# Quest

## May Edition (2023)

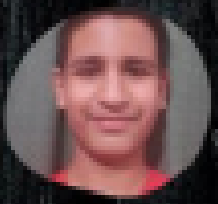
# Our Editorial Team

Shaurya Chawla M2D

Gargi Sharma S1D

Trejal Singh S1C

Lipika Singh S2A



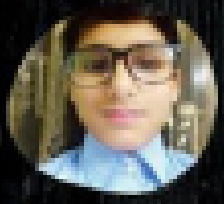
Nikhil Asrani S1A

Tanvi Dugar S2D

Aadya Srivastava S1D

Idhika Sood S2D

Aryan Chawla S2D



## FROM THE EDITOR'S DESK

DR. MANPREET KAUR

MRS. PRABHJOT KAUR

**All the students of classes P4 - SS2 are encouraged to bring forth their scientific temperament in any representation of writing, videos , photography or art forms**

# TABLE OF CONTENTS




“

All we have to do is to wake up and change.

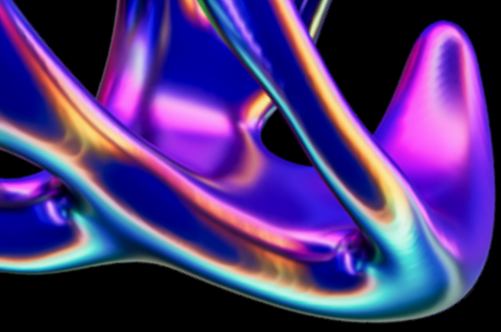
Greta Thunberg

# NEWS FROM THE FIELD OF MATHS

*Are you well-informed about what is currently happening in the field of Mathematics? Do you know about the recent breakthroughs in math? Have you known about the renowned mathematicians who have been awarded for their well-known work? Here's an article solely based on the latest news from the world of mathematics.*

**By- Sankalp Dubey, M3C**

**Supervised by- Mr. Vasudevan**



## ARGENTINE- AMERICAN MATHEMATICIAN WINS ABEL PRIZE

The Abel Prize, named after Norwegian mathematician Niels Henrik Abel, is considered one of the highest honours in mathematics. The prize is conferred every year by the King of Norway and is awarded to one or more outstanding mathematicians. This year, the Abel Prize was awarded to Argentine-American mathematician Luis Caffarelli for his ground breaking contributions to several areas of mathematics.

## NEW METHOD FOR DERIVING APPROXIMATE LINEAR EQUATIONS TO COMPLICATED NONLINEAR PROBLEMS

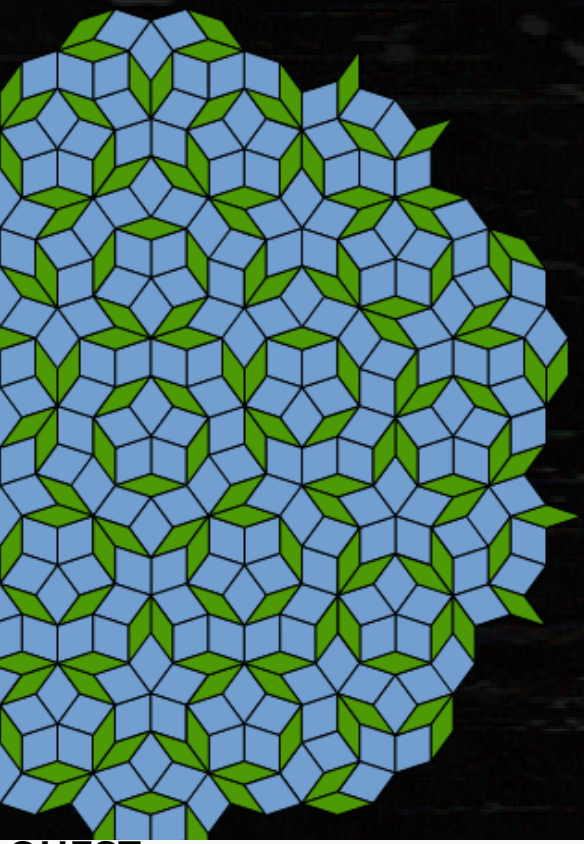
Researchers at the University of Tsukuba have created a new method for deriving approximate linear equations to complicated nonlinear problems. Using simulation results, they show that the model derived using their proposed pseudo-linearization approach yields responses that are closer to those of the well-known alternative method. This work can help scientists and engineers predict and more precisely apply feedback control over mechanical systems that are described with nonlinear equations.

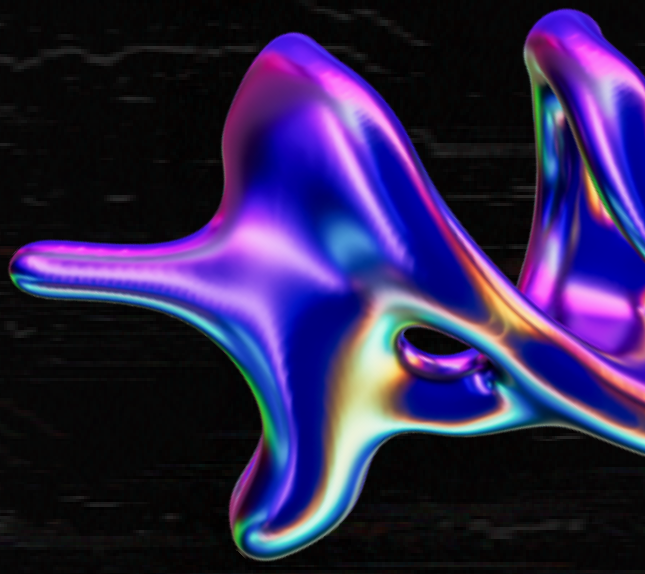
$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

## PENROSE TILING PROBLEM

In the world of mathematics, there are problems that have been around for centuries, or even millennia, waiting to be solved.

One such problem is the Penrose tiling problem, named after the British mathematician and physicist Roger Penrose. The Penrose tiling problem asks if it is possible to cover a surface with tiles that are aperiodic, meaning they can never be repeated in a regular pattern. In 2017, retired printing technician David Smith discovered a shape that can solve the Penrose tiling problem, which he named “The Hat”.

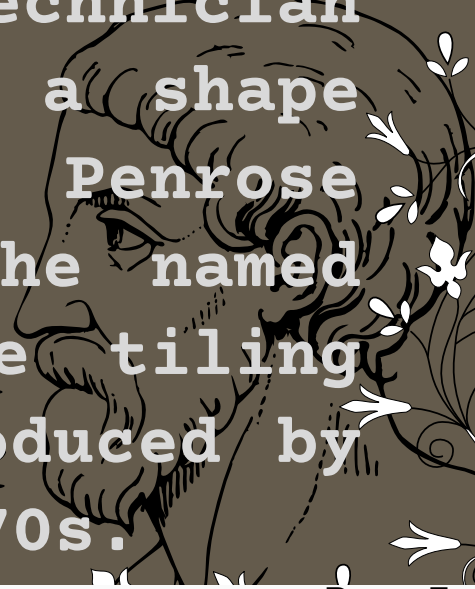




# Maths Current Affair

## By Angad Singh of M3-D

There are mathematical puzzles that have existed for decades or even millennia and are just waiting to be solved. One such problem is the Penrose tiling problem, named after the British mathematician and physicist Roger Penrose. The Penrose tiling problem asks if it is possible to cover a surface with aperiodic tiles, meaning they can never be repeated in a regular pattern. In 2017, retired printing technician David Smith discovered a shape that can solve the Penrose tiling problem, which he named “The Hat”. The Penrose tiling problem was first introduced by Roger Penrose in the 1970s.



He created a set of 20,426 tiles that can be used to cover a surface aperiodically. Later, he reduced the number of shapes from six to two. Even with this reduction, the problem remained unsolved for decades.

## David Smith and Penrose Tiling

David Smith started a blog on Penrose tiling in 2016 and detailed his findings about the issue. He got in touch with Craig Kaplan, a computer science professor at the niversity of Waterloo, seeking validation when he believed he had outdone Penrose in discovering Einstein. They worked together by using the software.

# Raman Parimala

Raman Parimala is an Indian mathematician known for her significant contributions in algebraic geometry and breaking many barriers in the field of Mathematics. Parimala was born on 21st of November, 1948 in Tamil Nadu. She studied in Saradha Vidyalaya Girls' High School andStella Maris College in Chennai. She received her M.Sc. from Madras University in 1970 and PhD from University of Mumbai in 1976. She was a Professor of Mathematics at the prestigious Tata Institute of Fundamental Research for several years. She also held visiting positions at the Swiss Federal Institute of Technology (ETH) in Zürich, the University of Lausanne, University of California-Berkeley, University of Chicago, Ohio State, and the University of Paris at Orsay. In 2005, Parimala was appointed the Asa Griggs Candler Professor of Mathematics at Emory University, USA. Parimala has a lot of achievements to her name. She is famous for her solution to the Serre conjectureand achievements such as publishing the first example of a nontrivial quadratic space over an affine plane at a young age. Having an expertise in algebra, she is often regarded as the 'Supreme and Powerful Algebraist' by mathematicians around the globe.

Mathematics has always been Parimala's true passion. After marriage, Parimala who was a professorat Tata Institute of Fundamental Research, took leave for a year and accompanied her husband to Dares-Salaam in Tanzania where her husband worked as the Chief Internal Auditor with the Board of Internal Trade, Tanzania. Parimala's husband realized her strong aspiration for mathematics and he therefore resigned and they both moved to Switzerland so that Parimala could work for her continue er study and research work in the field of mathematics.For her contributions and works in the field of algebra, Parimala has been awarded many international and national awards, including the Shanti Swarup Bhatnagar Prize for Science and Technology in 1987,honorary doctorate from the University of Lausanne in 1999, and the Srinivasa Ramanujan BirthCentenary Award in 2003. Parimala received a prize in the year 2005 in mathematics from theAcademy of Sciences for the Developing World for her work on the Quadratic Analogue of Serre's Conjecture. Prizes in the amount of $10,000 are awarded annually to scientists from developingcountries who have made outstanding contributions to the advancement of science. This was the first time in the 20-year history of the TWAS awards that a woman had been honoured with the prize in either mathematics or physics. In 2010, she received one of the highest and prestigious honours when she was selected for delivering an invited speech at the International Congress of Mathematicians in1994 in Zürich and was also invited as a plenary speaker at the 2010 ICM in Hyderabad.

**Written by**
**Shlok Dubey**
**M3D**

# THE SCIENCE BEHIND THE FUNCTIONING OF A WATER GUN

"Ever played Holi ? Ever thought of the principle that enables the usage of a water gun ? Lets see .

The key principle behind functioning of a water gun is "Atmospheric Pressure". Atmospheric Pressure refers to the pressure exerted by the column of air on a unit area. It is highest at the sea level and can be measured using a device called barometer in a SI unit known as *Pascals(Pa) or N/m.2*

While filling the water gun, we first push its handle to remove all the air present inside it and create a low pressure area. The surrounding air is present at a high pressure and we know that air moves from a high pressure area to a low pressure area. So the surrounding air pushes the coloured water inside the water gun. This fills up the water gun and we are able to enjoy "Festival of colours." 👀

The typical pressure at sea level is 1013.25 millibars or 14.7 pounds per square inch.

BAROMETER


## *QUIZ!!!!!??????*

This is a quiz based on atmospheric pressure-
https://forms.office.com/r/XWhyk87HU8
Please attempt it . Your response would be appreciated and the one who scores the highest would get recogonition in the next month's quest with his/her photo and name .

## *#TRY THIS*

Take a glass and fill it with water . Place a coaster on its brim . Hold the coaster with your hand and turn the glass upside down . Now remove your hand . Does the water fall ?

## *INTERESTING*

https://youtu.be/G7NE19NVaAg``

Made by - Nikhil Asrani S1E and Supervised by - Arvinder Kaur

# SPICES USED IN INDIAN KITCHEN

## (DR. KIRAN VARSHA)

Spices and preservatives used in Indian cooking have been used for centuries for their medicinal properties. They not only add flavor and aroma to the dishes but also have several health benefits. The use of spices and preservatives in Indian cooking dates back to ancient times when people used them for their medicinal properties.

**COMMON SALT: Salt is a commonly used preservative in Indian cooking, that enhances the taste of the food. Salt is important for maintaining the body's electrolyte balance and is necessary for nerve and muscle function. Salt brine helps dehydrate bacterial cells within foods, adjusting the pressure and hindering the development of bacterial growth thereby reducing spoiling and increasing the lifespan of food. It is used to preserve pickles, chutneys, and other foods.**

**CHILIES (MIRCH) : Used as food seasoning agent. It is a stimulant of ptyalin present in saliva which helps in digestion. A green chili is rich in Vitamin C & vitamin A. It is carminative and antiflatulence agent, which stimulates blood circulation.**

**BLACK PEPPER (KAALI MIRCH) : Used as a spice and medicine both. Pepper possesses its pleasant pungency and aroma. Peppers are good source of Manganese, Iron, Calcium, Potassium, Vitamin A, C, K, Zinc, Chromium and other nutrients. A numbers of medicinal benefits are found in peppers such as antihypertensive, anti-Alzheimer's, antidepressant, anti-inflammatory, antioxidant, antipyretic, antitumor, antiasthmatic, analgesic, antimicrobial etc. It also stimulates the secretion of hydrochloric acid in the stomach, resulting improves the digestion.**

**TURMERIC (HALDI) : Turmeric is a yellow-colored spice widely used in Indian cooking. It contains a compound called curcumin that has anti-inflammatory properties. Turmeric is commonly used to treat arthritis, digestive problems, and skin diseases. It is also used as an antiseptic and to treat wounds. If sprinkled over a bleeding wound, it causes instant clotting of blood.**

**CINNAMON (DALCHINI):** Cinnamon is a sweet-smelling spice that is commonly used in Indian desserts. It has antibacterial and anti-inflammatory properties and is believed to help regulate blood sugar levels. Cinnamon is also used to treat digestive problems, menstrual cramps, and colds.

**GINGER (ADRAK):** Ginger is a root vegetable that is commonly used in Indian cooking. It has anti-inflammatory and antibacterial properties and is commonly used to treat nausea, indigestion, and colds. Ginger tea is a popular remedy for colds and sore throats. Helps with osteoarthritis, lower blood sugars and improve heart health.

**GARLIC (LEHSUN):** Garlic is a pungent-smelling bulb that is commonly used in Indian cooking. It has antibacterial and antiviral properties and is commonly used to treat respiratory infections, high blood pressure, and cholesterol problems. Garlic is also used to boost the immune system.

**CLOVES (LAUNG):** Cloves are a spice with a strong, sweet aroma. They have antibacterial and antifungal properties and are commonly used to treat dental problems, such as toothaches and gum disease. Cloves are also used to treat digestive problems and to relieve pain.

**CARDAMOM (ILAICHI) :** Cardamom is a sweet-smelling spice that is commonly used in Indian sweets and teas. It has antioxidant properties and is believed to help regulate blood sugar levels. Cardamom is also used to treat digestive problems and to relieve nausea.

**CORIANDER (DHANIA):** Anti-microbial and anti-fungal properties. This superfood claims to have anti-microbial and anti-fungal properties, and is known to help lower blood pressure, blood sugar levels and cholesterol levels.

**CUMIN (JEERA):** Cumin has long been used in traditional medicine and is a rich source of iron. It aids in digestion and reduce food-borne infections. It is rich in antioxidants, and has been shown to exhibit anti-microbial and anti-inflammatory properties. Some studies have demonstrated that cumin can also aid in digestion, helps manage blood sugar levels and help in reducing food-borne infections.

**MUSTARD SEEDS (RAI OR SARSON):** Mustard seeds have a sharp and slightly bitter flavor with a rich aroma. These tiny seeds are rich in numerous essential minerals and various nutrients. They contain copious amounts of vitamins A, C, and K, which are crucial for fighting chronic diseases, better vision and eye health, and blood clotting mechanisms. Mustard seeds are rich in fibers, selenium, manganese, and magnesium, which boost our immunity, maintain various bodily mechanisms and are crucial for bone health. They also possess antibacterial, antifungal, anti-inflammatory, and anti-cancer properties. Extract of seeds benefits people with diabetes by lowering blood sugar levels.

**AJWAIN (CAROM):** The taste and flavor of the seeds are same as the aniseed and oregano. Bioactive compound present in the essential oil is thymol, which gives its bitingly hot and bitter taste that numbs the tongue when chewed. It is widely used as a spice in curries. It is a household remedy for indigestion. It is known for its antispasmodic, stimulant and carminative effect.

**FENUGREEK (METHI):** Fenugreek seeds are having many medicinal properties such as digestive disorders, bronchitis, tuberculosis infection, skin irritations, ulcers and menopausal symptoms, diabetes. It is used to reduce blood sugar level. It is also used with butter milk in the treatment of dysentery.

**ASAFOETIDA (HING):** Asafoetida is also commonly known as Food of the God and native to Iran and Afghanistan. It is good sources of protein, fiber, carbohydrates, calcium, phosphorous, iron, niacin, carotene and riboflavin. Asafoetida is very common and easily available spice in every home and effectively used in the treatment of indigestion, menstrual, pain, ear ache, body pains and tooth ache. It is used as an antimicrobial agent that increases the levels of detoxification enzymes in the body. It is also used in the treatment of chronic bronchitis and whooping cough.

**AAMCHUR POWDER (RAW MANGO POWDER):** It contains Vitamins A, C, D, B6, Iron and beta carotene. It gets rid of toxins, cleans the body of them, and is used to treat anaemia. It helps get rid of stomach acid, constipation, gastric problem and makes digestion better. Mango powder can also be used to treat problems with the blood pressure and nervous system, diarrhoea, dysentery, and infections of the urinary tract.

***Commonly used spices in different foodstuffs are having broad spectrum of bio- functions due to presence of bioactive compounds (curcumin, crocerin, D-carvone, D-limonere aldehyde cumino, eugenol, capsaicin, thymol, gingerol etc.) which may provide promising health benefits to our body from the many common disorders like cough, cold, fever, headache, stomach problems, cancer etc.***

**********

# Particle Accelerators

By Mr. Anil

## Introduction

### Atoms

Atoms. We have all heard of them before, but what does their name actually mean? Atom derives from the Greek 'atomos', meaning indivisible, i.e. not being capable of being divided into smaller pieces. They were named so by Democritus, a philosopher and a leading proponent of the theory of matter being made up of a large number of indivisible particles. However, are atoms really indivisible?

### The beginning of particle physics and the need for particle accelerators

**JJ Thomson,** with his **discharge tube experiment**, showed in 1897 that there exist negatively charged particles which were later called electrons. This marked the beginning of particle physics as a field of study. Note that here **electrons were accelerated from rest through a potential difference of 'V' volts**. Later, **Ernest Rutherford** accelerated α-particles(Helium nuclei) into a piece of gold foil in his famous **Gold Foil Experiment**. This experiment showed that the positive material inside an atom was concentrated in a small but massive area or the **nucleus**. Both these experiments show that it is important for us to be able to accelerate electrons and other particles through increasingly large potential differences so as to increase the speed of the particles (the formula for the speed of a charged particles is given by $v = \sqrt{2qV/m}$ where the symbols have their usual meaning).

As Rutherford himself said in his address to the Royal Society in 1927, "... if it were possible in the laboratory to have a supply of electrons and atoms of matter in general, of which the individual energy of motion is greater even than that of the alfa particle, .... this would open up an extraordinary new field of investigation....".

### Developments

"What we require is an apparatus to give us a potential of the order of 10million volts which can be safely accomodated in a reasonably sized room and operated at a few kilowatts of power. We require too an exausted (evacuated) tube capable of withstanding this voltage.....I see no reason why such requirements can not be made practical."
- Ernest Rutherford

### The First Particle Accelerator

A particle accelerator is defined as a device that produces beams of particles having **controllable intensity, energy, energy spread, transverse size** and **angular spread**. According to this definition the first particle accelerator ever produced was by **G. Cockroft** and **E. Walton**. They used a device called the **Cockroft-Walton Voltage multiplier**, which converts low voltage AC input to high voltage DC, to power their particle accelerator. With this accelerator, they performed the first nuclear disintegration in history in 1932, winning them the Nobel Prize in Physics. The energy of the ions obtained with this apparatus went up to 400 KeV.

### Van De Graff and Tandem Accelerators

A new type of generator was developed by **Robert Van De Graff** in 1929, which uses a moving belt to accumulate charges on a hollow metal sphere, creating extremely high electric potentials. Even tabletop versions of such generators can create voltages of the order of 100s of KVs. These generators were used in a special kind of particle accelerator called **tandem accelerators**. These accelerators use a negative ion source and ingeniously are able to utlilise the same potential difference twice, leading to much higher final energies. A lot of these accelerators are still in use today. Did you know that one such tandem accelerator is operating right in the very heart of our city Delhi? IUAC or the Inter- University Accelerator Centre in Delhi houses one of the finest tandem accelerator facilities in the world. It is capable of reaching terminal potential difference of about 15 MV or 15x106 Volts.

## Developments elsewhere

As early as 1923, **R. Wideroe** had invented the principle of a circular induction accelerator, called a '**betatron**', which used electric fields induced by varying magnetic fields to accelerate particles in a **circular orbit**. However, practical implementations of this apparatus only first appeared in the 1940s and even so they had multiple limitations. However, this wasn't Wideroe's major contribution. He also was responsible for the design and testing of the first linear drift-tube accelerator or Linac. This was an important development, as stated in the abstract of a paper from The American Physical Society from 1931 –

> 'The surprising effectiveness of this experimental method for the generation of intense beams of high speed ions is due to the development of simple, convenient and effective methods for focusing and synchronizing the ions as they pass through the accelerating system. The present experiments show that ions having kinetic energies in excess of 1,000,000 volt-electrons can be produced in this way with quite modest laboratory equipment and with a convenience surpassing the direct utilization of high voltages, that the limit to the attainable ion speeds is determined mainly by the length of accelerating system and the size of the high frequency oscillator system, and consequently that the production of 10,000,000 volt ions is an entirely practicable matter.'

## Modern Accelerators

**G. Ising** first published the principle of multiple acceleration in 1924, removing the limitations of electrostatics which had to be used up to that point in accelerators.
Once the possibility of multiple acceleration was discovered, the idea of accelerating particles by passing them several times through a same accelerating "gap" rather than once through many different gaps came to the mind of several researchers in slightly different form. It was E.O. Lawrence, inspired by Wideroe's "betatron", that first presented, pursued and patented the scheme later named "cyclotron". The first successfully operating cyclotron was built by **E.O. Lawrence** and **M.S. Livingston**. This was able to accelerate a few hydrogen molecules to 80KeV. Cyclotron facilities can be found across the world, with the biggest being the TRIUMF Laboratory in Vancouver, Canada operating at a maximum energy of 520 MeV.

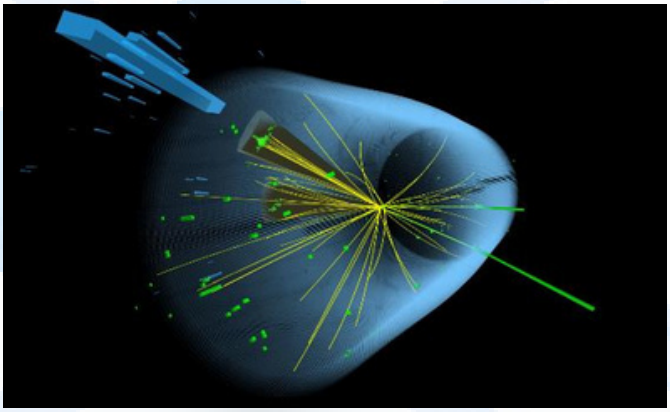
Nowadays, most accelerators are "Synchrotrons" which, similar to cyclotrons, involves particles moving in a fixed closed loop. The synchrotron is one of the first accelerator concepts to enable the construction of large-scale facilities, since bending, beam focusing and acceleration can be separated into different components.
The famous Large Hadron Collider at CERN in Switzerland, the biggest particle accelerator in the world with a circumference of about 27 kilometres, is a synchrotron type accelerator. The maximum energy at which the LHC can operate is an astonishing 6.8 TeV, making it the most marvellous piece of engineering in the world to date. However, it might be overtaken in the coming years by an even bigger particle accelerator called the 'Future Circular Collider" or the FCC. "The goal of the FCC is to push the energy and intensity frontiers of particle colliders, with the aim of reaching collision energies of 100 TeV, in the search for new physics.". This might well be the step to the next great discovery within particle physics.

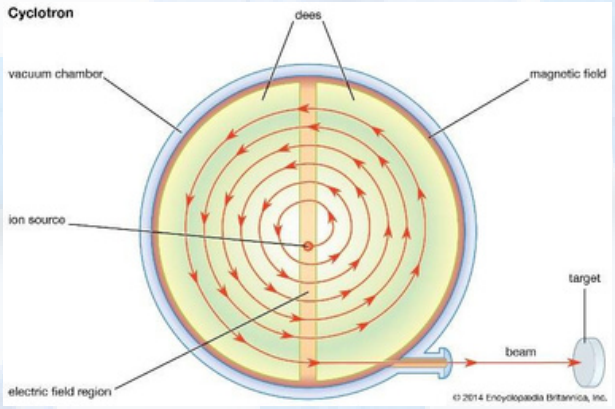
## Some Important Discoveries and uses

Particle accelerators have played a key role in advancing not only particle physics but nuclear physics and material science as well. The development of the Standard Model of particle physics has been made possible solely due to the development of particle accelerators. They have played a key role in advancing our understanding of the universe on the scale of atoms. One recent discovery that you might have heard of might help you realise the importance of the discoveries being made by particle accelerators. The existence of the Higgs Boson or, as it is popularly called, "The god particle", was proven by scientists at CERN in 2012. This discovery made headlines all across the globe. The Higgs boson is the fundamental particle associated with the Higgs field, a field that gives mass to other fundamental particles such as electrons and quarks. What this essentially means is that the existence of the universe is only due to this particle. In that sense, its popular name seems quite apt.

You might even have heard of the famous term “Antimatter”. It might seem like it exists only in movies or science fiction novels, but you might be surprised to know that the first anti-atoms were generated at CERN as early as 1995.

Particle accelerators have uses not only in physics research but in various areas of medicine among other fields. I am sure that in the coming years, you will hear and see much of the research being done at the LHC and other accelerators, be it on the news or somewhere else.






**WORKING OF A CYCLOTRON A LARGE VAN DE GRAFF GENERATOR IUAC TANDEM ACCELERATOR**

# CAN TIGERS RECOGNISE YOUR FACE?

Recent research suggests that tigers can indeed recognise human faces. Imagine spotting a tiger looking right at you, almost like it knows you!

However, if it weren't for Kailash Sankhala's groundbreaking survey on the tiger population in India 50 years ago, there wouldn't be any tigers to spot!

The survey revealed that only 1,800 tigers remained in the wild, prompting the Indian government to task Sankhala to establish and lead Project Tiger- a beacon of hope for the survival of India's fiery pride.

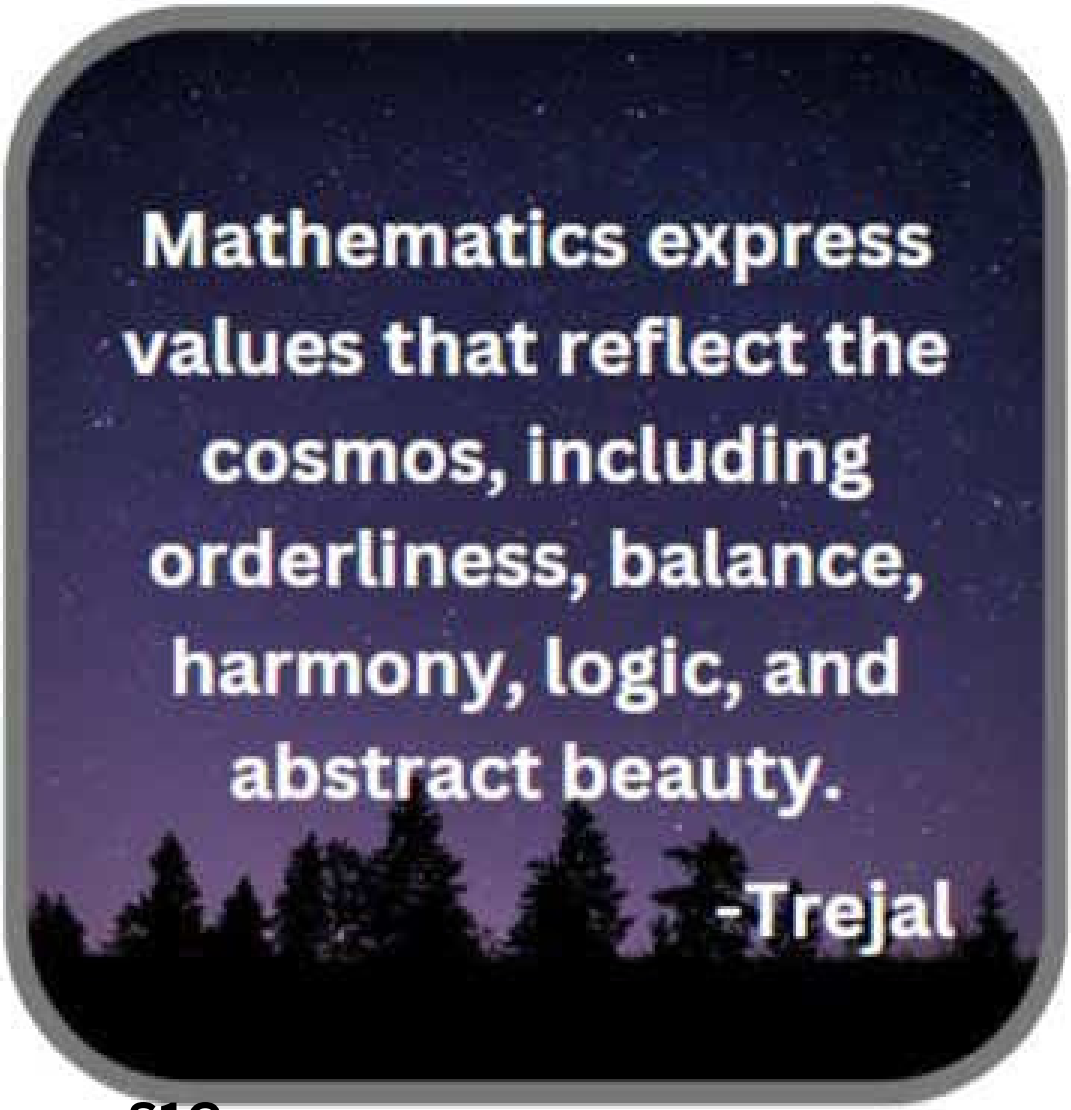
As we mark 50 years of Project Tiger, we also honour the eless efforts of Kailash Sankhala, because of whom, today, India's tiger population has increased to over 3,000. Bo next time you come across one, remember to thank him for his efforts.

## #SAVING OUR STRIPES

**SHAURYA CHAWLA, M2-D**

# Beauty of MATHEMATICS

## -Simplicity

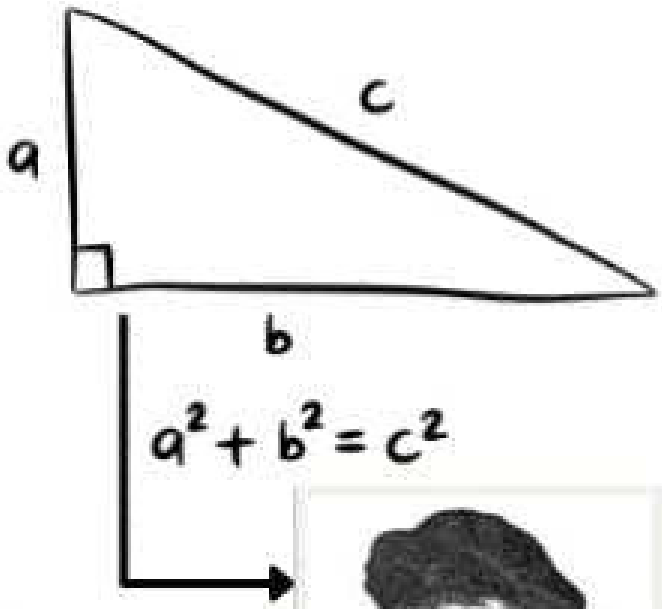



Aaryaman S1C
Trejal S1C

Supervised by Ms.Neelofar

Beauty exists in art, music, and nature, but it can also be found in mathematics. Despite its analytical nature, math possesses a unique aesthetic that is beautiful in its simplicity, elegance, symmetry, and its ability to represent and explain complex phenomena in the world around us.

The Pythagorean theorem is an example of a simple and elegant idea that has been admired for centuries. Elegant solutions to mathematical problems are those that are both simple and efficient, using a minimal amount of assumptions and steps, yet still able to provide a deep understanding of the problem at hand.



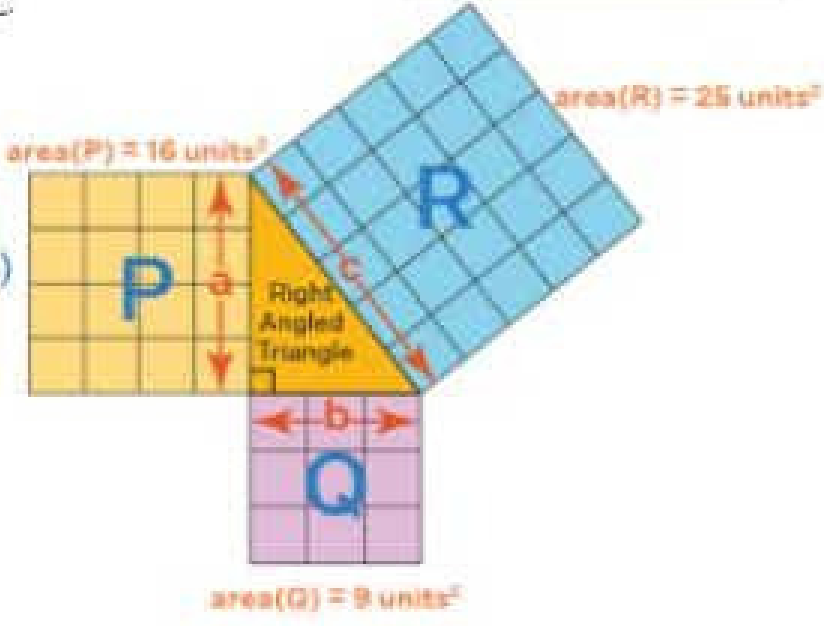

PYTHAGORAS

Pythagoras Theorem

area(P) + area(Q) = area(R)

16 + 9 = 25

$a^2 + b^2 = c^2$



The beauty of mathematics lies in its ability to provide insight into a problem that may seem insurmountable at first glance. Symmetry is a fundamental concept in mathematics and is important in many areas of science, from the study of crystal structures to the understanding of fundamental particles.

Beauty in math can be found in its simplicity, elegance, symmetry. By appreciating the beauty of math, we can gain a deeper understanding and appreciation for the world around us, and perhaps even find inspiration in its simplicity and elegance.

# Where Do Mathematical Symbols Come From?

Article By: Ms. Saumya Singh

**Math is full of symbols: lines, dots, arrows, English letters, Greek letters, superscripts, subscripts. It can look like an illegible jumble. It's normal to find this wealth of symbols a little intimidating. These symbols play a similar role as words in natural language. They may play different roles in mathematical notation similarly as verbs, adjective and nouns play different roles in a sentence. Have you ever wondered where these symbols come from?**

**In the 16th century, the mathematician Robert Recorde wrote a book named, "The Whitestone of Witte", to teach English students Algebra. Over and over, he used to write word equal to, equal to and get annoyed. Because it was too lengthy. He replaced those words with two parallel horizontal line segments because the way he saw it, no two things can be more equal. He could just as well have used four line segments instead of two. He could also have used vertical line segments instead. There is no reason why the equal sign had to look the way it does today. At some point, it just caught on. More and more mathematicians began to use it, and eventually, it became a standard symbol for equality.**

IS EQUAL TO
IS EQUAL TO
IS EQUAL TO
IS EQUAL TO
IS EQUAL TO
IS EQUAL TO

bobby007 @Robert_Recorde · 11s

Greetings everyone. Here's a radical idea: for expressing equality, instead of writing "is equal to", just use this symbol: =

**An apt conformity was noted between an equal to symbol and what it represented. Similarly, the plus sign (+) originated from condensing of the Latin word et meaning and. Sometimes, however, the choice of symbols is more arbitrary. Such as the symbol for factorial (!). Mathematician, Christian Kramp simply used '!' just because he needed a shorthand for expressions like**

$7 * 6 * 5 * 4 * 3 * 2 * 1$

**All of the mathematical symbols were invented or adopted by mathematicians who wanted to avoid repeating themselves or having to use a lot of words to write out mathematical ideas.**

7684932 − 7684930 = 2

## Ratio of the circumference of a circle to its diameter = 3.14159265358979323846264338327950Iamtiredalready!

Many of the symbols used in mathematics are letters, usually from the Latin alphabet or Greek. Characters are often found representing quantities that are unknown, and the relationships between variables. They also stand in for specific numbers that show up frequently but would be cumbersome or impossible to fully write out in the decimal form. Sets of numbers and whole equations can be represented with letters, too. Other symbols are used to represent operations. Some of these are specially valued as shorthand because they condense repeated operations into a single expression. The repeated addition of the same number is abbreviated with a multiplication sign so it doesn't take up more space than it has to.

$$2 + 2 + 2 + 2 + 2 + 2 + 2 = 2 \times 7$$

A number multiplied by itself is indicated with an exponent that tells you how many times to repeat the operation.

$$3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^7$$

A long string of sequential terms added together is collapsed into a capital sigma.

$$1 + 2 + 3 + 4 + \cdots + 99 + 100 = \sum_{i=1}^{100} i$$

These symbols shorten lengthy calculations to smaller terms that are so much easier to manipulate. Symbols can also provide succinct instructions about how to perform calculations. Instead of a lot of text, we end up with a compact elegant expressions with the help of mathematical symbols. Understanding them is a matter of memorizing what they mean and applying them in different contexts until they stick, as with any language.

# PROBLEM SOLVING

By. Deveshi Hans, S2C
Supervised by: Mr. Satish Dixit

## What is problem solving?

Well, it is very difficult to define problem solving. Some define problem solving in terms of the skills needed to solve problems, e.g. testing hypotheses, analysing data. Others define problem solving as a series of steps that people use to find a solution or answer to a question. Helgeson reports that in the literature of science education there is a strong linkage between problem solving and science process skills. That is, many science teachers teach students science process skills in the context of a subject---earth science, biology, chemistry, physics---because they accept the notion that these process skills are indeed the elements of problem solving. There are two aspects of this that should be pointed out. First, what are the generally accepted steps in problem solving, and secondly what are the science processes associated with problem solving.

## Steps for Problem solving

- Problem orientation
- Problem identification
- Problem solution
- Data analysis
- Problem verification

Scientific Thinking Skills and Problem Solving

The curriculum projects of the 1960s and 1970s placed emphasis on problem

solving, and developed it as a part of the organization of the curriculum, a series of problem solving skills which came to be known as the processes of science. They are also called the skills of science. Today, these skills are referred to as scientific thinking skills. It is important to note that problem solving as perceived in science classrooms is intimately related to these thinking skills. The thinking skills of science are conceptualized as belonging to two distinct groups, basic thinking skills, and integrated thinking skills.

The Eight Different Dimensions Of Hoover to operational construct are:

- Asking questions
- Constructing Hypotheses
- Designing and conducting a science investigation
- Repeated Trials
- Accurate Records
- Drawing conclusions
- Using Data
- Realizing

## Different types of Thinking skills

Basic thinking skills such as observing, emphasizing the foundations of science learning. The basic thinking skills are seen as a prerequisite for the integrated thinking skills. Integrated thinking skills are related more directly to problem solving, and are seen as the higher-order intellectual skills that problem solvers use.

Scientific Thinking Skills

| Basic Science Thinking Skills | Integrated Science Thinking Skills |
|---|---|
| **Observing**<br><br>Using the senses to gather information about an object or an event.<br><br>Example: Describing a mineral as red. | **Controlling Variables**<br><br>Being able to identify variables that can affect an experimental outcome, keeping most constant while manipulating only the independent variable.<br><br>Example: Controlling the type of soil or sand and the angle of incline when testing to find out what affect the amount of flow (water) has on the depositional rate of a model river in a stream table. |
| **Inferring**<br><br>Making an "educated guess" about an object or event based on previously gathered data or information.<br><br>Example: Saying that a landform was once underwater because of the presence of Brachiopod and trilobite fossils in the rocks. | **Defining Operationally**<br><br>Stating how to measure a variable in an experiment.<br><br>Example: Stating that depositional rate will be measured in grams of sand deposited in the stream table's "ocean." |
| **Measuring** | **Formulating Hypotheses**<br><br>Stating the expected outcome of an experiment. |

| | |
|---|---|
| Using both standard and nonstandard measures or estimates to describe the dimensions of an object or event.<br><br>Example: Using an equal-arm balance to measure the mass of an object. | Example: The greater the amount of flow in a river the greater the depositional rate. |
| Communicating<br><br>Using words or graphic symbols to describe an action, object or event.<br><br>Example: Describing the change in temperature over a month in writing or through a bar graph. | Interpreting Data<br><br>Organizing data and drawing conclusions from it.<br><br>Example: Recording information about weather changes in a data table and forming a conclusion which relates trends in the data to variables (such as temperature, pressure, cloud cover, precipitation) |
| Classifying<br><br>Grouping or ordering objects or events into categories based on properties or criteria.<br><br>Example: Placing all minerals having a certain hardness into one group. | Experimenting<br><br>Being able to conduct an experiment, including asking an appropriate question, stating a hypothesis, identifying and controlling variables, operationally defining those variables, designing a "fair" experiment, conducting the experiment, and interpreting the results of the experiment.<br><br>Example: Describing and carrying out a process to find out the effect of stream flow on depositional rates in rivers. |
| Predicting<br><br>Stating the outcome of a future event based on a pattern of evidence.<br><br>Example: Predicting the position of the moon in the sky based on a graph of its position during the previous two hours. | Formulating models<br><br>Creating a mental or physical model of a process or event.<br><br>Example: The model of how the processes of erosion, deposition, metamorphism, and igneous activity interrelate in the rock cycle. |

# THE RISE OF THE MACHINE ARTISTS

Generative AI (GenAI) is a type of Artificial Intelligence that can create a wide variety of data, such as images, videos, audio, text, and 3D models. It has the potential to transform many industries, like advertising industry, e-commerce industry and more. A generative model can take what it has learned from the examples it's been shown and create something entirely new based on that information. Hence the word "generative!"

Nowadays one of the most infamous multilingual generative pre-trained models is 'Chatbot' a highly controversial chat bot in the eyes of the human, the computer, and the interrogator. Chat GPT is a text generation model that uses autoregression and attention algorithms to generate coherent responses based on context and semantics. It can adapt to different situations and continuously learn through transfer training on new tasks and data.

## How does it work?

Chatbot has been created with one main objective – to predict the next word in a sentence, based on what's typically happened in the gigabytes of text data that it's been trained on. Once you give ChatGPT a question or prompt, it passes through the AI model and the chatbot produces a response based on the information you've given and how that fits into its vast amount of training data. It's during this training that ChatGPT has learned what word, or sequence of words, typically follows the last one in a given context. The success of Transformer inspired the development of more advanced pre-trained language models, such as GPT-1, which was released by Open AI in 2018. Open AI had recently launched chatgpt4, an improved version of its predecessors whose database is tuned to 2021. Which helps in replicating a human in terms of error while responding correctly.

AI trained models, in general, have been designed to replicate human responses. If we consider the infinite amounts of questions one can ask, the design structure might exceed the complexity of that of a human brain itself. To keep it simple, the designers use certain algorithms.
A unique pattern must be available in the database to provide a suitable response for each kind of question. A hierarchy is created with lots of combinations of patterns. Algorithms are used to reduce the number of classifiers and create a more manageable structure. Computer scientists call it a "Reductionist" approach- to give a simplified solution; it reduces the problem. Multinational Naive Bayes is the best example of the algorithm for NLP and text classification. For instance, let's look at the set of sentences that belong to a particular class. With new input sentences, each word is counted for its occurrence and is accounted for its commonality. Then, each class is assigned a score. The highest scored class is the most likely to be associated with the input sentence.

## CHATGPT: Saviour or destroyer?

One of the main benefits of CHATGPT is that it can easily comprehend and reply to normal languages. Due to which, it can be used to develop chatbots, virtual agents etc., which can communicate with people in a natural manner. This will be very helpful in education and customer service.
Chatgpt can be very helpful in the medical sector. It can help in more efficient diagnosis by summarising extensive medical records based on symptoms and lab results.
Chat GPT has the capability to produce text which is nearly impossible to tell apart from human typing.

# THE RISE OF THE MACHINE ARTISTS

Generative AI (GenAI) is a type of Artificial Intelligence that can create a wide variety of data, such as images, videos, audio, text, and 3D models. It has the potential to transform many industries, like advertising industry, e-commerce industry and more. A generative model can take what it has learned from the examples it's been shown and create something entirely new based on that information. Hence the word "generative!"

Nowadays one of the most infamous multilingual generative pre-trained models is 'Chatbot' a highly controversial chat bot in the eyes of the human, the computer, and the interrogator. Chat GPT is a text generation model that uses autoregression and attention algorithms to generate coherent responses based on context and semantics. It can adapt to different situations and continuously learn through transfer training on new tasks and data.

## How does it work?

Chatbot has been created with one main objective – to predict the next word in a sentence, based on what's typically happened in the gigabytes of text data that it's been trained on. Once you give ChatGPT a question or prompt, it passes through the AI model and the chatbot produces a response based on the information you've given and how that fits into its vast amount of training data. It's during this training that ChatGPT has learned what word, or sequence of words, typically follows the last one in a given context. The success of Transformer inspired the development of more advanced pre-trained language models, such as GPT-1, which was released by Open AI in 2018. Open AI had recently launched chatgpt4, an improved version of its predecessors whose database is tuned to 2021. Which helps in replicating a human in terms of error while responding correctly.

AI trained models, in general, have been designed to replicate human responses. If we consider the infinite amounts of questions one can ask, the design structure might exceed the complexity of that of a human brain itself. To keep it simple, the designers use certain algorithms.
A unique pattern must be available in the database to provide a suitable response for each kind of question. A hierarchy is created with lots of combinations of patterns. Algorithms are used to reduce the number of classifiers and create a more manageable structure. Computer scientists call it a "Reductionist" approach- to give a simplified solution; it reduces the problem. Multinational Naive Bayes is the best example of the algorithm for NLP and text classification. For instance, let's look at the set of sentences that belong to a particular class. With new input sentences, each word is counted for its occurrence and is accounted for its commonality. Then, each class is assigned a score. The highest scored class is the most likely to be associated with the input sentence.

## CHATGPT: Saviour or destroyer?

One of the main benefits of CHATGPT is that it can easily comprehend and reply to normal languages. Due to which, it can be used to develop chatbots, virtual agents etc., which can communicate with people in a natural manner. This will be very helpful in education and customer service.
Chatgpt can be very helpful in the medical sector. It can help in more efficient diagnosis by summarising extensive medical records based on symptoms and lab results.
Chat GPT has the capability to produce text which is nearly impossible to tell apart from human typing.

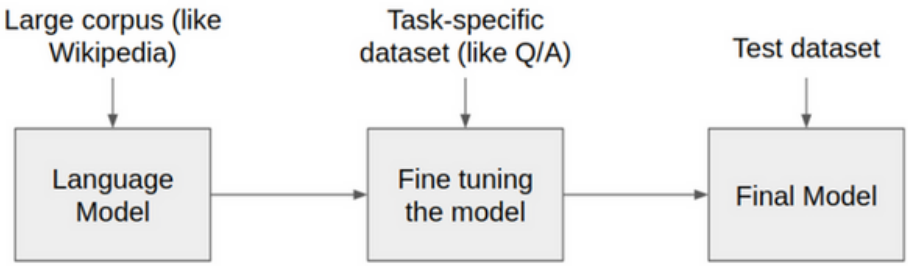
This could be revolutionary in social networking. We can use chatGPT to generate blogging and upuates on social media.

But there are difficulties with using Chat GPT as well. The potential for it to be exploited maliciously represents one of the main worries. It might be used, for instance, to just provide false information or misinformation, distribute information, or manufacture convincing phishing emails. The implications on democracy, public opinion, and cybersecurity could be substantial. The first worry is that ChatGPT could change the fundamental training structure of higher education. This system is at risk of being replaced with AI, giving rise to unimaginable problems. For instance, a student depending on traditional textbooks to accumulate knowledge in a certain discipline will be at a great disadvantage against an AI chatbot which possesses interdisciplinary and in-depth knowledge.

## Phishing & Malware:

AI-powered chatbots such as ChatGPT can be used by hackers to write persuasive phishing emails or messages, making them more challenging to detect and prevent. These chatbots can mimic the writing style and appear to be from a legitimate source, tricking users into giving away sensitive information or downloading malware.

To conclude all this, AI trained bots are still in the developmental stage. AI is an emerging technology and in the future these AI trained bots could easily replace routine jobs in some sectors. Yet this does not necessarily mean it is a curse to human life. On the contrary, these new AI tools could be very helpful for humans in doing various tasks such as writing emails, answering questions and more. So whether AI is a boon or bane depends on how we choose to use it. If we use it responsibly then it can be a very helpful tool for humans but if we choose to misuse it, then it could easily lead to ravaging consequences.


**Kaashvin Dhillon SS2A**
**Hamza Ahmed Siddiqui SS2B**

# Quantum Computing: Unleashing the Potential of the Future

## What is computing?

Computing is the utilization of computer technology to complete a given task. As computers developed through the 20th century, their applications expanded much further than anyone could have ever thought. Nowadays, computers are an essential part of almost all fields of study. Computers play an essential role in the simulation of physical systems and models. Any situation which requires automation of a task requires computing. An interesting use of computing is to encrypt and decrypt data, essential for the security of utilities we use daily, such as bank transactions. As such, computing has become essential for almost all forms of scientific inquiry.

## Quantum Computers - The Future of Computing

"Nature isn't classical, dammit, and if you want to make a simulation of nature, you'd better make it quantum mechanical, and by golly it's a wonderful problem, because it doesn't look so easy." – Richard Feynman

**Difficult Problems that cannot be solved**

**Some problems are impossible for classical computers to solve due to their immense complexity or size. One fundamental example is solving the equation "m=p*q" for sufficiently large p and q where both are prime numbers. This problem is so hard to solve that it is the basis for most of the data encryption and security today. Classical computers would take billions of years to solve this seemingly simple equation as they would have to work the answers out by trying all the possible combinations (of which there is a pretty large number).**

**Other problems arise in the study and measurement of quantities such as the bond length of molecules. It is found that with classical computers, the calculated bond length is off by a factor of 2 from the verified experimental measurements. This is due to the immense complexity of the overlapping orbitals which is the basis of the formation of molecules. Even the simulation of complex physical systems is not possible with classical computers, limiting the prospect of research that can be conducted using them.**

**Apart from these, there exist many other problems which expose the startling limitations of the machines we are all so familiar with today. It is predicted that no amount of development of these could ever lead to solving the problems mentioned.**

## What is a Quantum Computer? How will it impact the future of humanity?

**Quantum computers are devices that are fundamentally different from the classical computers of today. Instead of using bits to represent information, quantum computers use qubits. While bits can only be 0 or 1, qubits can be 0, 1, or both at the same time. This is crucial to why quantum computers are so much faster than classical computers in solving complex problems. Just to emphasize how much faster quantum computing is, we look at our example of solving the equation for p and q. Using a quantum computer, we can solve the same problem it would take a classical computer billions of years to solve in just a matter of minutes (using a quantum algorithm called Shor's Algorithm). This is just the beginning of the vast potential applications of quantum computers. Quantum computers can also utilize quantum entanglement to transmit data faster and more efficiently than ever before. All of this has profound implications not only for science but for society as a whole. Quantum computing will, once it's developed enough, completely change the landscape of security and encryption.**

In fact, some major banks and companies have already started working on impenetrable quantum encryption, making transactions safer than ever before. With such computers, complex systems can be simulated which opens many avenues for physical research. The analysis of complex molecules is also possible which has wide implications in the fields of medicine and chemistry. Studies show that calculations done by quantum computers are much closer to experimental values than any classical computers.

Quantum computers pose several challenges. Quantum processors need to be kept at temperatures approaching absolute zero for them to function properly. This means that a lot of machinery is required to cool the processor. Therefore, the scalability of such systems is a major challenge. This also means that the cost of research is extremely high. Apart from this, quantum systems are extremely fragile. They might give errors after performing a few successful computations in contrast to classical computers which can perform millions of computations seamlessly without faltering. We need new programming languages, compilers, and other software development tools to be able to completely harness the power of quantum computing. Even with the required tools, the number of skilled people who can understand and implement quantum algorithms is small and spread over the globe.

## The journey till now

The development of quantum computers is still in its early stages. The most advanced devices of today can be compared to the ENIAC (the first significant classical computer); large, inefficient, and difficult to use. The most advanced quantum computers yet use only 4-5 qubits. This means that there is still a large scope for improvement. The problems listed above are hard to solve and it will undoubtedly take a lot of time and resources to overcome these barriers. Even still, quantum computers are expected to develop rapidly in the near future. This means that you can look at quantum computing as something to make a career in.

To conclude, while quantum computers are not very developed at this stage, they can solve problems classical computers could not. They provide a very interesting and elegant solution. Even with the limitations and high costs, quantum computing is an extremely important field of study that might have a great positive impact on humanity. They will undoubtedly accelerate the development of science and mathematics, directly contributing to the expansion of human knowledge. They will also provide unbreakable encryption making our futures safe and secure.

Image 1: The ENIAC

Image 2: A modern quantum computer

Links:

https://www.youtube.com/watch?v=yy6TV9Dntlw&ab_channel=MITVentureCapital%26Innovation - Talk by Dr. Dario Gil (Vice-President IBM) explaining quantum computing

https://www.youtube.com/watch?v=yy6TV9Dntlw&ab_channel=MITVentureCapital%26Innovation - Interesting video on how to make a qubit

https://www.youtube.com/watch?v=yy6TV9Dntlw&ab_channel=MITVentureCapital%26Innovation - Ted talk on quantum by Dr. Shohini Ghosh

Eklavya Raman SS2A

# GBS celebrates EARTH DAY

**MS. MINI SETHI**
**DR. MANPREET KAUR**

**Every year, April 22 is celebrated as Earth Day to mark the anniversary of the birth of the modern environmental movement in 1970. Earth Day is widely recognized as the largest secular observance in the world. It is celebrated as a day of action to change human behavior and create global, national and local policy changes in order to protect our planet against the ravages of pollution, deforestation and climate change. The theme for the Earth Day 2023 is "Invest in our planet."**

*Students across M1 to M3 (Middle Department) celebrated Earth Day with great enthusiasm by putting up an installation under the guidance of Ms. Mini Sethi, Dr. Manpreet Kaur, Ms. Innocencia Kujur, Ms. Riya Pramanik, Ms. Poonam and Mr. Anjan.*

*The installation consisted of a rotating model of Earth in the centre with four different sections around it which highlighted the themes: Save Water, Save Biodiversity, Save Energy and Stop Desertification. Four display boards were also put behind the main installation that were decorated with posters, bookmarks, collage, etc. made by the students. The different sections around the Earth model were decorated with the relevant 3D and 2D models.*

**EARTH DAY INSTALLATION**


SAVE WATER


SAVE ENERGY

SAVE BIODIVERSITY

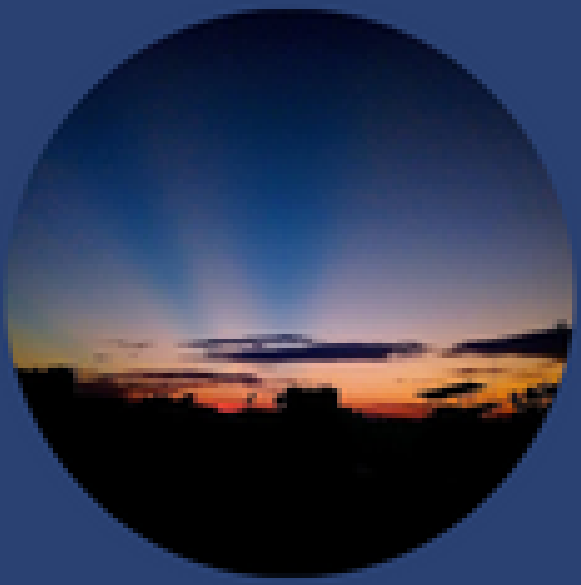
STOP DESERTIFICATION




DISPLAY BOARDS

https://drive.google.com/file/d/1hCoFEPO8KU3lfEITdjuSpLomMCoMPKOZ/view?usp=drivesdk

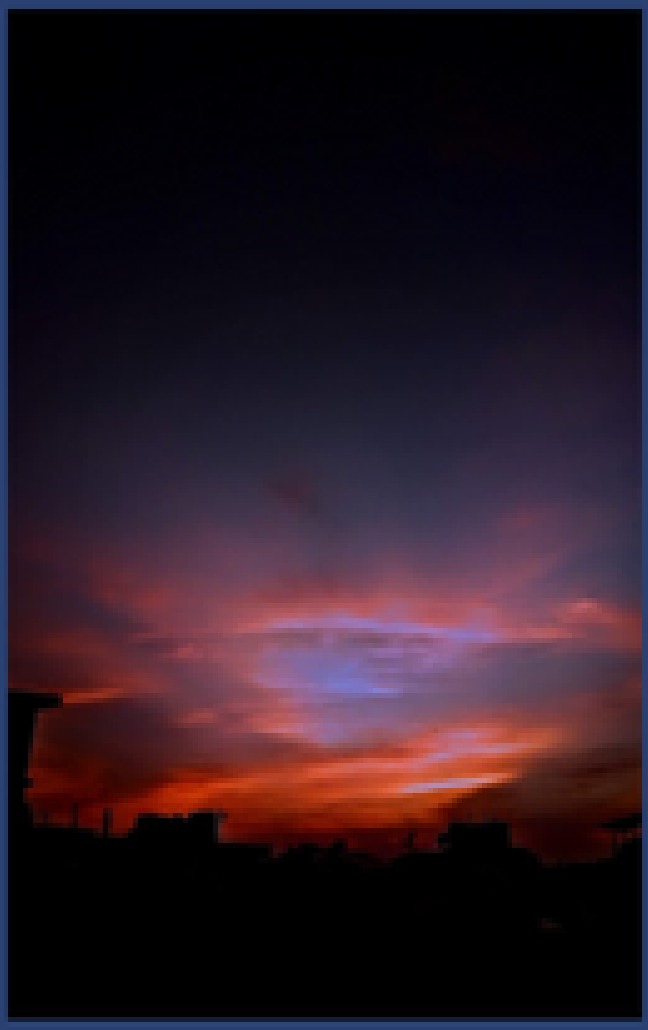
# The Vibrant Sunsets



What could be more mystical than enjoying a glorious sunset? The beautiful colours flowing across the sky full of hope. Well as magical as this scene may look, It has a very intriguing scientific theory behind it.

The colours seen in a sunset are due to the scientific phenomenon known as 'light scattering' . The Scattering of light happens when light rays hit particles in the air, changing the direction of the light hence we are shown such a vast variety of colours.

Each natural phenomenon in natural has a very intriguing scientific reason behind it hence we always refer to it as "Science in Nature"



PHOTOGRAPHY CLUB

-Pritika Oram S1A

# SUDOKU

Difficulty: medium

Time limit: 45min

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2 | 6 | | 7 | | 1 |
| 6 | 8 | | | 7 | | | 9 | |
| 1 | 9 | | | | 4 | 5 | | |
| 8 | 2 | | 1 | | | | 4 | |
| | | 4 | 6 | | 2 | 9 | | |
| | 5 | | | | 3 | | 2 | 8 |
| | | 9 | 3 | | | | 7 | 4 |
| | 4 | | | 5 | | | 3 | 6 |
| 7 | | 3 | | 1 | 8 | | | |

Answer-

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9 | 5 | 2 | 8 | 1 | 4 | 3 | 6 | 7 |
| 6 | 3 | 1 | 7 | 5 | 9 | 8 | 4 | 2 |
| 4 | 7 | 8 | 9 | 2 | 6 | 9 | 1 | 5 |
| 8 | 2 | 6 | 3 | 4 | 7 | 1 | 5 | 9 |
| 5 | 1 | 9 | 2 | 8 | 6 | 4 | 7 | 3 |
| 7 | 4 | 3 | 5 | 9 | 1 | 6 | 2 | 8 |
| 2 | 6 | 5 | 4 | 3 | 8 | 7 | 9 | 1 |
| 3 | 9 | 4 | 1 | 7 | 5 | 2 | 8 | 6 |
| 1 | 8 | 7 | 9 | 6 | 2 | 5 | 3 | 4 |

TREJAL SINGH S1C


# INVEST IN OUR PLANET