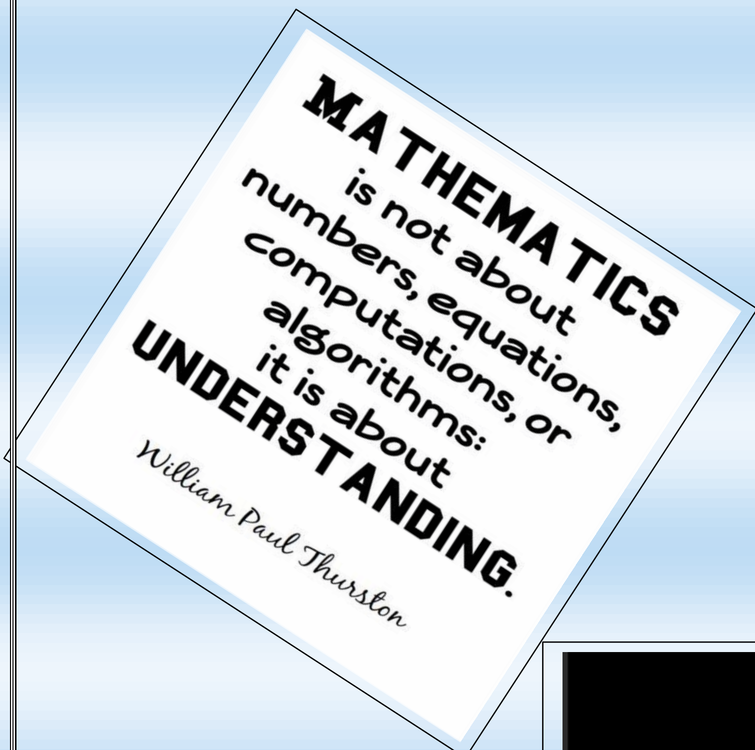
PERSONAL DEVELOPMENT

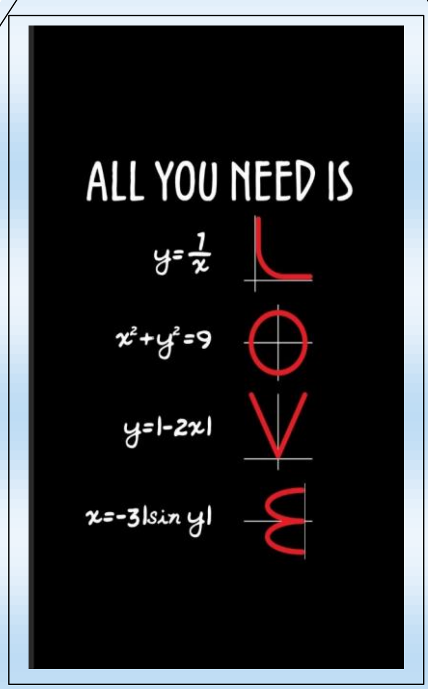
Mathematics makes it possible to form certain intellectual properties: inference, deductive, generalization, critical, the ability to make a forecast, think ahead. This science improves the ability of theoretical thinking, the ability to concentrate, exercises memory, and also increases the speed of thinking. The ability to analyze situations. Ability to consider difficult situations from a different angle - non-standard. The ability to find patterns and connections between certain things and events.

Knowledge alone is not enough to solve mathematical problems correctly. We need such qualities of character as attentiveness, perseverance, consistency, accuracy and accuracy. Mathematics is especially good at developing children's minds and plays an important role in development, namely: Mental, Physical and Aesthetics.

CONCLUSION

In conclusion, I would confidently like to mention that Mathematics is a vital discipline in every person's life. It enables one to have an open mind on how to solve problems because one can approach a problem in math using very many different ways. It also enables one to be alert so as not to commit unnecessary errors and to only aim for accuracy. To be honest, Mathematics can be the best thing that has ever happened to anyone. One step at a time and it will not take one forever to approach success in Mathematics. Without this discipline, the world would certainly not reap the benefits and would not be a better place to live.



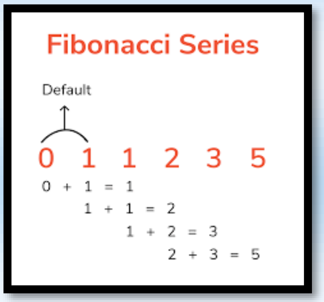


FIBONACCI SEQUENCE IN NATURE

- SANKET R DURGEKAR

- 3RD SEM

The famous Fibonacci sequence has captivated mathematicians, artists, designers, and scientists for centuries. Also known as the Golden Ratio, its ubiquity and astounding functionality in nature suggests its importance as a fundamental characteristic of the Universe. The Fibonacci sequence starts like this: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55 and so on forever. Each number is the sum of the two numbers that precede it. It's a simple pattern, but it appears to be a kind of built-in numbering system to the cosmos. Here are 14 astounding examples of phi in nature.



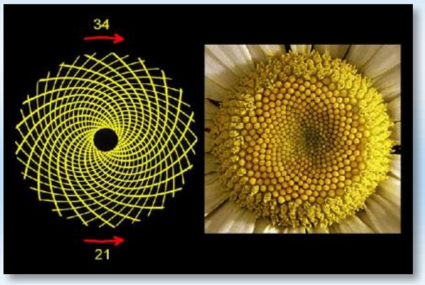
Leonardo Fibonacci came up with the sequence when calculating the ideal expansion pairs of rabbits over the course of one year. Today, its emergent patterns and ratios (phi = 1.61803...) can be seen from the micro scale to the macro scale, and right through to biological systems and inanimate objects. While the Golden Ratio doesn't account for *every* structure or pattern in the universe, it's certainly a major player

1. Flower Petals

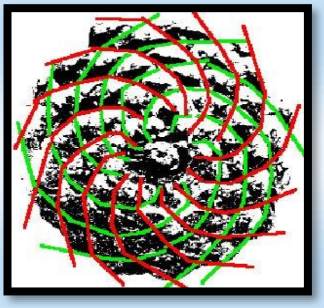
The number of petals in a flower consistently follows the Fibonacci sequence. Famous examples include the lily, which has three petals, buttercups, which have five (pictured at left), the chicory's 21, the daisy's 34, and so on. Phi appears in petals on account of the ideal packing arrangement as selected by Darwinian processes; 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.

2. Seed Heads

The head of a flower is also subject to Fibonaccian processes. Typically, seeds are produced at the center, and then migrate towards the outside to fill all the space. Sunflowers provide a great example of these spiraling patterns. In some cases, the seed heads are so tightly packed that total number can get quite high — as many as 144 or more. And when counting these spirals, the total tends to match a Fibonacci number. Interestingly, a highly irrational number is required to optimize filling (namely one that will not be well represented by a fraction). Phi fits the bill rather nicely.



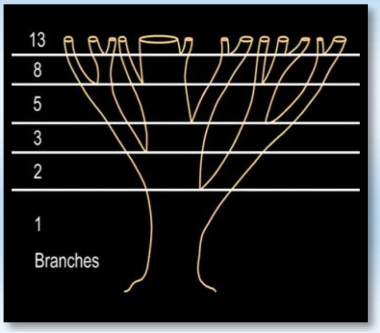
3. Pinecone



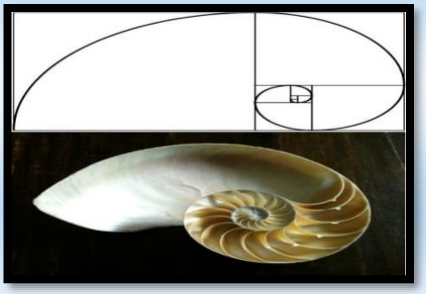
Similarly, the seed pods on a pinecone are arranged in a spiral pattern. Each cone consists of a pair of spirals, each one spiraling upwards in opposing directions. The number of steps will almost always match a pair of consecutive Fibonacci numbers. For example, a 3 - 5 cones is a cone which meets at the back after three steps along the left spiral, and five steps along the right.

4. Tree branches

The Fibonacci sequence can also be seen in the way tree branches form or split. A main trunk will grow until it produces a branch, which creates two growth points. Then, one of the new stems branches into two, while the other one lies dormant. This pattern of branching is repeated for each of the new stems. A good example is the sneezewort. Root systems and even algae exhibit this pattern.



5. Shells



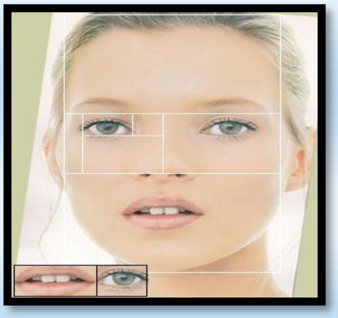
The unique properties of the Golden Rectangle provide another example. This shape, a rectangle in which the ratio of the sides a/b is equal to the golden mean (phi), can result in a nesting process that can be repeated into infinity — and which takes on the form of a spiral. Its call the logarithmic spiral and it abounds in nature. Snail shells and nautilus shells follow the logarithmic spiral, 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.

6. Spiral Galaxies

Not surprisingly, spiral galaxies also follow the familiar Fibonacci pattern. The Milky Way has several spiral arms, each of them a logarithmic spiral of about 12 degrees. As an interesting aside, spiral galaxies appear to defy Newtonian physics. As early as 1925, astronomers realized that, since the angular speed of rotation of the galactic disk varies with distance from the center, the radial arms should become curved as galaxies rotate. Subsequently, after a few rotations, spiral arms should start to wind around a galaxy. But they don't — hence the so-called winding problem. The stars on the outside, it would seem, move at a velocity higher than expected — a unique trait of the cosmos that helps preserve its shape.

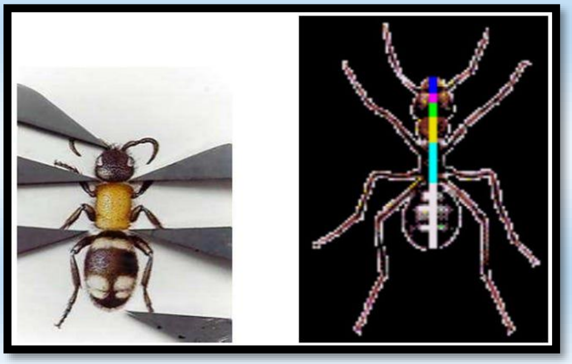
7. Faces

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. Similar proportions can be seen from the side, and even the eye and ear itself (which follows along a spiral). It's worth noting that every person's body is different, but that averages across populations tend towards phi. It has also been said that the more closely our proportions adhere to phi, the more "attractive" those traits are perceived. As an example, the most "beautiful" smiles are those in which central incisors are 1.618 wider than the lateral incisors, which are 1.618 wider than canines, and so on. It's quite possible that, from an evo-psych perspective, that we are primed to like physical forms that adhere to the golden ratio — a potential indicator of reproductive fitness and health.



8. Animal Bodies

Even our bodies' exhibit proportions that is consistent with Fibonacci numbers. For example, the measurement from the navel to the floor and the top of the head to the navel is the golden ratio. Animal bodies exhibit similar tendencies, including dolphins (the eye, fins and tail all fall at Golden Sections), starfish, sand dollars, sea urchins, ants, and honey bees.



TRIGONOMETRY
THE WORLD OF MEASUREMENTS

- Dr. Prameela Kolake
- Dept. of Mathematics

According to Morris Kline, in his book named- Mathematical Thought from Ancient to Modern Times, proclaimed that ‘trigonometry was first developed in connection with astronomy, with applications to navigation and construction of calendars. This was around 2000 years ago. Geometry is much older, and trigonometry is built upon geometry.

Systematic study of trigonometric functions began in Greek mathematics mostly from 7th century BC to the 4th century AD, around the shores of the Eastern Mediterranean. The word "mathematics" itself is derived from the Ancient Greek: meaning "subject of instruction".

In Indian astronomy, the study of trigonometric functions flourished in the Gupta period, especially due to Aryabhata (sixth century CE), who discovered the sine function. During the Middle Ages, the study of trigonometry continued in Islamic mathematics, by mathematicians such as Al-Khwarizmi and Abu al-Wafa. The development of modern trigonometry started with 17th-century mathematics (Isaac Newton and James Stirling) and reaching its modern form with Leonhard Euler (1748).


Hipparchus - Father of Trigonometry

The first trigonometric table was given by *Hipparchus of Nicaea* (180 – 125 BCE), who is now consequently known as "the father of trigonometry." Hipparchus was the first to tabulate the corresponding values of arc and chord for a series of angles.

Contribution of Indians

Indian mathematicians contributed significantly to Trigonometry during 4th to 5th century AD.

- Sinddantas of 4th–5th century AD, first defined the sine as the modern relationship between half an angle and half a chord.
- Another Indian mathematician and astronomer, Aryabhata (476–550 AD), collected and expanded upon the developments of the Siddhantas in an important work called the Aryabhatiya.
- In the 7th century, Bhaskara I produced a formula for calculating the sine of an acute angle without the use of a table.
- Later in the 7th century, Brahmagupta redeveloped the formula

$$1 - \sin^2 x = \cos^2 x$$

- In 12th century Bhaskara II developed spherical trigonometry, and was the first to discover trigonometric results like:

$$\sin(a + b) = \sin a \cos b + \cos a \sin b$$

- One more Indian Mathematician Madhava (in 1400) made studies on infinite series expansion of Trigonometric functions. He developed the concepts of the power series and Taylor series, and produced the power series expansions of sine, cosine, tangent, and arctangent. Using the Taylor series approximations of sine and cosine, he produced a sine table to 12 decimal places of accuracy and a cosine table to 9 decimal places of accuracy. He also gave the power series of π and the angle, radius, diameter, and circumference of a circle in terms of trigonometric functions. His works were expanded by his followers at the Kerala School up to the 16th century.

Trigonometry

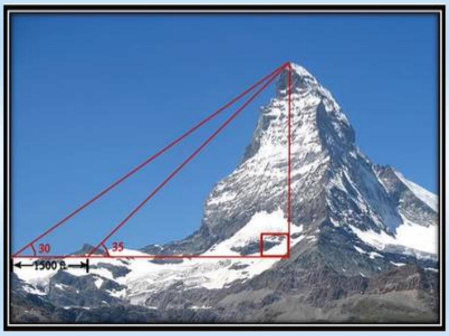
Trigonometry is a branch of Mathematics which focuses on the relationships between the sides and angles of triangles. It involves various trigonometric functions, and those functions are used for the determination of unknown angles and sides of a triangle. In fact, Trigonometry is derived from Greek Words

TRI - THREE, GON - SIDES, METRON - MEASURE

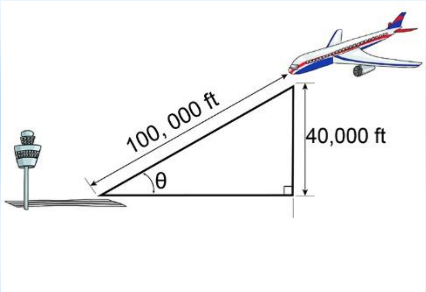
So, we can say that Trigonometry is the study of relationship between sides and angles of a triangle.

Real life application of Trigonometry

Although trigonometry does not have direct applications in solving real problems, it is used in many places or instances we enjoy. For example, sound travels in wave form, so as music. These patterns are, even though not as regular as a sine or cosine waves, trigonometry is used to in computer music development. Because a computer can't listen to or comprehend music like we can, it's represented mathematically by its constituent sound waves. So, it is important for a sound Engineers to understand trigonometry clearly.

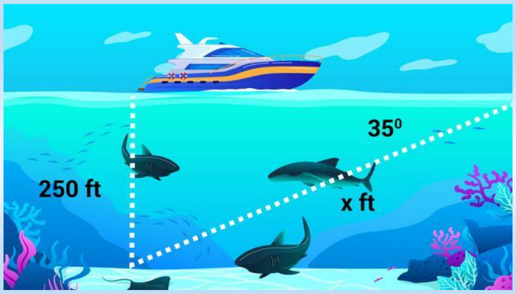


Trigonometry is mainly used in measuring the heights of very tall objects. If you know the distance from where you observe the building or mountain and the angle of elevation you can easily find the height of the building or mountain.

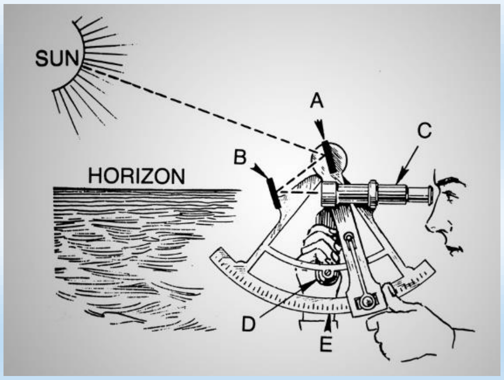


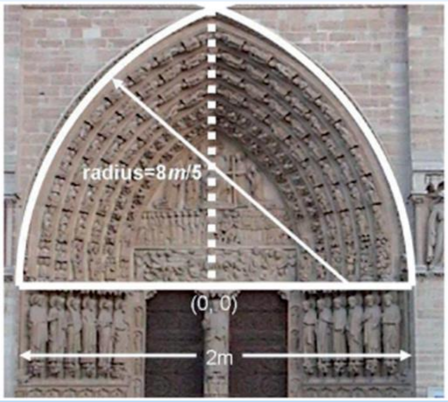
Similarly, flight engineers have to consider their speed, distance, and direction along with the speed and direction of the wind. It's important to estimate the distance and landing pattern to land a flight safely, where trigonometry is used for all such calculations.

Marine biologists often use trigonometry to establish measurements. For example, to find out how light levels at different depths affect the ability of algae to photosynthesize. Trigonometry is used in finding the distance between celestial bodies. Also, marine biologists utilize mathematical models to measure and understand sea animals and their behavior. Marine biologists may use trigonometry to determine the size of wild animals from a distance.



In oceanography, trigonometry is used to find distance of shore from a point in sea. It is also used to calculate heights of tides in ocean.

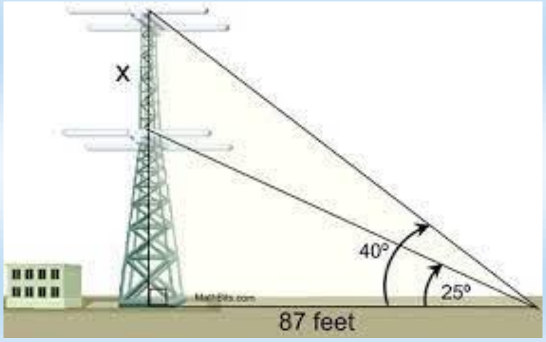




In construction field, trigonometry is used in following few areas

- Measuring fields, lots and areas
- Making walls parallel and perpendicular
- Installing ceramic tiles
- Roof inclination

The height of the building, the width, length etc. and the many other such things where it becomes necessary to use trigonometry. Architects use trigonometry to calculate structural load, roof slopes, ground surfaces and many other aspects, including sun shading and light angles.



An Architect Cynida Drepaul, in her write up mentions that "Trigonometry lets us be more accurate with our measurements so we can avoid any mishaps and disasters in structural integrity when in architecture or any other fields."

Dear Reader, Trigonometry is directly or indirectly involved in our day-to-day life. Majority of us learned trigonometry just a formula and used only in the simplification process of any problem, without knowing the beauty and real application of it. Here I could list out very few. I leave reader to explore more application of Trigonometry and enjoy the beauty of Trigonometry.