EUROMATH & EUROSCIENCE CONFERENCE 2025
&
EUROPEAN STEAME-ACADEMY SYMPOSIUM 2025

ABSTRACTS BOOKLET

12 – 16 MARCH 2025
THESSALONIKI, GREECE

EUROMATH & EUROSCIENCE 2025
and
EUROPEAN STEAME-Academy Symposium 2025

Opening Ceremony

Venue: GRACE HALL B&C
GRAND HOTEL PALACE, Thessaloniki

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Music Concert

By the Music School of Volos, Greece

1. Siyahamba, 2. Believer, 3. On top of the rosebush

Music Directors: Maria Petroulia & Antonis Vasileiadis

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Welcoming address by the chair of the Organizing Committee

Professor Gregoris Makrides,
Professor of Maths & STEAME Education
President of the European Federation of STEAME Teacher Facilitators Academies
President, Cyprus Mathematical Society and THALES Foundation

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Greetings

Professor Jan Philip Solovej
President of the European Mathematical Society

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Invited Plenary

What is intelligence?
Tomasz Szemberg, Professor of Mathematics
at the University of the National Education Commission in Krakow, Poland

FULL CONFERENCE PROGRAMME

Abstracts Booklet

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WELCOMING ADDRESS BY THE CHAIR OF THE ORGANIZING COMMITTEE

Prof. Gregoris A. Makrides*

Dear students, teachers, parents and colleagues, on behalf of the organizers we welcome you to the EUROMATH & EUROSCIENCE 2025 and the European STEAME-Academy Symposium 2025.
It is with great pleasure to welcome 500+ student participants and 100+ teachers from 20+ countries. During this event we will celebrate the International Day of Mathematics during the "Mathematics and Science by Night" dinner dance on the 14th March.
The conference programme has about 200 Math & Science Presentations by school students, 23 workshops delivered by teachers and researchers and several research presentations by teachers on STEAME related topics. Student participants have the opportunity to develop research and communication skills and at the same time to network and make new friends from many different countries.
We want to thank all the collaborating organizations, the collaborating colleagues with jury and coordination roles for their excellent volunteering support and contribution.
The abstracts booklet communicates the content of the presentations and workshops so participants can study before they design their programme of attending sessions of the conference.

We wish everyone a fruitful and enjoyable conference event.

*Dr. Gregoris Makrides, Professor of Mathematics and STEAME Education at the University of National Education Commission in Krakow, Poland; President of the Cyprus Mathematical Society; President of the THALES Foundation; Coordinator of the STEAME-Academy project and chair of the organizing committee of the conference.

PLENARY TALK

PL1. WHAT IS INTELLIGENCE?

Tomasz Szemberg
Professor of Mathematics, University of the National Education Commission in Krakow, Poland

In a world driven by rapid technological advancements and the rise of artificial intelligence, the concept of intelligence itself has become increasingly complex. But what exactly is intelligence? Is it the ability to solve complex mathematical problems, make decisions, or learn from experience? In this talk, we will explore the various facets of intelligence – ranging from human cognitive abilities to machine learning systems – and discuss how mathematics plays a crucial role in understanding and defining intelligence. We'll also delve into the differences between artificial intelligence and human intellect, examining how the two complement and challenge each other in today's world. Join the talk to explore the fascinating question: What does it really mean to be intelligent?

Short Bio of prof. Tomasz Szemberg

Tomasz Szemberg obtained his master's degree in mathematics from the Jagiellonian University in Krakow, Poland, in 1990. In 1994, he earned his PhD in mathematics from the University of Erlangen-Nuremberg in Germany. He has held postdoctoral and research fellow positions at numerous institutions, including the Henri Poincaré Institute in Paris, France, and the Max Planck Institute for Mathematics in Bonn, Germany. He was also invited as a senior Fulbright researcher at the University of Michigan in Ann Arbor, USA. In 2001, he obtained his habilitation degree in mathematics in Essen, Germany. Since 2002, he has been a professor of mathematics at the University of the National Education Commission in Krakow, Poland. Since 1995, he has been involved in various research-based activities with talented youth, and several of his students have gone on to become professional mathematicians. He has also trained multiple groups of Polish students to participate in earlier editions of Euromath.

STUDENT PRESENTATIONS IN MATHEMATICS

MP1. THE MAGIC OF CHAOS: UNVEILING THE DYNAMICS OF THE LOGISTIC MAP

Anthi Eleni-Pinelopi, Diamanti-Polychronopoulou Danai, Nasi Virginia, Tourva Irini
The Moraitis School, Athens, Greece

We believe that most of you think that chaos is completely indefinite. What if we told you that it is not? That is exactly what we also assumed before we discovered the logistic map. Apparently, this simple mathematical formula can show how a predictable and calculable pattern can lead to chaotic behavior, which, in fact, may not be as orderless as one might think!
In this work, we explore the dynamics of the logistic map: By changing the initial conditions, we observe the diagrams that emerge. We investigate its relation to chaos theory and present its remarkable applications in Economics and Epidemiology.

MP2. GOTCHA? PARADOXES AND FALLACIES IN MATH & LOGIC

Aashna Khot, Rohin Khot
Meritorin Koulu School, Finland

Once upon a time, there was a barber who said, “I shave every single man in this town, but never, ever, anyone who shaves themselves.” A while later he was seen sporting a shaggy beard and a cartoon moustache. He continues to ponder on how to get them shaved. Why?
The barber cannot be shaving himself because he shaves anyone who shaves themselves. At the same time, if anyone else shaves the barber, then that anyone has to be the barber. So, who shaves the barber? Gotcha?
This is a classic paradox, a statement that contradicts itself. In fact, this one is Russel’s barber paradox found in a book by Martin Gardner.
How about I show you that 1€ is equal to 1 cent? Would you be able to spot the fallacy (error in the logic)? Paradoxes and fallacies are logical impossibilities, statements or actions that cannot exist; but do. They are so magnetic - because they are puzzles simply not feasible to solve. But they do help us to improve our logic and critical thinking. Great minds and mathematicians like AlanTuring, Bertrand Russel, Martin Gardner and Kurt Gödel have explored this domain and have come up with some interesting ones.
In our presentation, we will challenge and fascinate you with some of the most interesting contradictions and paradoxes in mathematics and logic. One little thing though- please come ready, because I’m no neurosurgeon to fix your brain if it blasts.

MP3. BEES AND REGULAR HEXAGONS

Polymeropoulos Dimitris, Kagioglidis Panagiotis, Spyridakis Michalis, Chandakas Stylianos, Saounatsos Alexandros, Peppas Ioannis
Erasmios Ellinogermanic School, Athens, Greece

Are bees mathematically literate?
The common bee, properly known as the HONEYBEE, uses wax released from glands on the underside of its abdomen to create its honeycomb. The honeycomb is regarded as an engineering wonder. Why?
For ages, mathematicians have thought that since hexagonal partitions require the least amount of building material and maximize available space, they are better than equilateral triangles, squares, or any other design. They were unable to provide a complete explanation, though. This advantage was mathematically shown in 1999 by Professor Thomas C. Hales, who dubbed it the "honeycomb conjecture." He proved that the most effective technique to partition a space into equal sections with the least amount of structural support is to use regular hexagons.
The hexagonal cells allow bees to make the most of their limited space, create a strong, lightweight honeycomb with the least amount of wax, and store the most honey in the accessible area. Not surprisingly, the honeycomb has been referred to as a "architectural masterpiece."
Explaining why bees build their honeycombs in regular hexagons is the presentation's main goal. In order to accomplish this, we will first go over the fundamentals of bee biology so that everyone is aware of what we are discussing. The basic geometric shapes will next be discussed, along with their basic characteristics and a mathematical justification for why bees construct their honeycombs in the shape of regular hexagons.

MP4. FROM DECORATING THE ALHAMBRA TO MODERN TILING THEORY

Georgountzos Alexandros, Kokkinos Filippos, Lalis Ion
The Moraitis School, Athens, Greece

Assume you are a famous architect living in Granada, Spain in the 13th century and that you are hired to build and design the Alhambra for Muhammad XII, the sultan of the Nasrid dynasty. After the long and tedious task of designing the main body of the palace, the only thing that is left is to decorate the buildings. Obviously, you master all architectural and designing practices of all previous civilizations. However, you must show originality! Your tiling techniques have to break new ground. You combine and experiment with tiles used to decorate temples you have visited or studied from all around the world. You wish to discover the most fitting and interesting tiles and create intricate and unique designs.
In this work, we present the mathematics of tiling. Tiling is the covering of a plane using geometric shapes, or tiles, without gaps or overlaps. Shapes that are used include the familiar triangles, squares and rectangles, but the options are endless. We mention periodic and aperiodic tilings, Euclidean, Archimedean and Penrose tilings and list the 17 distinct symmetry groups. We investigate shapes that exhibit symmetry, the relation to the golden ratio (phi) and reproduce the wonderful designs of the Alhambra.
We find out that tiling theory not only explores the combinatorial and geometric aspects of tiling patterns, but impacts fields like group theory, architecture and robotics.

MP5. THE MATH BEHIND BLOOD FLOW

Marielena Neophytou
Kykkou B Lyceum, Nicosia, Cyprus

The interface between mathematics and biology has fostered the development of innovative mathematical models, where the principles of fluid dynamics are applied to understand complex biological processes such as blood circulation. Blood flow, a key aspect of the cardiovascular system, is typically modeled as a fluid moving through arteries, veins, and capillaries. In this presentation, we explore a simplified yet effective mathematical approach to modeling blood flow and blood pressure. Assuming blood behaves as a Newtonian fluid, governed by the Navier-Stokes and continuity equations, we derive a basic differential equation known as the circulatory system equation. This model is extended using Poiseuille's law to account for blood pressure. We also analyze these models numerically, investigating how the surface area, pressure gradient, and vessel length affect blood flow dynamics. Our presentation aims to provide a clearer understanding of how mathematics can be applied to study normal blood flow and diagnose health conditions. The results demonstrate the power of mathematical modeling in capturing the behavior of cardiovascular systems and offer insights into potential applications in medical diagnostics.

MP6. THE SOUND OF MATHEMATICS

Maria Andra, Xristina – Eleni Douloudi
Mandoulides Schools, Thessaloniki, Greece

The presentation is structured on the relationship between Mathematics and music, including the history behind these two topics. There is a thorough analysis of the basic music terms directly related to Mathematics, as well as a timeline of their relationship, that goes back to the 6th century BC. This timeline includes the beliefs of certain ancient philosophers and Mathematicians, such as Aristoxenus and Pythagoras.
Our aim is to raise awareness around the unexpected relationship between Mathematics and music - two subjects hardly anyone could ever imagine are connected - as well as the history behind them. Via this presentation, we also intend on acknowledging Pythagoras, who discovered the harmony of tones that are pleasing to the human ear, even though he was a Mathematician.
The information was collected from reliable sources such as Iamblichus, a philosopher and bibliographer of Pythagoras, while the timeline is formed by historical data and events. Our familiarity with music allowed us to analyze basic music terms and connect them with the subject of Mathematics.
The main reason we selected this topic is our familiarity with both Mathematics and music. We perceive music terms and have also observed many arithmetic concepts hidden in the art of music. Thus, we decided to explore all aspects of this art that are connected to Mathematics.

MP7. HOW CRYPTOGRAPHY WORKS: CREATING YOUR OWN CIPHERS

Dmitrii Stiufliaev
Med High Private English School, Larnaca, Cyprus

Even as children sitting in school classes, many of us tried to pass notes through our classmates, trying to think of a way to keep them from being understood. This simple desire to keep secrets from curious eyes was already stimulating interest in encryption, even in its most primitive forms. Encryption is the foundation of secure communication in today's world. Over the centuries, cryptographers have come up with a bunch of cool methods to make ciphers, and cryptanalysts have tried to crack them. For example, things like the Caesar cipher, the Vigenère cipher, and one-time-pad were real breakthroughs in their time. But technology advances very quickly, and the advent of quantum computers made many of the old methods outdated. So, people switched to more complex and secure algorithms like RSA and AES, which are now considered the best and most secure. My project is not about old encryption methods, but about modern technology that will protect us in the future. I will explain how strong modern algorithms are, show how RSA and AES work, and explain how data is encrypted now.

MP8. MATHEMATICS BEHIND CRYSTALS

Natasa Michailidou, Kayla Pasha, Dorin Kliger
Med High Private English School, Larnaca, Cyprus

Since ancient times, crystals known as nature's perfection have been considered to be an enchanting and fascinating material such as diamonds, categorized by their unique properties. This presentation investigates the mathematical side of crystals. How does math help us interpret what's happening inside a crystal that we can’t see with our eyes? isn't it amazing that math can explain something as simple as the sparkle of a crystal? This presentation deals with: crystal shapes and polyhedral, quasicrystals, crystal patterns, fractals and crystalline structures, geometry role and some other mysteries that want to be unraveled…

Crystal is a word that comes from the Greek word “krystallos” which means ice. One thing found compelling was crystals shapes and polyhedra; the regular shapes of crystals immediately remind mathematicians of, the regular convex polyhedra commonly known as platonic solids with coinciding faces and the same number of faces meeting at each vertex. There are exactly five Platonic solids: tetrahedron, hexahedron or cube, octahedron, dodecahedron, and icosahedron; their faces are equilateral triangles, squares, or pentagons. While this presentation internal mathematical harmony within crystals mathematics also explains external beauty.

MP9. PROBABILITIES AND COMBINATORIES

Antiukov Myron
Med High Private English School, Larnaca, Cyprus

This project explores the profound impact of probabilities and combinatorics in solving real-life problems and optimizing decision- making. By examining everyday scenarios such as scheduling, risk analysis, resource allocation, and game strategies, we demonstrate how mathematical principles can simplify complex systems and improve outcomes. Probabilities help us measure uncertainty and predict future events, while combinatorics aids in understanding the arrangement and selection of possibilities in diverse contexts. Through practical examples and engaging applications, this project showcases the power of these mathematical tools in enhancing critical thinking, fostering innovation, and solving challenges in fields such as healthcare, logistics, and technology.

MP10. THE MATHEMATICS OF SENSE(S)

Nikolina Markovic, Jana Pantelic, Stefan Jovanovic
High School “Sveti Sava”, Serbia

Mathematics lies at the heart of artistic expression, shaping how we perceive and experience the interplay of sight and sound across all forms of art. From visual arts to music, architecture, and beyond, mathematical principles harmonize sensory elements, creating experiences that resonate deeply within us. This exploration delves into how fundamental mathematical concepts—such as the Golden Ratio, harmonic sequences, and fractal patterns—integrate visual and auditory dimensions, forming the foundation of artistic creation and perception.

In every medium, mathematics orchestrates the balance between structure and emotion. The composition of a painting, the acoustics of a concert hall, or the rhythm of a dance follow patterns that optimize sensory harmony. These principles are not isolated; they work together to shape how we interpret space, motion, and sound as a cohesive whole. The recurrence of mathematical relationships, from the proportions of a sculpture to the frequencies in a musical scale, highlights the universal nature of these patterns in evoking emotional and intellectual responses.

Advancements in computational tools have further illuminated the role of mathematics, enabling precise manipulation of sensory elements and fostering new creative possibilities.

By uncovering the mathematical underpinnings of artistic expression, we gain insight into why certain creations transcend their medium to captivate our senses. The interplay of sight and sound, governed by quantifiable relationships, reveals art as not just a reflection of human creativity but a testament to the inherent order and beauty of the natural world.

MP11. MATHEMATICS AND FOOTBALL

Ioannis Alkiviades, Nikolas Hadjichristou, Afxentis Ioannou, Andreas Konstantinou, Adamos Kosma, Stylianos Michael, Theodoros Protopapas, Panagiotis Vasiliou
Xenion High School, Cyprus

Football and Mathematics are intricately connected, with mathematics playing a crucial role in understanding, analysing, and improving the game. Some key areas where the two intersect are strategy and game theory, player and team performance analytics, geometry in the game, physics, kinematics and ball trajectory, scheduling and optimization, tournament design, machine learning and artificial intelligence, fan engagement, injury prevention and recovery, and virtual and augmented reality. Mathematics transforms football from a purely physical game into a domain of strategic, data-driven decision-making, making it more engaging and insightful for players, coaches, and fans alike.

MP12. FRACTALS

Maria Messiou, Marios Economou
Xenion High School, Cyprus

It is remarkable to acknowledge that Fractals exist in our daily lives in general. The explanation of the term 'Fractal' has helped numerous distinguished scientists in the fields of Physics, Mathematics, and even Biology. Fractals describe morpho-fractal sets, which have a geometric shape that repeats itself infinitely at every level of magnification and can be described as 'infinitely complex'. The mathematician Benoit Mandelbrot was the one who invented the theorem, which has contributed to various fields, such as the shape of the human lung, the branches of a tree, lightning, and the shape of snowflakes. Inspired by the snowflake, Niels Fabian Helge von Koch invented the description of fractals, which have finite area, infinite length, are continuous everywhere, and nowhere differentiable. Finally, Fractals were initially invented to answer the question of whether the universe has a fractal structure, as it has been proven that galaxies share the same property, based on the primordial matter of the universe.

MP13. EQUILATERAL AND EQUIANGULAR SHAPES

Giatrakos Nikolaos, Gavathas Konstantinos, Valasopoulos Panagiotis, Giobliakis Dimitrios, Dimopoulos Giorgos
Erasmios Ellinogermanic School, Athens, Greece

Can two straight-line shapes with the same area and perimeter be built using the same unit of measurement?

It is true that the fundamental concepts of the perimeter and area of shapes often confront us with interesting issues. Using mathematics, we will try to show in this presentation how to create simple planar objects with the same area and perimeter but various dimensions.
The characteristics of fundamental geometric shapes, including triangles, rectangles, and squares, will first be shown. After that, we will only show, with simple examples, how shapes of different sizes can have the same area and then the same perimeter.

In the presentation's main body, we will then use more complex mathematics to show how to create plane shapes of various sizes with the same area and perimeter. We will end with two distinctive instances.

MP14. THE ART OF CHAOS (THE BUTTERFLY EFFECT)

Konstantinos Kouimitzis
Doukas School, Athens, Greece

Chaos theory, with its mesmerizing interplay of deterministic systems and seemingly random behavior, has become a captivating arena of exploration. In our presentation, we will unravel the intricate threads of "The Art of Chaos," with a specific focus on the Butterfly Effect—an emblematic phenomenon within chaos theory.
We delve into the delicate sensitivity of deterministic systems to initial conditions, examining how a small change can cascade into profound and unpredictable outcomes. The Butterfly Effect, symbolized by the notion that the flap of a butterfly's wings can trigger a chain of events leading to significant consequences, encapsulates the essence of chaos theory. The presentation scrutinizes practical applications in diverse fields, from weather prediction to socio-economic systems, where small perturbations can amplify into substantial impacts.
We aim through our presentation to demystify chaos, offering insights into the underlying principles governing complex systems. By understanding the artistry of chaos, we gain a deeper appreciation for the unpredictable beauty inherent in the fabric of our dynamic world. The exploration transcends mere mathematical formalism, inviting attendees to contemplate the profound implications of chaos theory in shaping our understanding of the universe.

MP15. GOLDEN RATIO AND FIBONACCI SEQUENCE

Antonis Kyritsis, Giannis Kalloutsis, Theodoros Koutras, Konstantinos Moschonas, Aggelos Fanourgakis, Achilleas Tsergas
Erasmios Ellinogermanic School, Athens, Greece

If the ratio of two quantities to the larger amount is equal to the ratio of the larger quantity to the smaller one, then the two quantities have the golden ratio in mathematics and art.

The golden rule or the golden mean are other names for the golden ratio. In Euclid, the phrase "extreme and mean ratio" was used, but other names include "divine proportion" and "golden proportion."

Believing that the golden ratio provides aesthetic pleasure, many 20th-century artists and builders modified their creations to resemble it, particularly in the shape of the golden rectangle, where the ratio of the longer side to the shorter one is the golden section. Since Euclid's time, mathematicians have examined the characteristics of the golden ratio, such as how it manifests in the dimensions of a regular pentagon and a golden rectangle that, as the accompanying image illustrates, can be split into a square and another rectangle with the same side ratio. Both artificial systems like financial markets and natural items' proportions have been examined using the golden ratio.
The calculation of the number φ, the fundamental characteristics of the golden number, and the instances in which the golden number occurs in our daily lives will all be covered in this paper. The mathematical connection between the Fibonacci sequence and the golden ratio will then be discussed, along with examples of its use in architecture, painting, and music. Mathematics will be used to support this claim.

MP16. ESCAPE ROOMS IN TEACHING MATHEMATICS: A LITERATURE REVIEW

Ariana Sarafi, Yianna Stefanou
Mandoulides Schools, Thessaloniki, Greece

In recent years, Escape Rooms (ERs), physical and digital, have emerged as an innovative and interesting pedagogical tool. This review aims to synthesize the latest research findings from 2023 until now on the use of ERs in teaching Mathematics. Studies indicate that ERs can increase student motivation, enhance critical thinking, autonomy in learning, problem-solving skills, and can even reduce anxiety. In escape rooms Mathematical concepts and puzzles are used, as well as cryptarithmetic problems which engage players in deciphering codes with Algebraic expressions. These encourage creative thinking while Geometry-based tasks test spatial reasoning as participants navigate through shapes and patterns. Recognizing a number of sequences helps players uncover hidden messages. In addition, pattern recognition facilitates problem-solving by extending relationships among shapes, colors, and other elements.
Although the research interest has recently shifted from physical ERs to digital ERs, digital ERs are still being developed, and they face certain challenges regarding players' experience in areas such as graphics and narratives.
New technologies and Generative AI tools can certainly address these issues. Overall, the ERs can act as an alternative to conventional teaching approaches, transforming abstract concepts into interactive experiences aligned with contemporary students' needs and preferences.
This review concludes by presenting the proposed directions for future research which emphasize the need for large-scale empirical and interdisciplinary studies as far as the development of digital ERs tools is concerned.

MP17. MATHEMATICS IN ARCHITECTURE: THE ART OF PRECISION AND INNOVATION

Anastasia Bata, Anneta Gkolna, Konstantinos Chatzigeorgiou
Mandoulides Schools, Thessaloniki, Greece

Mathematics has always played a fundamental role in shaping architectural design, bridging aesthetics, functionality, and innovation. From ancient times, the use of symmetry and proportions has established a sense of harmony and balance in structures like temples and cathedrals, while the application of the Golden Ratio and Fibonacci sequences has imbued iconic buildings with timeless appeal. In Islamic architecture, tessellations and patterns demonstrate the power of Mathematics in creating intricate, awe-inspiring designs. Modern advancements, such as computational Geometry and Algorithms, have revolutionized architectural practices, allowing for the emergence of parametric design and dynamic, curved structures that push the boundaries of creativity. Fractals, inspired by nature, bring a unique perspective to design by mirroring organic patterns, while Chaos Theory introduces unpredictability that adds a layer of complexity to architectural forms. Modular and prefabricated design, rooted in Mathematical principles, has led to more adaptable and efficient construction methods.
Furthermore, Trigonometry is essential in designing curved surfaces and dynamic spaces, enabling the realization of innovative structures. Mathematical optimization has also become crucial in sustainable architecture, ensuring efficient resource use while maintaining structural integrity.In today's digital age, Mathematics continues to drive innovation through technologies like 3D printing and digital fabrication, which blend precision with creativity. These advancements underscore the unbreakable link between Mathematics and architecture, showing how calculations and algorithms transform abstract concepts into tangible, functional masterpieces. By merging science, art, and nature, mathematics stays at the heart of architecture's evolution, shaping the future of design.

MP18. FRIENDSHIPS THROUGH STATISTICS

Rallis Maroulas, Anthi Sklavou, Charis Chalkiotis
Mandoulides Schools, Thessaloniki, Greece

This presentation is an attempt to inform our fellow students about the Theorem of Friendship, its proof and its application through a statistical perspective. The Friendship Theorem is a fascinating result in Mathematics that connects the structure of friendships with Graph Theory and Combinatorics. It states that, in a party of n persons, if every pair of persons has exactly one common friend, then there is someone in the party who is everyone else's friend. (It is assumed that "friendship" is a symmetric, irreflexive relation).
In this presentation, we will search for real world applications and make a "star graph". The data for this graph will be gathered through a research study conducted within our school. We will ask each group member to report the number of friends they have within their social environment. The findings from this

study can be applied in various fields, such as networking, Sociology, and communication networks, providing valuable insights into how relationships are formed and maintained in different social contexts.
The reason for the making of this presentation is our passion for Mathematics and love for educating our fellow students on topics they otherwise would have never been interested in. To our view, this is a chance to learn, and to showcase our inclination towards Mathematics. We would love to exercise our passion in the field and present this topic. We believe in the importance of educating the youth and learning along with them.

MP19. LAPLACE'S DEMON: DETERMINISM AND RANDOMNESS

Katomeris Georgios, Gourlis Achileas
Doukas School, Athens, Greece

Can the future be utterly predicted? Does everything happen for a reason? Is there randomness in our mathematical universe? Humanity has always desired to foretell future events. Determinism, the concept suggesting that all future events are determined by preceding events, satisfies this aspiration. According to determinism, with perfect knowledge of all the initial conditions of all particles in the Universe and complete understanding of the Laws of Physics, one can predict the future with precision. This concept was later coined Laplace's Demon, a being, so vast and intelligent that it could analyze all information about all particles in the Universe, to predict their behavior. As Pierre – Simon Laplace stated: "for such an intellect nothing could be uncertain and the future just like the past would be present before its eyes." The theoretical possibility of its existence will be examined, through the prism of determinism and quantum theory. In the previous century, numerous theories were developed, such as Heisenberg's Uncertainty Principle, asserting that the future cannot be thoroughly determined, but we can only know the possibility of certain future outcomes. However, this does not mean that Laplace's Demon cannot exist in cooperation with probabilistic models. As a matter of fact, determinism and quantum theory can be used simultaneously to give even more accurate results, as stated by the theory of Compatibilism. Two seemingly opposite theories will be studied, their consequences to human life, the Universe and Laplace's Demon Existence.

MP20. PINEAPPLE SHAPE

Proios Dimitrios, Tsintzos Georgios, Hongchen Zhu
Doukas School, Athens, Greece

The Fibonacci sequence is a mathematical series where each number is the sum of the two preceding ones. Starting with 0 and 1, the sequence progresses as 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, and so on. The formula for the sequence is: $F(0) = 0$, $F(1) = 1$, and $F(n) = F(n-1) + F(n-2)$ for $n > 1$. The Fibonacci sequence appears in many natural and scientific contexts, such as the growth patterns of plants, the arrangement of leaves, and the spiral shapes of shells. It is closely related to the golden ratio, a mathematical constant that appears frequently in art, architecture, and nature. Interestingly, the pineapple (Ananas comosus) also exhibits a connection to the Fibonacci sequence. The pattern of the "eyes" or scales on the surface of a pineapple forms spirals that align with Fibonacci numbers. These spirals are typically seen in two directions: one clockwise and one counterclockwise. The number of spirals in each direction often corresponds to consecutive Fibonacci numbers. This natural occurrence of the Fibonacci sequence in the pineapple's design is an example of how mathematical patterns can manifest in the natural world, demonstrating the harmony between nature and mathematics. The pineapple thus serves as a fascinating example of Fibonacci's influence in nature In a PowerPoint presentation we aim to present you directly and indirectly this original topic.

MP22. THE SHAPE OF A SNOWFLAKE

Delieza Adamantia, Xiaohe Wang
Doukas School, Athens, Greece

In this project we aim to analyze the propositions and symmetries of the snowflake. Snowflakes are an excellent example of geometric propositions and symmetries in nature. Each flake has a hexagonal shape, which results from the arrangement of the ice crystals. The geometry of these crystals follows natural laws that determine the creation of hexagonal shapes though the accumulation of water molecules. Each snowflake is different. So, how does a snowflake form? And how is geometry connected to the shape of the snowflake? We will present our study on the above questions through photographs and a brief description of snowflakes' shapes. We aim to create a PowerPoint Presentation combined with a poster in order to cover all aspects of the topic presented.

MP23. THE MATHEMATICS THAT GOVERNS LIFE: BEHIND THE HEARTBEAT

Mario Petraccaro
Liceo Scientifico “G. Rummo”, Benevento, Italy

The heart is the machine that keeps us alive, beating incessantly, even when we don't realize it. Every day, at every hour, it does its work, never stopping, to keep us breathing, moving, thinking. But what happens when something goes wrong? A blood vessel narrows or the rhythm of the heart falters? How can we predict and understand these changes before they become dangerous? This is where mathematics comes in. The heart follows well-defined patterns, whether it is the electrical impulses that regulate its beat or the dynamics of the fluids flowing through the arteries. In my presentation I will explore how various mathematical principles govern the functioning of the heart and how this knowledge can help us improve our health . Can we, with the right mathematical elements, predict and prevent heart problems before they occur? The future looks hopeful.

MP24. THE HIDDEN CODES OF THE COLD WAR

Gentilcore Fabio, Manocchio Giuseppe, Pica Angela, Vernacchio Erika
Liceo Scientifico “G. Rummo”, Benevento, Italy

The clandestine world of Cold War espionage between the KGB and CIA was underpinned by a powerful ally: mathematics. Cryptography, the art of encoding and decoding messages, became a battlefield where numbers opened the doors to intelligence while theorems and functions handled the interrogations, suggesting the techniques to adopt to obtain the desired information. By delving into these hidden codes and the minds behind them, we uncover how mathematics served as the unsung hero in one of history’s greatest geopolitical chess games.

MP25. HOW THALES MEASURED THE HEIGHT OF THE GREAT PYRAMID OF GIZA

Margaritis Philippos, Antoniadis Theodore
Doukas School, Athens, Greece

The topic of our presentation is how Thales managed to measure the height of the great pyramid of Giza without modern equipment and technology in ancient times. We will be exploring his intricate and fascinating methods to achieve his long-awaited result. In our project we are going to go through his thought process and how he reached his conclusions with as much detail as we can in 15 minutes. The way in which Thales measured the height of that great pyramid, may not seem that difficult to think of and execute right now, but considering the knowledge and technology of his era, his answer to the lingering question of the height of the pyramid, was way ahead of its time. For viewing purposes, we will be making a presentation to go along with us and make the content we talk about more understandable to the audience, whilst also helping us keep track of how far along on our presentation we are. We will also be trying to recreate Thales’s measurements by using a projector, ourselves, and, potentially, a miniature version of the great pyramid of Giza. From this presentation, we hope to fully incorporate all the methods that Thales used for his experiments and explain them to our audience successfully whilst also keeping the presentation at a level where everyone can understand it.

MP26. THE FUTURE IN NOW: TESLA ROBOTS

Bruno Boscaino, Chiara De Nigris, Antonio Fusco
Liceo Scientifico “G. Rummo”, Benevento, Italy

Can robots think, learn, and exhibit intelligence similar to that of humans?
This question lies at the heart of today’s technological challenges. Robots, powered by artificial intelligence (AI), are transforming into systems capable of learning, adapting, and performing complex tasks. Whether viewed positively or negatively, our future will be profoundly shaped by the development of these technologies.
In our presentation, we analyzed Optimus, Tesla’s humanoid robot, and the intricate interplay of mathematics and physics that makes its design possible. Advanced equations and algorithms enable the robot to move, learn, and operate safely. To explore these dynamics, we utilized 3D models and platforms such as Tinkercad to simulate designs and functionalities, as well as programming tools like Python to analyze algorithms and trajectories.

Optimus is not just an example of technological innovation but a demonstration of the potential robots hold: assisting people, automating repetitive tasks, and improving quality of life. Robotics is not merely the future—it is our present. It is up to us to decide how to guide this evolution.

MP27. HEALING NUMBERS

Luigi Mancini, Christian Ianaro, Simone Ianaro
Liceo Scientifico “G. Rummo”, Benevento, Italy

Medicine: the science that has as its object the study of diseases, their treatment and their prevention. The science that has supported everyone’s life for centuries, but not everyone knows about the fundamental help and the mathematical and geometric bases that have contributed to the formation of any field of medicine that we know today and that we will continue to discover in the future.
By delving into the depths of medicine we will uncover and analyze the mathematical, algebraic and statistical elements that hide behind every medicine and analysis we take and do every day.

MP28. NOTHING IS AS IT SEEMS

Auciello Angela, Caliendo Samuele, Iacovella Gaya, Tavini Andrea Celeste
Liceo Scientifico “G. Rummo”, Benevento, Italy

The Pythagorean theorem, attributed to the famous Greek mathematician, states that in a right-angled triangle the sum of the squares of the two legs is equal to the square of the hypotenuse. This principle, fundamental in Euclidean geometry, also applies to analytical geometry, where it is used to calculate the distance between two points in the Cartesian plane using the specific formula. An intriguing geometric curiosity is the missing area paradox, in which figures composed of triangles and other polygons appear to change area when their pieces are rearranged. This effect is caused by visual errors related to slightly curved or misaligned lines. The paradox highlights the importance of mathematical precision, showing that nothing is as it seems. These phenomena remind us that mathematics, behind appearances, reveals a deep and unexpected logic, challenging our intuitions. In short, Pythagoras and analytical geometry provide essential tools for understanding space and its properties, enriched by curiosities that stimulate critical thinking.

MP30. THE HIDDEN PATTERNS IN PRIME NUMBERS

Georgios Pateras, Christophoros Chiras
Doukas School, Athens, Greece

Mathematics scientists have lately shed light into the strange way prime numbers are distributed. While people thought they were unpredictable for a long time, researchers have found a pattern in the way they are arranged. They used advanced computer mathematical methods and with their knowledge in quantum physics, they made a study which revealed that prime numbers have a statistical behavior, like energy levels in quantum systems. This reveal deepens our understanding of number theory, and, quite impressively, it also brings mathematics and physics closer together. Potential applications range from improving cryptographic algorithms to solve longstanding problems in mathematical analysis. The study exemplifies how such approaches can uncover the order within seemingly chaotic systems. We would like to make a 15-minute ppt presentation and a poster in which we showcase such patterns and explain them shortly to the audience. For example, we will talk about the 9-sector circle system that resembles the cosmic web, and with the help of which we can find all prime numbers. We will then show the audience how to recognize them by dividing them into 4 categories. In that way more and more people would understand the way genius scientists work and have something to explain to their relatives and friends. So, basically, in that poster we will suggest a potential theme of long discussions in schools and workplaces. In conclusion, prime numbers may seem weird, but they have a pattern in the way they are.

MP31. FUN-MATHEMATICS

Paris Zamboglou, Eleni Antoniou, Avgoustina Theodoridou, Alexandros Fasouliotis, Nicou Johnny, Marinos Christodoulou, Marina Panayidou, Marialena Fantousis, Pasik Larry
PASCAL Private Secondary School Lemesos, Cyprus

We seized the opportunity and, through some humorous mathematical images, explored mathematical concepts that we frequently encounter, either in our studies or in everyday life. Our project delves into irrational numbers, imaginary numbers, and infinity. We engaged with straight lines and their applications, square roots, and the concept of averages. Our interest was also piqued by polygons and their angles, as well as the introduction and use of variables. All these concepts were "captured" through photographs that present them in a unique way. Thus, we present them not only with their strict mathematical essence but also with a touch of humor.

MP32. DO YOU SEE A CUP OR A DONUT? POINCARE'S CONJECTURE

Kleovoulos Zolotas, Victoria Thomaidi, Theano Kyriakou, Kalliopi Plastourgou
Europaiko Protypo, Athens, Greece

The purpose of this paper is to present Poincaré's conjecture and to help every student grasp the magic of Topology, a crucial branch of Mathematics, in a simple and understandable manner. Poincaré's conjecture was one of the seven unsolved problems in the world. A few years ago, a man named Grigory Perelman managed to solve it, but he refused the million-dollar prize, stating he was more interested in Mathematics than in money. Poincaré's conjecture relates to Topology and Geometry. Henri Poincaré discovered that if you take a ribbon and wrap it around a basketball, it will create a knot, something that seems very logical to us today, yet the underlying explanation remains elusive. This is similar to the reasoning that a cube is topologically equivalent to a sphere and that a cup is topologically equivalent to a donut because they both have a hole.

MP33. RITHMOMACHIA, THE BATTLE OF AGREEMENTS OF NUMBERS

Theodora Vasilaki, Stelios Kavvadas, Manos Kargiotakis, Elli Kordellou, Rengina Neroutsou
Europaiko Protypo, Athens, Greece

The ancient and esteemed Pythagorean Game known as Rithmomachia, or the Battle of Agreements of Numbers, was created for the enjoyment and benefit of scholars by Francesco Barozzi. Francesco Barozzi was a distinguished Greco-Italian mathematician and the foremost intellectual who contributed to the advancement of Mathematics in Greece during the Greek Renaissance. Rithmomachia merges fascination, which signifies precision, with complexity. Of the 48 pieces - round, triangular, and square - each is arranged in specific sets of arithmetical ratios, such as sums and square values, evoking concepts from Pythagorean philosophy. Furthermore, the incorporation of pyramids adds another layer, as they symbolize the sequential structure of numbers. In this game, all the pawns move in all directions. Most of the pawns serve a similar purpose as chess pieces, but with a unique twist. To win, you must capture all of your opponent's pieces. To assist you in this endeavor, there are seven ways to capture a pawn. The game began to experience a revival, according to Western historians interpreting information gathered by Latinized scholars, contributing to its popularity. Even the configuration of the board, a classical enlargement of the chessboard, was designed with a careful balance of beauty and practical necessity, enhancing both the functional and ornamental aspects of Mathematics. Rithmomachia features a variety of games and is designed for anyone looking to keep their mind sharp while having fun.

MP34. THE RIDDLE OF THAMBRINIS: WHAT TYPE OF FISH DOES THE GERMAN POSSESS?

Thanasis Zarkaliou, Lambros Krithinas, Giannis Siganakis
Europaiko Protypo, Athens, Greece

Einstein's riddle was an extremely challenging puzzle created probably by Albert Einstein to test people's intelligence and creativity. It is said that only the smartest 2% of individuals possess the ability and intellectual skills to solve such a bewilderingly intricate riddle. To solve the puzzle and uncover the information, one must experiment with numerous possible combinations of the data already available, making it quite time-consuming; many people give up out of boredom before reaching the solution. There are various versions of this puzzle, influenced by age, culture, and era. Another intriguing fact about the riddle is that Albert Einstein was so intelligent that he crafted such a difficult puzzle when he was a child!

The riddle features 5 houses, each a different color, 5 people of various nationalities, 5 distinct pets, and 5 beverages. The final category is versatile and often includes many variations such as cigarette brands, ice cream flavors, car brands, etc. The objective is to determine which person owns the fish. While it's not essential to find all the other information, it is nearly necessary to identify who has the fish. This puzzle is particularly interesting because one correct piece of information can connect to others, making it much easier to find them. The purpose of this paper is to demonstrate the intriguing nature of solving puzzles, as Recreational Mathematics is a captivating field. Additionally, it aims to explore how easily we, as students, can create puzzles and present them for the general public to solve.

MP35. GEODESIC LINES ON THE SURFACE

Sofiia Andrusenko
Pisochyn Lyceum, Kharkiv, Ukraine

The most fundamental concept in Euclidean geometry on the plane is the straight line. In the process of developing geodesy as a science that studies methods for measuring the earth's surface and determining the size of the globe, a need arose to generalize the concept of a straight line segment as the shortest distance between two points to arbitrary regular surfaces. Although most surfaces are curved in such a way that they do not contain straight lines, they do contain curves called geodesics, which have many of the important characteristic properties of straight lines.

Definitions of geodesic lines in various spaces depend on the specific structure (metric, linear element, linear connection) on which the geometry of a particular space is based. In the geometry of spaces in which the metric is considered to be given in advance, geodesic lines are defined as locally the shortest. In connected spaces, a geodesic line is defined as a curve for which the tangent vector field is parallel to that curve. In Riemannian geometry, where the line element is given in advance and the lengths of the lines are obtained by subsequent integration, geodesic lines are defined as extremals of the length functional.

MP36. CAN MUSIC BE ANALYZED MATHEMATICALLY?

Ivan Ananev, Evgeniy Kolkovskiy, Lizaveta Kurylava, Kseniia Shchepetova, Mikhail Zubkov
The Island Private School of Limassol, Cyprus

In this presentation, we will be looking at how mathematical functions of waves can help us calculate the wavelength of any sound. Specifically, we will be focusing on the sinusoidal wave equation. This formula is widely used to describe sound waves and other periodic phenomena. Each variable in the equation corresponds to a specific property of the wave and we will be primarily analyzing them. To calculate the wavelength of a wave, we focus on the frequency factor which is related to the wavelength by formula $B = 2\pi/\lambda$, where λ is the wavelength. This equation allows us to determine the wavelength from the frequency. Understanding this formula enables us to calculate key properties of sound waves, including their pitch and tone. In our presentation, we will discuss real-life applications, such as in acoustics and music production, to illustrate how mathematical modeling transforms sound into a measurable phenomenon.

MP37. MATHEMATICS IN A.I.

Tymur Marchenko
The Island Private School of Limassol, Cyprus

Mathematics was and will always be the king of sciences and will be relevant anywhere and anytime. Because of Artificial Intelligence, which was created based on mathematics and algorithms we could start to see how much faster the world started to change. It is all because of quantum growth which started happening. Previously, humanity would need decades if not centuries to invent or discover something. Now, with the help of AI it takes just a few seconds. We live in a time where everyday, humanity has access to more and more information and even some of our jobs, would already be giving way to AI. In this presentation, we will deeply explore this topic and understand why we live in one of the most important times of the last centuries!

MP39. GOLDEN FACADES: THE RATIO BEHIND MODERN BEAUTY

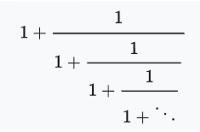
Athina Nicole Kolovou, Anastasia Hadjichristou, Elli Kappellou, Michaella Neokleous
American Academy Larnaca, Cyprus

The golden ratio, approximately 1.618, is a mathematical principle derived from a specific proportional relationship. Celebrated for centuries as a symbol of beauty and harmony, it has influenced fields ranging from art to science, but also in the world around us. Today, it plays a prominent role in shaping modern beauty standards, particularly in plastic surgery and aesthetic medicine. In facial aesthetics, the golden ratio is often used as a guideline for ideal proportions, influencing procedures aimed at enhancing symmetry and balance. Surgeons may reference this ratio when sculpting features in the human face like the nose, lips, or jawline wth aim to create outcomes perceived as more universally attractive. Similarly, body proportions aligned with the golden ratio are frequently cited as desirable in shaping contemporary ideals of beauty, over the years. However, the use of the golden ratio in plastic surgery has sparked debate. While some argue that its application leads to more harmonious and aesthetically pleasing results, critics contend that these ideals are culturally biased and not universally applicable. They question whether the golden ratio is an objective standard of beauty or a construct rooted in historical and scientific myth. By exploring the intersection of mathematics, beauty standards, and surgical practices, and by interviewing plastic surgeons, we aim to present how the golden ratio offers a fascinating lens to examine how human aesthetics have been shaped—and challenged—by the pursuit of perfection.

MP40. THE GOLDEN RATIO: AESTHETICS OF PERFECTION

Liangxuan Yu, Mengci Xie
American Academy Larnaca, Cyprus

As humans, none of us are flawless, so it is naturally a part of human nature to strive for perfection. It is a normal act to compensate for a feeling of inadequacy. However, simply because it is humanly impossible to achieve perfection, it does not mean perfection does not exist. Have you ever noticed that the beautiful things always follow the same pattern? Or how nature tends to form elegant things in a specific way? Well, today we are going to talk about this hidden pattern, this mysterious relationship between natural perfection and mathematics. We are going to delve into the history behind this visually and spiritually appealing number and why it has been known by names such as “The Divine Proportion” and “The Epitome of Beauty”. A number, when written in its infinitely non-recurring decimal form: 1.618033988749894…, becomes



as a continued fraction. It’s link to perfection has made it a powerful influence to artists, mathematicians and philosophers. Humans can never be completely perfect, however, numbers can, the Golden Ratio is proof of that.

MP41. WHEN NUMBERS MEET THE RING

Tristan Alexandrou, Michael Calligeris, Stefanos Kypri, Panagiotis Angonas, Sotos Afxentiou, Yu Hon Harry Hu
American Academy Larnaca, Cyprus

The art, complexity, and beauty of boxing continue to amaze us as a group. Initially, we believed that boxing was all about having the strongest punch or the quickest feet. However, after hours of vigorous research, we discovered that the true essence of boxing is much more complex—it's deeply rooted in mathematics. While physics and biomechanics certainly play a role, this presentation focuses on the key mathematical factors that shape the sport. Concepts such as geometry and trigonometry, game theory, probability, and statistics are essential tools that help analyse and optimise boxing techniques, strategies, and performance—without diving into the physical forces at play.

MP42. CASINO AND MATHEMATICS

Filoxenidis Stavros-Loukas
Doukas School, Athens, Greece

Many people think that casino games rely solely on luck, a fundamentally flawed belief, as no one can win in the long run at a casino with luck as their only asset. In casino games (including those of online casinos), beyond luck, you need both skills and strategy, as well as a solid understanding of Mathematics.
Mathematics, of course, pertains not only to the casino but also to the player themselves. Below, we will explore how Mathematics is utilized in a casino and how you can leverage this knowledge to your advantage in games. Probability theory is the fundamental pillar of mathematical gambling. This principle enables players to assess their chances of winning by calculating the probability of specific events occurring.
In this paper, we will explore the Mathematics involved in gambling, also known as experiments of chance. While craps may appear to be a complex game, understanding the underlying Math will reveal that it is actually a simple and enjoyable game. Through popular games of chance, we will showcase mathematical models that conceal and allow a player to compute their odds of winning. Mathematics is present in every aspect of our lives.

MP43. TRIANGLE DRAMA: THE TRUE INVENTORS OF THE PYTHAGOREAN THEOREM

Xihan Xie, Melina Lellepi, Michael Duan, Kavish Gangrade
Foley's School, Limassol, Cyprus

Pythagoras's Theorem is renowned worldwide, but is its attribution solely to Pythagoras truly justified? While Pythagoras may have been a mathematical pioneer, evidence suggests that the theorem predates him by millennia. Historical records reveal that this theorem was known and utilised by various civilizations long before Pythagoras's time. Legends claim that Pythagoras discovered the theorem by observing palace floor tiles, but how original was this idea? Given that Pythagoras studied in Egypt, it raises questions about the randomness of his discovery, especially considering the use of knotted ropes to form right angles during construction, including in the building of pyramids. However, the evidence extends beyond Egyptian practices to include Babylonian clay tablets, ancient Indian Vedic scriptures like the "Baudhayana Sulba Sutra," and Chinese astronomical texts. By examining the theorem’s independent discovery and use across civilizations, we uncover a broader narrative of collective human innovation in mathematics. This perspective highlights the diverse cultural contributions that have shaped the enduring legacy of the Pythagorean Theorem.

MP44. MANURE VS FIREWOOD: CALCULATING THE SPECIFIC HEAT OF AN ALTERNATIVE FUEL (MANURE)

Nikoloz Chkareuli, Davit Bitsadze, Lekso Pitskhelauri, Paata Liklikadze
Tbilisi International School, Georgia

In the context of the modern energy crisis and growing ecological concerns, the search for alternative fuels has become increasingly important. Dried cattle manure (manure) stands out as a biological waste that can be repurposed into a renewable fuel, especially useful in agricultural regions. Manure offers a dual benefit: effective waste management and a sustainable alternative to traditional fuels like firewood, which contribute to deforestation and air pollution.
This research aims to assess the thermal value of manure as a fuel and compare its efficiency to that of firewood. The approach involves calculating the specific heat of manure by heating water and recording the temperature increase. These measurements will be verified using bomb calorimeter tests to ensure precise and reproducible results under standardized conditions.
The findings are expected to reveal the ecological and economic advantages of using manure as an alternative fuel. Adoption of manure could reduce the dependency on fossil fuels and firewood, thus preserving forest resources and lowering carbon emissions. Moreover, this provides an affordable energy option for rural communities, promoting sustainability and energy independence. Preliminary results suggest that manure could serve as a competitive alternative fuel, improving energy sustainability and reducing environmental pollution. Detailed data from bomb calorimeter tests will validate the specific heat capacity of manure, confirming its role as a viable renewable energy source. This study underscores the broader implications of using manure for energy policy and environmental conservation.

MP46. DO ANY ODD PERFECT NUMBERS EXIST? THE OLDEST UNSOLVED PROBLEM IN MATHS

Ismini Herodotou
The Grammar School, Nicosia, Cyprus

Perfect numbers-those rare integers equal to the sum of their proper divisors-have intrigued mathematicians for over two millennia. While all known perfect numbers are even, the existence of an odd perfect number remains one of the most tantalizing mysteries in mathematics. Despite centuries of effort, no one has found one-or proven they can't exist. In this presentation, we embark on a thrilling mathematical journey to uncover the secrets of odd perfect numbers. Why are they so elusive? What makes them so important to number theory? We'll delve into the history of this unsolved problem, examine the clever techniques mathematicians have used to narrow the possibilities, and explore the profound implications of solving this ancient riddle. This is not just a story of numbers; it's a quest for perfection. Will the odd perfect number remain forever hidden, or are we closer than ever to cracking the code? Join us as we dive into one of mathematics' greatest unsolved mysteries.

MP47. RECOIL AND BALISTICS THE MATHEMATICAL PRECISION BEHIND GUNS

Antreas Michailidis, Nikolas Felekkis
The Grammar School, Nicosia, Cyprus

It has taken humanity over 4000 years to create guns.Why is it that something that exists widely today take so long to figure out?Well in order for guns to be created an extensive view of mathematics, physics and engineering was necessary. Concepts like bullet velocity, recoil and internal Ballistics has to be taken into account in order to understand how guns truly are able to work.Why do they kick back when shooting them and why is aiming long distances so difficult?All of these questions can be answered through an understanding of mathematics and physics.You would be surprised just how much maths is behind a basic gun such as a pistol and how complicated it is for it to function the correct way.In order for somebody to shoot comfortably ,one incredibly important factor is recoil,there is so much behind which guns have the most and least recoil and how we can reduce it.An understanding of force absorption and pressure has to be known In order for us to significantly decrease any recoil that a gun might have.Understanding bullet drop and ways that we can calculate it is also incredibly important for us to be accurate from long distances.In the military snipers need to have an extensive knowledge of mathematics and physics and even perform calculations using a piece of paper,during warfare.Guns will constantly keep improving as the knowledge of mathematics and physics keeps improving.without the mathematics and physics guns would never exist.

MP48. CONNECTING THE DOTS: THE MATHS OF SOCIAL NETWORKS

Michelle Papadopoulou, Georgina Anastasiadou
The Grammar School, Nicosia, Cyprus

In this presentation, we investigate the intriguing connection between social networks and graph theory. By modeling social networks as graphs, we gain insights into complex social structures and relationships. We explore key graph theory concepts such as nodes, edges, degrees, paths, and cycles, demonstrating their practical applications in analyzing social networks. The discussion also highlights centrality as a tool for identifying influential individuals or groups within a network. Concluding with a forward-looking perspective, we consider the potential future of social networks and the pivotal role of graph theory in their development.

MP49. APPLICATIONS OF PARABOLIC CONIC SECTION

Anastasia Kikvadze, Bachana Ardoteli, Andria Kartozia, Anastasia Nikoladze, Barbare Tabidze
Tbilisi International School, Georgia

A curve generated by intersecting a right circular cone with a plane is called a 'conic'. Depending on the position of the plane that intersects the cone and the angle of intersection, different types of conic sections are obtained. A conic section can also be defined as the locus of all points such that the ratio of the distance of a point on the curve from a fixed point known as focus to its distance from a fixed line, known as directrix (with the focus not on the line), is a constant, e, known as eccentricity. Different values of eccentricity

produce circles, ellipses, parabolas, and hyperbolas. A parabola is generated when the eccentricity equals 1, indicating that the distances from every point on the curve to the directrix and the focus are equal.
The geometry of a parabola makes it particularly suitable for applications where light or sound waves need to be focused on a single location. The parabolic shape ensures that incident parallel rays perpendicular to the directrix converge at a single point (focus), regardless of where they strike the surface. Conversely, lines from the focus reflect off the parabola and continue perpendicular to the directrix. This unique property is why parabolic shapes are employed in reflectors, satellite dishes, radio telescopes, and many other devices designed to focus light or sound efficiently.
Keywords: conic sections, parabola, reflector, parabolic mirror, satellite dish.

MP50. HARMONIC EQUATIONS: THE MATH BEHIND VOCAL SOUNDS

Andria Agathocleous, Marina Petsa
The Grammar School, Nicosia, Cyprus

Imagine this: every time you sing a note, there's a hidden world of math working behind the scenes. We can uncover how mathematics controls the vibrations of our vocal cords, the sound waves we produce, and even the harmonies we hear in music. Starting with the basics—vocal cords. The motion of your vocal cords determines the pitch and tone of your voice. This is like an encoded message or an algorithm that your vocal cords follow to produce sound. However, this is only the beginning. This is because the human voice is very complicated; it creates a symphony of sound waves. To understand it, we can break down the sound of your voice into its basic building blocks. It's like listening to a song and figuring out the note sequence. We also dive into how things like the wavelength and the frequency of sound waves form musical scales and harmonies, which are the foundation of music. Why do you think that certain notes sound "right" together and others don't? It's all maths! To bring these ideas to life, we can test out the movement of vocal cords through simulations. This proves that maths is hidden behind everything around us and we use it subconsciously in our everyday lives. Even simple things like speech are based on maths. Thus we can use maths to improve vocal technique and even enhance our voices. So, how does this benefit us? The science behind the voice is much more than just theory—it can improve your singing, it may help diagnose issues with the voice, and may push the boundaries of audio technology. It's all about making the connection between music and math, and this is something that can be applied in everything from vocal training to the next big breakthrough in music tech. Who knew that singing could be so full of math, right?

MP51. KNOT THEORY

Stefanos Afxentiou
The Grammar School, Nicosia, Cyprus

What's the simplest knot you can have? Easy, a circle, but it isn't really a knot, therefore it is classified as an unknot. The simplest knot after that is a trefoil. Knot theory is a branch of mathematics which aims to identify, categorize and understand every possible knot that could ever exist. Knots can be separated into two categories, just like numbers. These categories are composite knots and prime knots. Composite knots are the addition of several prime knots to create a new, composite knot. Since all composite knots are composed of prime knots, mathematical studies on knot theory primarily focus on prime knots. The first reference to knots from a mathematical perspective came from the 18th century. Originally this study was driven by pure curiosity, but since then it has extended into numerous scientifical disciplines, including understanding the structure of Proteins and DNA. It also plays a role in creating new materials stronger than Kevlar – a substance which is used in aerospace engineering, bulletproof vest, and car brakes. Due to this theory, it's been discovered that the simple act of tying your shoelaces clockwise or anticlockwise on your shoe can have a drastic impact on the stability and strength of the knot.

MP52. GAME… SET…MATH

Nikolas Toumbas
The Grammar School, Nicosia, Cyprus

Why is badminton considered a special sport? What sets it apart from other athletic activities? What makes the shuttlecock so unique compared to other sport balls? Isn't it incredible how a small shuttlecock can travel so fast across the court? From its origins as a recreational pastime to becoming an internationally recognized competitive sport, badminton's growth reflects its universal appeal. How does it manage to combine intense physical exertion with mental agility? The answer lies in its combination of speed, precision, and adaptability, requiring players to react swiftly, anticipate their opponent's moves, and employ a range of techniques. This abstract illustrates why badminton stands out as not just a game but a dynamic sport that promotes physical fitness, strategic thinking, and global connection.

MP53. LOCI

Konstantinos Kallergis, Vaggelis Lamprinakos, Giannis Patelis, Fotis Stamatopoulos, Pantelis Stefanou
I.M.Panagiotopoulos School, Junior High School, Athens, Greece

In this project, we will explore the concept and significance of loci in geometry. First, we will provide a brief historical overview, focusing on the evolution of this idea over the centuries and the contributions of notable mathematicians. Then, we will examine some of the most characteristic loci, analyzing both the construction process and their practical applications in various mathematical problems and scenarios.
Finally, we will address the problem of constructing a triangle with the maximum area, given that its perimeter is fixed and one of its sides is known. Through this process, we will highlight the importance of loci in solving complex geometric problems.

MP54. MATHEMATICAL GAMES IN ACTION: STUDENTS PERSPECTIVES AND EDUCATIONAL APPLICATIONS

Michalakea Maria, Alexopoulou Alkmini, Zourari Martha, Michalakea Aggelina, Nika Sofia, Baritaki Konstantina, Stathis Christides, Basanou Panagiota, Skiadas Panagiotis
I.M.Panagiotopoulos School, Junior High School, Athens, Greece

Mathematical games have a rich history of inspiring curiosity and fostering problem-solving skills. From ancient puzzles to modern strategy-based challenges, games have been a vehicle for exploring mathematical concepts in engaging and innovative ways. This study examines the historical significance of mathematical games, their underlying principles, and their potential for educational use in the classroom.
We present a variety of well-known mathematical games from around the world, including the timeless Nim Games, and analyze the mathematical theories that form their foundations. By uncovering the strategies and logic behind these games, we demonstrate how they can help students develop critical thinking and enhance their understanding of key mathematical topics, such as number theory, combinatorics, and algebra.
The study also explores the pedagogical potential of these games, emphasizing how they can be adapted to align with curriculum objectives. We discuss practical strategies for integrating games into teaching practices, catering to different learning styles, and promoting active participation and collaboration among students.
Finally, the study includes the design and presentation of a new mathematical game created by students. This original game showcases how learners can engage creatively with mathematics, applying their knowledge to develop enjoyable and educational challenges for their peers. By blending history, theory, and practice, this study highlights the enduring value of mathematical games as tools for both teaching and discovery.

MP55. PYTHAGOREAN TRIADS

Melina Athanasopoulou, Giannis Bogiatzis, Michalis Ligkas Kaplanis, Christina Logotheti, Chara Maria Pantazopoulou, Kalliroi Politou
I.M.Panagiotopoulos School, Junior High School, Athens, Greece

In this paper, we will delve into the Pythagorean Triads, one of the most well-known topics in mathematical science. First, we will conduct a brief historical overview, starting from the era of Pythagoras and his School, which laid the foundations for understanding the relationship between the sides of right triangles, as well as the work of many other mathematicians who studied these over the centuries. Next, we will examine the generation of Pythagorean Triads, that is, sets of three integer numbers that satisfy the Pythagorean Theorem. We will explore various methods for generating these triads and focus on particularly interesting cases. Finally, we will analyze the application of Pythagorean Triads in practical problems, highlighting their importance both in ancient mathematics and in the modern era.

MP56. MATHEMATICS AND TENNIS

Alkinoos Christoforidis, Andreas Nedeltsidis
Mandoulides Schools, Thessaloniki, Greece

The aim of the presentation is to explain to my fellow students the connection between Mathematics and tennis. Mathematics plays a crucial, yet often overlooked, role in the sport of tennis, influencing everything from strategy to equipment design. The study of Geometry, Statistics, and Physics provides a deeper understanding of the game, revealing patterns that can enhance player performance. Concepts like angular velocity, projectile motion, and spin mechanics govern the trajectory of the ball, while optimization techniques help players refine shot placement and movement on the court. Furthermore, advanced statistical analysis allows coaches and players to assess performance metrics, leading to data-driven strategies. More specifically, the ATP or WTA level tennis coaching team analyzes the statistical performance of the rising opponent. For example, the stats of serve, forehand, backhand and the general style of the play.
The presentation highlights how mathematical principles are integral to both the tactical and physical aspects of tennis, offering a framework for improving outcomes through quantitative insights.
The reason for making this presentation is my passion for tennis and my love for helping other students learn new things. By means of this presentation, my fellow students will have the chance to learn many interesting things about tennis and I hope that they will consider trying it out or improve their mindset about it.

MP57. CONFUSION IS PART OF THE PROCESS: HOW TO SOLVE SIMULTANEOUS EQUATIONS IN THE CLASSROOM

Kazalaki Marilia, Karamitsas Panagiotis, Paraskeuopoulos Nikitas, Kanellakis Eustratios, Letsas Pantelis, Stamataki Paraskevi
I.M.Panagiotopoulos School, Athens, Greece

Confusion in mathematics is often seen as an obstacle to understanding. However, this paper argues that it is a natural and helpful part of the learning process. In this study, we examine how confusion plays a role in solving simultaneous equations in Year 7 classrooms, suggesting that it should be viewed as an opportunity for breakthroughs in understanding mathematical strategies. Through hands-on activities and problem-solving procedures, students are introduced to substitution and elimination methods. These activities are intentionally designed to create moments of confusion, encouraging students to engage critically and learn from their mistakes. Working in groups, they reflect on their confusion and build confidence in their problem-solving abilities. The findings show that embracing confusion leads to greater persistence and a stronger understanding of key concepts. So, the next time you make a mistake, think of it as a stepping stone toward learning!

MP58. YOUNG MATHEMATICIANS IN ACTION: INVESTIGATING THE MATHEMATICS OF THE SHORTEST SHOELACE

Loukas Nikas, Michail Kallergis, Sakellaridis Theodoros, Alexandros Kanellakis, Emelleia Tsianaka, Theodora Bintza, Skiadas Panagiotis
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This paper presents the results of our classroom investigation into the Shoelace Problem, inspired by John Halton's insights. The problem challenged us to determine which lacing method requires the shortest shoelace, combining mathematical modeling, geometry, and practical experimentation. Through a hands-on activity, we analyzed formulas for common lacing styles based on the number of lace-holes, the vertical spacing between them and the horizontal gap between the lace-holes' columns. Additionally, we explored Halton's innovative application of optical reflection principles to visualize and compare lacing paths. Our findings confirmed that the American lacing style is the most economical. This project allowed us to connect theoretical concepts with real-world applications, such as material efficiency and cost reduction. It also strengthened our critical thinking and problem-solving abilities while demonstrating how mathematics can provide insights into everyday phenomena.

MP59. THE ROLE OF MATHEMATICS IN DISASTER MANAGEMENT

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Natural disasters like hurricanes, floods, and earthquakes pose significant risks to human life and infrastructure. Mathematics plays a critical role in understanding and quantifying the impact of these events. By analyzing data, creating predictive models, and optimizing resources, mathematical tools empower us to make informed decisions—but isn't their potential to reduce disaster damage and save lives undeniable?This presentation explores the application of mathematical formulas to disaster management, focusing on hurricanes, floods, and earthquakes.

Through live experiments and real-time calculations, we will demonstrate how mathematical models are used to estimate the potential damage of these natural phenomena and predict their behavior. For earthquakes, we will explain how historical data can be used to approximate the likelihood of seismic activity in a given region and demonstrate a formula to calculate evacuation times for populations at risk. In the case of hurricanes, we will focus on how wind speed and energy can be calculated using basic mathematical equations. Finally, for floods, we will explore flood frequency analysis and river flow calculations to better understand flood discharge and the probability of future flooding events.

Our interactive approach, which includes live demonstrations of these formulas, will show how mathematics is not just a theoretical tool, but a practical one that plays a crucial role in disaster preparedness and response. By making these mathematical principles more accessible and understandable, we aim to highlight their importance in disaster risk reduction and emergency management.

MP60. THE MELODY OF MATHS

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One of the most famous mathematicians of ancient Greece is Pythagoras. While Pythagoras's best-known theorem is about angles in a right angle triangle, he also made one about music and harmony. One time while he was taking a walk he heard two hammers banging on a metal at the same time. One hammer was exactly twice the size of the other. The smaller one though produced a sound two times higher than the bigger none. Pythagoras after listening to this came up with the idea that the sounds had an exact 2:1 ratio to each other. When he went home, he pulled out a string and divided it into parts to see if more ratios like that could exist. He was thrilled when he came up with more and more ratios his favorite one being the 3:2 ratio, better known as a perfect fifth in today's music. He loved the 3:2 ratio so much he came up with an actual scale using it. He called it the Pythagorean scale. A scale supposed to be mathematically perfect. Only, it was not. By creating this scale Pythagoras sort of ruined Western music for 2 000 years.

MP61. THE FASHION EQUATION

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Mathematics is fundamental to the structure, precision, and elegance of fashion. Without it, fashion would lack the harmonious balance and detail we admire in well-crafted garments. Math shapes various elements of design, such as the balance between symmetry and asymmetry, which creates both structure and fluidity. This balance adds a captivating quality to garments, drawing the eye with visual harmony. Proportions, guided by mathematical concepts like the golden ratio, are essential in creating garments that fit well and enhance the wearer's silhouette. Designers apply these principles to craft clothing that is aesthetically pleasing and proportionally balanced. Techniques inspired by origami, an art rooted in geometry, further highlight math's role in fashion. Origami techniques allow flat fabrics to transform into three-dimensional designs with structured folds and fluid forms, blending mathematical precision with creativity. Pattern cutting is another area where math is indispensable. Accurate calculations determine how much fabric is needed, reducing waste and minimising costs. Factories leverage advanced software to optimise fabric use, ensuring efficiency and resource conservation. Technology also relies heavily on mathematics: 3D printing and CAD (computer-aided design) software require precise calculations to achieve innovative, accurate designs. In modern fashion, math bridges creativity and technology, allowing designers to produce both visually stunning and functional pieces. Integrating art and science elevates fashion, combining beauty with practicality and sustainability. Fashion, therefore, is a field where equations and fabric intersect to create something extraordinary—an expression of art brought to life with mathematical precision.

MP62. MATHS AND DREAMS

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The English School Nicosia, Cyprus

How can something as precise as math and science have relations with something as complex and limitless as the landscape of our dreams? We can answer that in several different ways. Many people don't realise how big of a role math plays in the content, formation and plot of our dreams. Ever been intrigued about why certain encounters or people appeared in your dreams? Or why events that you feel strongly about seem to reappear several times? Well maths has an answer to your question. What are REM cycles? And how does their variety in duration affect how vivid and complex our dreams are? Can different sequences and patterns highlight why some dream contents rely on previous ones? Do you think that the fact that mathematicians use sleep and relaxation methods to solve complex problems is just a coincidence? Or perhaps is there a reasoning behind it...
As we were investigating, we came across a fascinating study on nightmares that took place in Japan, that examines their causes, frequency and psychological impacts. We have conducted our own research on groups of people aging from 15-65 to further verify and link the data we collected. At last, maths reveals the hidden patterns in our dreams, proving that even the unconscious mind follows its own patterns.

MP63. MATHS AND DANCE

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Can mathematics shape the art of dance? Could everything be calculated for the perfect movement? While dance is often viewed as a purely artistic expression, mathematics and physics reveal the hidden structure behind its grace. The principles balance, symmetry, transformations, and timing give structure and precision to movement. This includes kinematics of dance, showing how velocity and acceleration influence leaps and turns. Geometric angles, both in poses and trajectories, balance achieved by managing the center of mass and conserving momentum in spins. Symmetry and asymmetry play key roles, with symmetry providing harmony and asymmetry adding tension and dynamism to choreography. Geometric transformations, such as translations, rotations, and reflections, structure dancers' movements across the stage, creating fluidity and spatial design.Tessellations and group patterns are explored through dancers forming interlocking shapes, filling the stage with organized formations. Timing and precision are essential for rhythm and flow, as dancers synchronize movements, change speed, and pause to create emotional and visual impact. By understanding these mathematical principles, we gain a deeper appreciation for how dance blends creativity with maths, demonstrating that art and calculation can coexist to create something truly extraordinary.

MP64. IS MATHEMATICS AN INVENTION OR A DISCOVERY?

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Would mathematics exist if people didn't? A timeless question that has been debated for many centuries, is the topic of mathematics the discovery of universal truths revealing hidden patterns of nature or is an invention born within the human mind? We will explain both sides of this subject by giving examples that recall back up to the 5th century Greece. The discovered side of this topic states that mathematical terms would exist on earth whether humans discovered them or not. The way bees build their honeycomb or the symmetry that can be seen in a butterfly's wings are some examples that connect math with nature. Whereas the invented side investigates the concept of numbers which is purely manmade. Natural numbers help us count the objects around us but other concepts like negative integers, rational and irrational numbers were developed to serve our purposes and not necessarily because we witnessed them in nature. Richard Feymann, a famous physicist believed that mathematics was more of a human-created tool, a system of rules and logic that can feel very real but it's at its core, an invention in the human mind. What do you believe is the answer to this controversial topic?

MP65. IS IT ADDICTION OR MATHS?

Antrea Iacovou, Stephanie Kremmou, Theodora Hajigeorghi
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Shopping and math go hand in hand more often than you might think! Whether you're comparing prices, budgeting, calculating discounts, or figuring out the cost of multiple items, math skills come in handy. It explores the idea that math is an important part of everyday shopping decisions, even if we don't always notice it. It suggests that whether you're trying to save money or enjoy shopping as a hobby, you use math to decide what to buy. It usually highlights the concept that when we shop, we balance factors like price, the practical use of the item, how it makes us feel, and the additional costs involved, such as dry cleaning or maintenance. By using a simple formula, the presentation demonstrates how math can help us figure out if something is really worth buying based on its overall value compared to its cost. We'll explore how to shop smarter while sticking to a budget, offering valuable tips along the way, it's also your secret weapon for more effective shopping. Understanding the numbers behind your purchases means making better choices, saving you both time and money. When you apply these skills, you're not just sticking to a budget—you're gaining control over your finances and making decisions that improve your day-to-day life.

MP66. HOW AI IS USED IN MATHS

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Have you ever wondered how AI works, or even if mathematics has to do anything with its functions? What is that thing that maths has in common with artificial intelligence? We show everything about computational thinking used in mathematics and how it is applied in the software of artificial intelligence. This can be shown in many ways, but the best examples are those that are interactive and are used to solve real-life problems, showcasing precisely what power the AI does have using the same logic and algorithms used in mathematics. Sometimes we don't even understand that computational thinking is behind lots of problem-solving, including helping AI to think, understand, and learn by means used in mathematics. Even if the problem is something that AI has never heard of, then it gets data from another problem it solved, like we do in mathematics. we use information from a similar problem we already solved, and we apply our knowledge to solve the new one. In the end, both mathematics and AI rely on patterns, logic, and structured problem-solving to make decisions and learn from new data. By understanding the connection between computational thinking and mathematics, we unlock the true potential of AI to adapt, grow, and solve complex challenges in ways that were once unimaginable.

MP67. ELECTIONS: MATH CAN CHANGE WHO WINS

Aglaia Patsalides
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Can math determine the winner in elections? What if the outcome of an election could be predicted - or even manipulated - using math? We often think of electoral processes as simple - whoever gets the most votes wins. But behind the scenes, mathematical strategies can predict, and even change results in surprising ways. From how voting districts are drawn to the way votes are counted, math plays a powerful role and it can sometimes be the hidden force that influences the final results. In votings, numbers can reveal patterns as well as influence decision-making and unexpected outcomes. It's not just about counting ballots – there's a deeper layer of strategy and mathematics involved in this procedure. In this presentation we will explore the hidden role that math plays in elections. You will discover how numbers, calculations, and strategies can shift the "balance of power" in ways we don't often think about. Induced in the presentation are techniques like gerrymandering – the redrawing of district boundaries – that can turn in favor of one candidate, even if they don't have the majority of support. Voting systems such as: winner-takes-all, ranked-choice voting and proportional representation, further demonstrate how math can tip the scales. This will give us a fresh perspective on how elections work, and how math plays a key role in the process. Concluding, are elections decided by the votes of people, or is math the secret force that decides who wins? Let's find out together!.

MP68. LET'S MAKE MATH VISUAL: THE CASE OF FACTORIZING TRINOMIALS

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Mathematics can be difficult due to its abstract and rigorous nature. Students often learn more effectively when they can use all of their senses. To make math more accessible, visual methods can be highly useful. This paper examines the factorization of trinomials, particularly through strategies like algebra tiles and the box method. These approaches allow us to physically manipulate terms, turning abstract concepts into more tangible ones. By using these hands-on methods, we gain a clearer understanding of factoring and strengthen their overall math skills.

MP69. IN THE WORLD OF TWO PARALLEL LINES: SAME AREAS, INFINITE PERIMETERS

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Imagine two parallel lines: one serves as the fixed base for triangles, while the other allows a point—the triangle's vertex—to move freely. Surprisingly, all triangles created in this way share the same area, determined by the fixed height between the lines. However, as the vertex moves farther along the parallel line, the perimeter of the triangle increases infinitely. This simple yet intriguing geometric idea provides an engaging way to explore the fundamental principles of Euclidean geometry. Through hands-on activities and visual aids, we examine why this happens and how it connects to Euclid's Fifth Postulate and the uniqueness of parallel lines. We also highlight why only one parallel line can pass through a given point—a cornerstone of Euclidean geometry. This setup sparks discussions about how fixed and infinite dimensions coexist in geometry and helps students build a stronger and more intuitive understanding of geometric relationships.

MP70. TANGLED MATHEMATICS: EXPLORING KNOT THEORY IN THE CLASSROOM

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This paper looks at how knot theory, a part of mathematics that studies loops and tangles, can be introduced to Year 7 students in a fun and easy way. Knot theory is not only interesting but also a great way to teach important math ideas like symmetry, patterns, and shapes in space. The paper explains the basics of knot theory, such as how knots are drawn, grouped, and changed. It highlights simple, hands-on activities—like making and studying knots with ropes—to help students understand these ideas through play and exploration. It also shows how knot theory is useful in real life, such as in studying DNA, solving problems in science, and designing strong materials. These examples help students see how math connects to the world around them. The main aim of this paper is to give teachers practical ideas for using knot theory in their lessons to spark curiosity and make math fun and meaningful for students.

MP71. THE “BEAUTIFUL GAME”: A DATA-DRIVEN APPROACH TO FÚTBOL ANALYTICS

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Football—often hailed as the “beautiful game”—has entered a new era where mathematics and data science demonstrate each play on the pitch. My Euromath project focuses on translating key match events (shots, passes, xG), into physical metrics for concrete use by coaches, analysts, and fans when making evidence-based decisions. I noticed how dramatically an action's impact changes with time, score, and player interaction; therefore, I built the Game State Weighted Performance Model, or GSWPM. I chose this subject because it merges my passion for mathematics with my favorite, and the world’s most popular sport.

GSWPM revisits statistics by assigning context-sensitive weights to everything that happens on the field: a tackle back in the 90th minute of a tied game carries more weight than a precautionary pass in the case of leading by four goals, whilst including synergy-a component specifying how well any two players function together. Finally, viewed in mathematical perspective, each and every moment gets automatically judged based on its actual merit of changing the match outcome.

To demonstrate the power of the model, I have developed a simple, interactive website visualizing GSWPM with real and synthetic data. One can see how the model calculates the performance score for a particular play, synergy bonuses for key player partnerships, and what role certain plays have in more close matches. This approach shows how mathematical insights can transform our understanding of the sport.

MP72. SOLVING ENVIROMENTAL PROBLEMS WITH MATHEMATHICS

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The project focuses on the integration of mathematics and ecology to tackle pressing environmental issues such as pollution, climate change, deforestation, and biodiversity loss. The project aims to demonstrate how mathematical models, statistical analysis, and data visualization can provide effective solutions for complex ecological problems.
The presentation begins by outlining the most significant environmental challenges facing the planet today. These include rising levels of air and water pollution, increasing deforestation rates, and the impact of global warming on ecosystems. By presenting compelling statistics and trends, it highlights the urgency of addressing these issues. Next the role of mathematics as a powerful tool in solving ecological problems is explored. This section delves into methods such as population growth modeling etc. Real world examples will illustrate how these mathematical approaches have been successfully applied to reduce pollution, conserve water, and protect endangered species.
The presentation demonstrates how mathematics helps solve ecological challenges through methods like modelling and simulations. A case study shows how mathematical models address specific problems, such as pollution’s impact on ecosystems. The conclusion calls for collaboration between math and ecology, inspiring action for a sustainable future.

MP73. MATHEMATICS IN THE HUMAN BODY

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The project explores the intersection of mathematics and the human body, illustrating how numerical principles, proportions, and formulas underpin the structure, function, and development of our physiology. Mathematics serves as the language of nature, offering insights into how the human body is designed and operates. Key concepts such as the Golden Ratio (Phi), Fibonacci numbers, and symmetry are central to understanding the proportions of the human form. The Golden Ratio, for example, is found in various aspects of the body, including facial features and the relative dimensions of body parts, often associated with aesthetic harmony. Similarly, Fibonacci sequences can be observed in the arrangement of bones and the growth patterns of hair and cells.

The project further delves into how the human body uses fractal geometry in systems like the circulatory system and bone structure, optimizing energy and material use. Mathematical models also help explain the heart's rhythm, neural activity, and the biomechanics of movement. The interaction between organs, including synchronization between the cardiovascular, respiratory, and nervous systems, is also modeled mathematically.

Additionally, the presentation touches on how geometry plays a role in sensory perception, body balance, and temperature regulation, all vital for maintaining homeostasis. By exploring these mathematical principles, the project demonstrates how deeply embedded mathematics is in our anatomy and physiology, offering a new perspective on the beauty and efficiency of the human body.

MP74. THE CHANCES OF VIRAL MUTATIONS

Samuil Ivanov Terziyiski
125th Secondary School "Boyan Penev", Sofia, Bulgaria

Mutations in Bioorganisms: A Mathematical and Biological Analysis of SARS-CoV-2 are a natural process through which nature preserves and develops life. In this study, I examine the mathematical probability and biological mechanisms behind viral mutations, focusing on SARS-CoV-2. The frequency of mutations in RNA viruses is analyzed, alongside the role of nucleotide substitutions and how these changes affect amino acid sequences, particularly in the spike protein (S protein).

A probabilistic model is used to assess the likelihood of a single amino acid substitution at a specific position and its potential impact on the virulence of the virus. Statistical data from documented cases are presented, where mutations have enhanced the transmission or resistance of the virus.

Keywords: Mathematical probability, frequency, data, mutations (of viruses), S protein, nucleotide substitutions, amino acid substitution, virulence.

MP75. MATHEMATICAL FORECASTING IN THE SIR MODEL

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We present mathematical models related to the spread of pathogens, specifically viruses – from the fundamental mathematical models for epidemic spread to the first cases of Ebola; from the probability of infection to how populations can protect themselves from future epidemics. The foundation of our project is the SIR model. The origins of this model can be traced back to a chance meeting between William Kermack, a Scottish biochemist, and Anderson McKendrick, a military physicist, which laid the groundwork for mathematical models in epidemiology, particularly the SIR model.

We delve into the concept of Patient Zero – a term that emerged from the misinterpretation of the letter "O." We also focus on the basic reproduction number and exponential growth – what they represent, how they are calculated, and their crucial role in understanding epidemics. These concepts are intertwined with herd immunity – the solution humanity has been striving to implement for decades, the very approach that could put an end to epidemics like COVID-19 once and for all.

These ideas are vital in the global effort to prevent future health crises. To create more accessible and comprehensible mathematical models, we must study and build upon the existing ones, analyze and refine them, and take them to the next level. Every journey starts somewhere, so let us begin here.

Keywords: SIR model, Patient Zero, basic reproduction number, exponential growth, herd immunity.

MP76. THE EFFECT OF THE OPPOSITION BLACK – WHITE

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The report explores the complex relationship between technology and the humanities, focusing on the philosophical and physical aspects of black and white.
Answers to questions such as "Are black and white considered colors?", "Why is the night sky black?", and "Is non-white still white?" are sought in the realms of cosmology, metaphysics, technology, and everyday life. Black holes and white holes provide a unique perspective in astronomy, with black holes representing regions of intense gravity and white holes theoretically emitting matter and energy.
The analysis of the light spectrum highlights the physical properties of light and its influence on perception and daily life. The project examines how the humanities and the arts interact with patterns in color theory, influencing creativity and interpretations of reality.
From a logical perspective, the opposition between black and white is analyzed using operations such as disjunction, conjunction, negation, and implication. Examples and analogies in mathematics, such as positive and negative, presence (1) versus absence (0), and (ir)rationality, illustrate the foundational principles of mathematical laws.
This interdisciplinary project aims to integrate these aspects into a unified concept, emphasizing the significance of black–white (and gray) not only as visual elements but also as symbols of oppositions that shape our understanding of the world.

Keywords: logical operations, philosophy, color theory, astronomy, light spectrum, interdisciplinary

MP77. PARABOLAS FOR RECORDS: THE SCIENCE BEHIND OPTIMAL THROWS

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Our project focuses on identifying the optimal angle for throwing implements in various track and field events. Specifically, we concentrate on two of the three disciplines commonly referred to as throws – javelin (throwing), discus, and hammer (throwing). Throws involve complex spatial, speed-strength movements with cyclic, acyclic, and mixed characteristics. The flight distance of the implements depends on numerous factors and patterns, some of which emerge when the implement is in the athlete's hand, while others manifest during its flight.
During the Olympic Games, for instance, in these disciplines, after the athlete releases the implement, the screen displays the throwing angle (in degrees) and the achieved distance (in meters). Why is this so important? Isn't it enough to simply be strong enough to throw the farthest? What is the relationship between the throwing angle and the flight distance?
In our presentation, we will answer these questions: understanding the characteristics of the parabola described by the thrown object can optimize performance. Each of the three types of events will be analyzed and explained separately.

Keywords: throws, track and field disciplines, throwing angle, parabola

MP78. CHAOS IS ALL AROUND US

Kristiyan Rosenov Naydenov, Hristo Kostadinov Kostadinov
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This project explores the fundamental principles of chaos theory. Often referred to as the "butterfly effect" this phenomenon highlights how small changes in initial conditions can lead to significant and unpredictable outcomes over time. It is a pivotal concept with a broad range of applications, encompassing everything we consider unpredictable – such as human psychology or stock markets, for example. From a mathematical perspective, chaos can be observed in the most unexpected places – such as the trajectory of space rockets, ocean currents, blood circulation, and even music and visual arts.
The focus is on uncovering hidden patterns within seemingly random processes and examining the role of chaotic systems in various fields, including meteorology, astronomy, biology, and economics. In some cases, the project also analyzes the accuracy and parameters of predictions. The presentation features visualizations of well-known examples, such as the Lorenz attractor, alongside demonstrations of chaotic behavior through videos and simulations.

Keywords: chaos theory, butterfly effect, attractors, nonlinear systems, forecasting

MP79. PIROUETTES WORTH APPLAUSE

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Pirouettes in figure skating combine elegance, athletic mastery, and fundamental mathematics and physics. This report presents and analyzes the role of one of the two primary motions in the universe – the geometric transformation of rotation – in the execution of these pirouettes. We demonstrate the core principle used during their performance: the law of conservation of angular momentum.
We explore the factors influencing the body during rotation – how and when a skater loses initial momentum and increases their rotational speed. In original video clips, we showcase the three types of pirouettes, demonstrating how changes in mass distribution affect rotation. For instance, in the most complex pirouette, the moment of inertia is at its highest, leading to slower rotation but requiring precise balance. Additionally, we will present original performances of the other two pirouette types and analyze their mathematical and physical components, highlighting the techniques that earn applause. Mathematical models and equations complement our understanding of pirouette techniques, bridging theory and practice in the art of figure skating.

Keywords: pirouette, rotation, axis of rotation, momentum, inertia, speed

MP80. REMARKABLE NUMBERS

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In this presentation, we explore fascinating natural numbers in a more demonstrative way. First, we prove that each of them is both interesting and unique – worthy of recognition. Then, we showcase how we can investigate, create, and name various series of numbers with distinctive properties: square sums, cubic sums, square-square numbers, cubic-square numbers, and hyper-square numbers. We challenge the audience to represent a number as one of the two types of sums and invite them to choose numbers that we will represent as sums of cubes or squares. Proofs of the corresponding theorems are included in an appendix.
A key focus of the presentation is the so-called base numbers – exploring why different civilizations, scientific fields, and societies have selected particular numbers as the foundation for their numeral systems. More than 10 such numbers are analyzed.
A brief encyclopedia examines and comments on a variety of natural numbers with unique properties that appear in literature but are not widely known – such as polite numbers, τ-number, refactorable numbers, gapful numbers, phoenix numbers, Harshad numbers, Mersenne numbers, Münchausen numbers, universal numbers, numbers of the beast, and others.

Keywords: natural number, notable numbers, interesting numbers.

MP81. THE TOWER OF HANOI

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Legend has it that when the monks of Brahma complete the arrangement of the 64 disks in the Tower of Hanoi, the end of the world will come.
The "Tower of Hanoi" is a classic mathematical puzzle and algorithmic problem. The game consists of three rods and several disks of different sizes, initially stacked on one rod in ascending order (largest at the bottom). The recursive relationship is shown how the required number of moves increases with each additional disk and proves its analytical form using mathematical induction. Additionally, a short program is presented to calculate the number of moves based on this recursion.
The focus is on the role of this game in developing fundamental communication skills in mathematics – understanding and using mathematical terminology, algorithms, and formulas; mastering mathematical language. The report demonstrates why this game serves as a communication method in mathematics education, offering an engaging and enjoyable approach on the "playfield" of education. Such tools ("weapons") can effectively match the challenges posed by "opponents."
Situational parallels are drawn between the concepts and activities involved in playing the game of building towers and in mathematical education (relations, operations, optimization, organization, functions, induction, combinatorics, and more). Based on these analogies, a psycho-pedagogical graph-tree is constructed to model the stability and dynamics of communicative mathematical competencies, as well as the capacity for problem-solving and creative inquiry.

Keywords: Tower of Hanoi, mathematical communication, algorithm, induction, recursion, loop, graph-tree.

MP82. WHO AM I

Nikola Stanislav Vasilev
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This project explores the mathematical dimension of anthropogenic genetics. It outlines the process of DNA analysis and sequencing in a schematic manner. Calculations are presented for the percentage of ethnic heritage among relatives – parent-child, siblings, cousins, etc. These calculations are compared with real data obtained from the genetic testing of my family. The project traces the origins of my inherited ethnic genes from specific ancestors. Hypotheses are proposed regarding percentage variations across different generations.
The analysis is further contextualized by examining data from different regions across Europe, highlighting variations influenced by geographic and historical factors.

Keywords: sequencing, percentage, ethnicity, trends.

MP83. WHY ARE KNOTS MORE THAN JUST KNOTS?

Ekaterina Frolova
The Senior School, Nicosia, Cyprus

I have decided to do a project about the Knot theory, to find out what knots are in mathematics and how we can use them. Knots first found their use in Chemistry in 19th century, when different chemists were trying to systemize the atoms and the vortex theory of the atom was suggested, which said that an atom is just a tiny knot. Later, the theory proved to be wrong, but this was how scientists started studying knots. Nowadays, Knot theory is widely used in quantum physics, genetic engineering, and medicine – to understand the processes in DNA better, to make new materials and medicine. Today, over 159 billion knots are known, and, theoretically, we could make over 159 billion new materials from a single molecule. Moreover, Knot theory is used to cure cancer and explain properties of chiral molecules, such as thalidomide. In mathematics a knot is a knotted loop of string, which we can represent as a 2D projection. We can say that two knots are different if one cannot be changed into another. However, to prove that two knots are not the same, we cannot just do the Reidemeister moves – the three types of modifications you can do to a knot – but need to use other methods such as colorability and polynomials. Overall, Knot theory is an extremely fascinating field of mathematics. It is new but it is now rapidly developing.

MP84. THE AERODYNAMICS OF FORMULA 1

Domenico Landolfi
Liceo Scientifico “G. Rummo, Benevento, Italy

Formula 1, often considered the Olympus of motorsport, is immersed in a thrilling dimension of high-speed racing, cutting-edge technology and relentless competition. At the heart of this extraordinary show lies the intricate science of aerodynamic. This discipline shapes the flow of air over and around the prototypes with the help of front/rear wings, floor and diffusers, directly influencing downforce, drag, and tire performance.
Diving into this presentation, we’ll look at the vital role it plays in optimizing vehicle performances and race strategy. Specifically, without delving into complex theoretical details, we’ll analyse the balance between the aforementioned elements, and the evolution they have undergone in the last 75 years, since F1 foundation.
Furthermore, we’ll try to explore the main mathematical concepts behind it, especially the Computation Fluid Dynamics (CFD), that, combined with the wind tunnel testing, have a crucial role in refining of wings and diffusers’ design.
By understanding these concepts, we’ll gain a general overview about how the engineering teams push the boundaries of technical innovation at the uncontrolled research of the best laptime, the pulsing heart of this sport.

MP85. MATHS WEARS PRADA

Vittoria Panarese
Liceo Scientifico “G. Rummo, Benevento, Italy

Math has always been an essential part of fashion, influencing everything from design to production. Early designers used geometry to craft symmetrical patterns and applied concepts like the golden ratio to create visually appealing garments. These principles also supported the development of standardized sizing, making tailoring more precise and accessible.
Over time, statistical analysis became a powerful tool for identifying popular colors, fabrics, and styles. By analyzing data, designers could predict trends and create collections that connected with consumers.
Today, digital tools have transformed the way fashion is created. Advanced 3D modeling software allows designers to test and refine their ideas virtually, reducing waste and streamlining production. This seamless transition from virtual prototypes to physical garments highlights how technology is driving innovation in the industry. Looking to the future, 3D modeling and CAD tools are taking pattern-making to new heights, ensuring better fit and personalization with the help of algorithms. From ancient geometric principles to cutting-edge digital design, math has been woven into the fabric of fashion’s evolution, bridging creativity and practicality at every step.

MP87. DICE WITH MATHS

Myronas Andreakos, Cai Weizhe
Doukas School, Athens, Greece

My friend and I wanted to see if dice rolls are truly random or if you can control them. In this project, we use math and physics to show that with the right techniques, you can influence the result of a roll. Dice are often seen as tools of pure chance, but we believe that maybe there is a way to control the roll by changing the angle by using a machine constructed by us. The main question we’re trying to answer is: Can you use math and physics to control and predict dice rolls? To figure this out, we’ve planned experiments where we roll dice under specific conditions such as the angle using the proper machine and try to figure out if there is a pattern about the dice. First, we will study how dice work, like their shape, weight, and how they move when thrown. Then, we’ll test different throwing methods, adjusting the angle of the roll. We will track the results of each roll and look for patterns. If the same technique keeps giving us the same outcome, we will know it works. By comparing these results with what physics and math predict, we hope to discover if dice rolls are completely random or not. We expect to show that it is possible to control dice rolls if you are careful enough. While it will not work perfectly every time, it could show that randomness is not as chaotic as it seems. This project will help us understand how math and physics play a role in everyday things like games and decision-making.

MP89. WEAPONISED MATHEMATICS

Stephanos Constantinou, Andreas Ioannides, Elena Ioannidou, Maria Tsangaridou
The GC School of Careers, Nicosia, Cyprus

The act of shooting, whether in sports, ballistics or archery, relies heavily on mathematical principles to optimise accuracy and precision. Key concepts include projectile motion, which models the trajectory of a bullet based on initial velocity, launch angle and gravitational forces. Another concept includes calculating the distance from shooting to the target, which uses the height of the target and the mil dot measurement. For longer distances, the mil size changes, and the formula must account for this. Also, the time to reach maximum height is analysed through equations invloving gravity and the time of flight.
Geometry, trigonometry and equations of motion are essential for aiming, as shooters must take into account the horizontal distance to the target position, horizontal speed and angle of elevation.
External factors such as temperature, air density and wind also influence the bullet's trajectory. Warmer temperatures increase the muzzle velocity, while colder temperatures decrease it. Wind drift can shift the bullet's trajectory, with crosswinds, headwinds, and tailwinds having distinct effects on the bullet’s motion. Furthermore, Coriolis deflection, caused by the Earth's rotation, must also be considered in long-distance shooting. Calculating these elements helps shooters accurately estimate target distance and bullet behavior during flight.
This presentation investigates the mathematical foundations behind shooting, highlightng their critical role in both recreational and proffesional domains.

MP90. THE MATHEMATICAL THEORY OF CHAOS

Evalena Papadopoulou
The GC School of Careers, Nicosia, Cyprus

What if the tiniest change could lead to wildly unpredictable outcomes? How can chaos arise from the simplest rules? Chaos theory reveals how mathematics exposes hidden patterns in what seems like disorder, challenging our perceptions of predictability and randomness. To understand the theory of chaos, we look at dynamical systems in one, two and three dimensions.

In one dimension, we begin with a simple idea: interval maps. When these maps follow a monotonic pattern, their behavior remains consistent and predictable. But what happens when that order is disrupted? This introduces the quadratic map—an entry point into chaos. Through its characteristic period-doubling bifurcations and strange attractors, it demonstrates how even deterministic systems can display remarkable unpredictability.

In two dimensions, chaos reveals even greater complexity. The well-known horseshoe and solenoidal mappings produce intricate, spiralling paths, yet within this apparent disorder lies a surprising truth: randomness can still exhibit structure. These systems defy expectations, illustrating how intricate behavior can arise from basic principles.

Finally, in three-dimensional space, we encounter the Lorenz equations—a foundation of modern chaos theory. The mesmerizing Lorenz attractor, with its intricate, swirling motion, embodies the nature of chaos: endless unpredictability contained within a beautifully organized framework.

Can we ever truly understand chaos, or is it destined to remain an enigma? By exploring these questions, we uncover how mathematics transforms disorder into a realm of stunning complexity and beauty. Chaos isn't just disorder—it's a profound reflection of the universe itself.

MP91. THE BEAUTIFUL GAME

Andreas Akkelides, Loucas Epiphaniou, Alexandros Lazarou
The GC School of Careers, Nicosia, Cyprus

Football requires many different skills, but have you ever thought that mathematics is one of them? Mathematics and football have an interesting correlation. Football is often referred to, as "the beautiful game," by Pelè, is more than just a sport; it embodies a blend of mathematical principles and strategic thinking. At its essence, football relies on geometric and statistical concepts that influence every shoot, pass and defensive action.

A key element in football is the geometry of the field. Understanding the dimensions of the field and the positioning of players, form a dynamic system, where spatial understanding is crucial to support a team in winning. The particular angle at which a player kicks a ball, controlling the direction, speed and destination of the ball are part of the process in helping to achieve best passing routes and movement.

Beyond geometry, probability and statistics are equally essential, with metrics like Expected Goals, quantifying the quality of scoring opportunities and providing data-driven approaches in decision-making. Coaches are keeping a close eye on players' and opponents' statistics, to enable teams to access player contribution, predict outcomes, and refine their strategies on and off the field.

This presentation aims to show the mathematical concepts hidden behind football and how mathematics has and continues to revolutionize the game. Does a mathematician have what it takes to guide a football team to glory?

MP92. SHAKING THE GROUND: EXPLORING THE MATHS OF EARTHQUAKES

Andreas Kyriakides, Kyriaki Tzialli, Yige Wen, Junkai Yu
The GC School of Careers, Nicosia, Cyprus

Mathematics has a wide range of applications, one of which is its role in understanding earthquakes. This presentation explores the fascinating world of earthquakes and earth waves, through the scope of mathematics.

Earthquakes occur daily and are one of the most unpredictable, destructive and natural hazards on earth. Their nature makes them inherently hard to predict. How do seismologists determine the location and strength of earthquakes, as well as predict the smaller aftershocks that often follow? Seismic waves, which travel through the earth, are examined using wave equations, to determine their speed, energy and amplitude. The size of an earthquake is measured using the Richter and Moment Magnitude Scales, which rely on logarithmic and advanced mathematical formulae. Geometric methods, such as triangulation, help determine the location of an earthquake's epicentre, by finding the point of intersection between three circles formed around each seismic station.

Predicting earthquakes with high accuracy remains a major challenge in seismology, as earthquakes are complex and induced by many unpredictable factors. While scientists cannot yet predict earthquakes with exact precision, progresses in monitoring, data analysis and probabilistic models allow for better awareness and ability to understand and mitigate the impacts of seismic events. Additionally, techniques like seismic inversion and topography, highpoint how mathematical tools reconstruct the Earth's interior and locate earthquake sources.
Can we truly grasp the immense power of earthquakes without relying on the mathematical models that allow us to predict, analyse and interpret them?.

MP93. PASCAL'S TRIANGLE

Achilleas Americanos, Stavros Rallis, Giorgos Tryfonidis, Fotini Tzialli
The GC School of Careers, Nicosia, Cyprus

Pascal's Triangle is a fascinating mathematical pattern that reveals a lot about combinatorics, probabilities and natural patterns. It is a mathematical marvel offering a world of possibilities at the intersection of logic and beauty. In our presentation, we will explore the endless uses of Pascal's triangle.

Named after Blaise Pascal, although a triangle, it is actually a structure where each number is the sum of the two numbers directly above it. This pattern shows up in various areas of mathematics and in our presentation we will explore some of the most known facts of the infinitely many that exist. We are going to talk about how it entangles in many aspects of combinatorics and how it creates beautiful patterns that we can find in nature. Pascal's triangle unveils so many patterns that appear in various chapters of mathematics and assist us in understanding even more problems to this day.

The Chaos game is one of the many games that anyone can play using the greatness of Pascal's triangle. How do you get this amazing triangle just by adding two numbers in every row to generate the next row? Join us in this game and the quest to understand the mysteries of this triangle that mathematicians are still figuring out.

MP94. MATHS BEHIND BETS

Sophia-Irene Karantoni, Marina Ktori, Irene Vasou
The GC School of Careers, Nicosia, Cyprus

Betting is an extremely popular topic in our daily conversations, especially in our generation. It revolves around probability, statistics and decision theory to analyse outcomes in games of chance. There are three types of odds (moneyline, fractional and decimal), with decimal odds being the most used in Europe. Bookmakers set odds by balancing probabilities of outcomes and incorporating margins to ensure profitability.
Betting goes way back in history. With football and basketball being the two most popular sports that people bet on for many years now, we examine the potential profitability of a bet. As football is the most popular and complicated sport, we use it as an example to present the three types of sport betting to help up us further analyse it. Furthermore, we display real life statistics from relatives and friends, showing their winning and losing streaks.
Is there a higher losing streak than winning streak? Do people lose more money than winning? This presentation explores the interplay of mathematical tools and strategic thinking, concluding whether sports betting is profitable or not.

MP95. FROM VISION TO ILLUSION; MATHEMATICS WORKING BEHIND THE SCENES TO TRICK OUR EYES

Daphne Hadjipavlou, Styliani Anna Kyprianou, Andriani Mafka, Efi Mafka
The GC School of Careers, Nicosia, Cyprus

Have you ever wondered what hidden mathematical rules are at play when our eyes deceive us? Through optical illusions, where perception does not match reality, our brain is tricked into seeing something different from the physical properties of the object. In this project, we explore the mathematical concepts behind these illusions.

Our project will explore illusions, impossible figures and some rivalry experiments. We'll look at how different types of illusions manipulate our perception, and we will dive into fractals, which show infinite patterns that create complex illusions, like the Mandelbrot Set. This set is an example of an illusion which

offers an interactive way to explore its mechanics and understand the distinction between bounded and unbounded sets.

M.C. Escher's famous artwork uses symmetry and geometry to create impossible designs that challenge our perception of reality. Inspired by these mesmerizing designs we visited the Paradox Museum and journeyed through each room, trying to understand the geometry and symmetry behind the illusions that challenge the brain and twist reality into fun and fascinating puzzles. Join us as we venture through the world of optical illusions unveiling the unknown.

MP96. MATHS AROUND THE WORLD

Despina-Maria Christoforou, Sophia Forster Georgiou, Olga Salidou, Maritini Stylianou, Smaragda Vasiliou
The GC School of Careers, Nicosia, Cyprus

Have you ever wondered how famous, impressive monuments around the world were built? Is their longevity and beauty by chance? Mathematics reigns over their construction, structural unity and aesthetic charisma.
"Maths Around the World" presents multiple famous monuments and their hidden mathematical properties. The presentation will explore their structure, construction, as well as the similarities and differences between them. It examines the mathematical principles of geometry and trigonometry, whilst also referring to wind forces, the golden ratio, and angles.
Trigonometric principles, for example, used by architects and engineers of the past were used to calculate angles and distances in the construction of huge and complex buildings such as temples, amphitheatres, and even laboratories of a kind. It helped them authorise the exact placement of materials in order to create these magnificent structures.
The presentation will take you to the engineering feat of the Eiffel Tower, to the mathematical expertise and astronomical understanding of the Egyptians, to the Colosseum in Rome and the Parthenon in Athens built by two ancient civilisations who relied on geometric principles to create congruous and proportional designs and finally to the miraculous lean of the medieval Leaning Tower of Pisa.
All of these monuments still stand to this day as mathematical wonders of the world, proof of human creativity and ingenuity and the elegance of nature's laws.

MP97. HOW TO WIN F1 USING MATHS

Constantinos Diomedous, Andreas Koutas, Orestis Stylianides
The GC School of Careers, Nicosia, Cyprus

Have you ever watched a Formula 1 race? Witnessed the velocities they reach? The tight corners that need to be navigated each time? The overtakes, accidents and the speed of the pit-stops? While this may be engaging and interesting to observe, do you believe it would be feasible without the application of mathematics?
Engineers and scientists spend years designing and developing the car's structure, considering everything from materials to component angles. They develop winning strategies, mathematical models and data analytics to drive every aspect of the competition. Drivers train extensively to handle cockpit pressure and temperature while improving reaction time to avoid crashes. Mechanics put their all into figuring out how to perform a successful pit-stop in the shortest time possible. The team dedicates substantial effort to developing strategies considering the track conditions, weather factors, and the driver's status. These are only some of the factors needed for a successful F1 race and of course, none of those would be possible without the use of mathematics.
Algorithms, statistical analysis and optimization techniques transform raw data into competitive advantages. Whether you are a racing enthusiast or a math lover, this presentation will reveal how the perfect combination of speed, precision and mathematics leads to victory on the track.

MP98. GUESS A NUMBER

Nikolas Christodoulou, Iasonas Diakos
The GC School of Careers, Nicosia, Cyprus

Can humans develop a better strategy than Nash equilibrium, or does it remain the best, most ideal decision-making method in game theory? Given the complication of strategic interactions, the Nash equilibrium is often regarded as the most practical solution. This is largely because people hardly engage in boundless reasoning, typically limiting themselves to one, two or at most three steps in the process.

This presentation delves into the mathematical principles underlining the Nash equilibrium and its role in game theory, with particular focus on the well-known Prisoner's Dilemma. The Prisoners Dilemma provides a clear example of the tension between individual self-interest and group outcomes. In this presentation, participants will engage in an interactive activity of game theory by experiencing a live example of a strategic decision-making problem, allowing them to actively practice the theories discussed. The findings of this problem will emphasise the gap between mathematically ideal models and the way people actually behave. To bridge this gap, it is essential to improve models that will more accurately reflect how people make decisions. Such models would develop the practical usefulness of mathematical modelling in fields like psychology, economics and game theory. The closer these models align with real human decision-making, the more effective they will be in real world applications. After all, isn't it the ultimate challenge of strategy to predict and influence the choices of others?

MP99. HOW TO MAKE A STRIKE

Mamakou Despoina, Mouteveli Paraskevi
Doukas School, Athens, Greece

How can you make sure you get the right strike in bowling? The aim of this presentation is to explain the steps and rules that one should follow to have a successful strike every time they bowl. Some of them relate to how to choose the right ball and what kind of angle your hand should make at the moment you throw the ball. To choose the right ball, we need to consider the weight of the ball, how to apply our fingers (not too tight or too loose), and the quality of the ball. But in addition, each individual must choose a bowling ball that is comfortable for them to bowl. Here is how to ensure the perfect strike: First, to find the angle of the ball, you need to have the tangent angle to the negative power 1 multiplied by the division between the lateral displacement of the ball from the starting line (15-20cm) with the length of the runaway (18.29 meters). Also, to throw the ball, you put the mass of the ball (5-7 kg) with the acceleration given to the ball. Additionally, the rotation of the ball is related with the speed of the ball (16-19mph or 27-30 km/h). Lastly the radius of the ball is 10.9 cm.

MP100. MEASURE YOUR MATHEMATICAL VISUAL PERCEPTION! HOW MUCH "MATHEMATICS" CAN YOU SEE?

Anastasiadi Elefteria-Evangelia
Music School of Volos, Volos, Greece

We live in the era of imagery, where mathematical symbols and numbers are widely used to condense written text, as seen in modern forms of communication (e.g., Erasmus+, Study4Exams, STR8). This practice has its roots in the past, such as illustrated puzzles and rebuses. The integration of these mathematical elements and symbols requires further familiarization with mathematical literacy, while it may also contribute to reducing math anxiety.

Game-Based Learning (GBL) emerges as an ideal method for engaging students, alleviating stress, and making mathematics more accessible. Inspired by the tender allegory of happiness and self-fulfillment in Shel Silverstein's "The Missing Piece", and enriching it with mathematical elements and symbols, we created a game-test that measures Mathematical Visual Perception. In its initial phase, a poster presents the mathematically adapted story in comics' form, where the viewer-reader is invited to identify and count hidden mathematical elements.

The participant's performance is evaluated based on levels of success, while they are encouraged to continue their exploration in the world of mathematics. This project combines mathematical thinking with creativity, offering an interdisciplinary and innovative approach to further disseminate mathematics.

MP101. ZENO'S PARADOXES

Dinos Papathanasiou
The Moraitis School, Athens, Greece

Zeno of Elea (born in the Greek colony of Elea in Magna Graecia, Southern Italy around 495 B.C.), was one of the earliest Greek philosophers, famous for posing so-called 'paradoxes' which have fascinated mathematicians, philosophers and others since their first formulation.
Zeno's paradoxes initially contradict the common-sense conclusions. In many cases these paradoxes went unresolved, misread and misunderstood for many centuries.
Their comprehension became possible with the definition of the concept of the mathematical limit in modern times. It was then that it was understood, mainly by mathematicians, that 'apparent paradoxes' are NOT paradoxes.
The examples: the paradox of Achilles and the tortoise, the Dichotomy paradox, the Arrow paradox and the Stadium.

MP102. SPLITTING THE RENT, A FAIR DIVISION PROBLEM

Vassilis Kekis, Dimitris Zafeiropoulos, Nikolas Gerasopoulos, Apostolos Zachos
The Moraitis School, Athens, Greece

On our way to the Euromath 2025 Conference, we encountered a rather unexpected problem. The apartment we were to live in had 3 different rooms and an amount of money to be paid. All three of us could not come up with an agreeable decision on how to divide the rooms and split the rent. If only the rooms were the same; that would have been much easier to solve. However, that was not the case, every room had its own characteristics, and every roommate had his individual preferences.
In this paper, we solve the “Split the rent” problem using Sperner’s Lemma, a well-known result that is applied in various fair division situations and in many mathematical fields such as Game Theory and Topology.

MP103. THE PIGEONHOLE PRINCIPLE AND ITS APPLICATIONS IN SOLVING VARIOUS PROBLEMS

Nahal Mannani
Enghavegard Skole, Denmark

The Pigeonhole Principle is one of the simplest yet most widely used theorems in mathematics. In this article, the author aims to explain this principle in a simple and comprehensive manner. Subsequently, the article will demonstrate how this seemingly simple principle can be applied to solve various important problems.

MP104. INNOVATIVE SOLUTIONS FOR CHALLENGING FRACTIONAL, EXPONENTIAL, AND RADICAL PROBLEMS

Diana Mannani
Kildegardskole Vest, Denmark

His paper presents a historical analysis of diverse solution strategies for complex mathematical problems, particularly those involving fractions, exponents, and radicals. It posits that variations in problem-solving methods are influenced by the individual perspectives and approaches of mathematicians. The study categorizes and synthesizes these techniques, aiming to provide a valuable resource for students and researchers, thereby facilitating the resolution of future mathematical challenges.

MP105. FINDING REMAINDERS AND LAST DIGITS: APPLYING MODULAR ARITHMETIC TO EXPONENTIAL NUMBERS

Shayan Hasani
TAHA High School, Zanjan, Iran

Modular arithmetic, a fundamental branch of number theory, is concerned with the concepts of congruence and remainders. This seemingly abstract mathematical framework finds extensive applications in diverse areas of daily life and scientific disciplines. In cryptography, modular arithmetic is essential for creating secure encryption and decryption algorithms. It also plays a crucial role in computer science, particularly in random number generation and memory management. Furthermore, the principles of modular arithmetic are used in scheduling to calculate time cycles and coordinate events, and its repeating patterns have influenced art and music, contributing to innovative works and harmonic structures. This paper explores the utility of modular arithmetic in divisibility analysis, focusing on determining remainders and identifying the last digit of large exponential numbers. By employing the techniques of modular arithmetic, we present an efficient method for tackling these problems, which often involve computationally intensive calculations. This approach provides a simplified and more accessible means of addressing divisibility and remainder problems in the context of large powers.

MP106. SYSTEMATIC APPROACHES FOR SOLVING PATH FINDING AND MAZE CHALLENGES IN INTELLIGENCE TESTING

Seyede Elisa Hashemi
Roshd Junior High School, Zanjan, Iran

The application of statistical and probability principles, along with mathematical techniques and graph theory, is widely used to solve problems involving the calculation of the number of paths, shortest paths, and related challenges. Path finding and maze-related problems are frequently encountered in intelligence and academic aptitude tests. In this article, we propose a step-by-step methodology for solving these problems and provide a systematic classification to facilitate their resolution.

MP107. THE USE AND DESCRIPTION OF π

Stelios Giamos, Aleksandr Lomadze, Yue Hang Xu
International School of Paphos, Cyprus

Pi (π) is used every day by many people even though we all think that pi can only be used in our Math lessons. We chose this topic so that in this presentation we can change everyone’s perspective on when, why, and how pi is used in other daily activities. Even though people who use pi frequently are a few, it doesn't mean that you may not be using it too!

Its use is mainly in Math, Science, Engineering, Architecture, Construction, Manufacturing, Building Spaceships and Flight Planning. For example, for a plane to fly they need to use actuators to control the flaps that move on plane wings and tails or the parts that open and close valves on jet engines then controllers send signals to electric motors, telling them how fast they need to spin to make the actuators move. Also, as we all know, in Math, we use π to find the circumference and area of a circle or any other circular shape.

The origin of π was in Ancient Egypt. The Egyptians calculated the area of a circle by a formula that gave the approximate value of 3.1605 for π, even though today we use the approximate value of 3.14. The first calculation of π was done by Archimedes of Syracuse who is one of the best mathematicians of the ancient world. Even though today most of us just see π as another equation in our Math classes, depending on where our academic lives take us, π may become part of our life.

MP108. MATHS IN FORENSIC SCIENCE

Marta Dorontić, Dominik Ivančević, Erika Mikić, Nika Papac,
Gita Pavić
Gimnazija Požega, Požega, Croatia

Mathematics is one of the most valuable tools in modern forensic science. Probability theory and geometry help in solving crimes. The presentation reviews DNA matching, fingerprint analysis, Bayesian probability in identifying suspects, and other mathematical forensic techniques. The geometric methods to be discussed in detail include trajectory reconstruction of bullets, blood spatter analysis, and mapping at crime scenes. Trigonometry and vectors will help in reconstructing events and scenes at the crime scene.
This presentation also uses examples from the popular TV series Numb3rs to explain just how algorithms and statistical models can help in the process of tracking criminals, identifying patterns, and analyzing evidence in real-life cases. Famous cases are presented, showing how geographic profiling was used in investigating the BTK killer and statistical linguistics were used to decode messages by the criminal, striking a balance in effective case-solving.
The presentation then presents the challenges and constraints of using mathematical models in forensic science, such as having the data input and analyzed accurately. Finally, it investigates the great potential of new technologies, especially artificial intelligence and machine learning, in advancing forensic mathematics.
This presentation aims to demonstrate how the fusion of mathematics and science revolutionizes criminal investigations, inspiring a greater appreciation for the practical applications of mathematical theories in real-world scenarios.

MP109. ON THE FOUNDATIONS OF MATHEMATICAL THOUGHT: A META-ANALYSIS OF THE PHILOSOPHICAL UNDERPINNINGS OF MATHEMATICAL PRACTICE

Martin Kostov, Daniel Kolev, Ivan Stoyanov
125th Secondary School "Boyan Penev", Sofia, Bulgaria

On the Foundations of Mathematical Thought: A Meta-Analysis of the Philosophical Underpinnings of Mathematical Practice

This analysis explores the intricate relationship between mathematical reasoning and philosophical inquiry, emphasizing the foundational principles at their intersection. Drawing from mathematical logic, epistemology, and the philosophy of mathematics, it addresses key questions regarding the nature of mathematical truth and the limits of formal systems.

The study examines three critical areas: the ontological status of mathematical objects and its implications for practice, the role of intuition in discovery and its interplay with formal proof, and the impact of Gödel's incompleteness theorems on understanding formal systems. These themes highlight how the practice of mathematics is deeply intertwined with its philosophical foundations.

Contemporary mathematical practice cannot be fully appreciated without acknowledging these philosophical underpinnings, just as modern philosophy of mathematics necessitates an understanding of mathematical methodologies. This interdependence bridges Platonist and constructivist perspectives, offering a framework that unifies philosophical and mathematical approaches to knowledge.

MP110. WHERE MATH MEETS MONEY: REAL-LIFE APPLICATIONS OF QUADRATIC PROGRAMMING IN INVESTMENTS

Klara Šokac, Luka Zulian
Prva riječka hrvatska gimnazija u Rijeci, Croatia

Do you want to invest but feel overwhelmed by complex math? Quadratic programming can be a game-changer! This method helps you balance risk and reward while staying within your budget or other constraints. The best part? You don’t need to be a math genius to use it!
In this presentation, we will explore how quadratic programming works and why it’s so useful. By combining special functions called quadratic equations with rules called constraints. These constraints act like boundaries, making sure our solutions are realistic and practical.

To make things clear, we'll use tools like Excel to demonstrate real-world applications. Even if math seems challenging at first, we'll break it down step by step so you can follow along with ease. You'll see how math can be a powerful tool for solving problems that matter.
Using relatable examples, we'll break down the process further. Whether you want to plan for your future, manage resources or simply invest wisely, this method will equip you with a powerful tool to make better decisions.
By the end of the presentation, you'll not only understand the basics of quadratic programming but also gain hands-on skills to apply in managing your finances. Investing isn't just for experts—it's for anyone ready to take control of their financial future!

MP111. APPLICATION OF MATHEMATICS IN ANIMAL SPECIES INTERACTIONS – THE LOTKA-VOLTERRA MODEL

Fran Blažić
Prva riječka hrvatska gimnazija u Rijeci, Croatia

Animals have always been an area of interest for humans. We have studied the evolution and the purpose of their traits, their habitats and diets, the behaviors and their patterns in interactions both within a species and among different ones. Perhaps, the most well-known type of interaction is the one of predators and prey. At first glance, its terms and conditions may seem simple – the predator eats the prey, and the prey does everything to avoid the predator. However, a more detailed analysis of this relationship suggests a more complex and dependent nature. This presentation will dive into a mathematical model of two differential equations which describes the predator-prey relationship known as the Lotka-Volterra model. It will also look at its many applications, such as predicting species' population and addressing and solving the problem of endangered and invasive species.

MP112. APPLICATION OF MATHEMATICS IN BAKING - INVESTIGATING THE EFFECT OF BAKING POWDER ON CRESCENT ROLL VOLUME

Eni Žeželić
Prva riječka hrvatska gimnazija u Rijeci, Croatia

Mathematics is present in many aspects of our daily lives, often in ways that we may not immediately recognize. However, the use of mathematical concepts extends far beyond the classroom. This research explores the relationship between the amount of baking powder used in crescent roll preparation and the resulting volume of the rolls. Using calculus, specifically integration and volume of revolution, this study models the crescent rolls shape to calculate its volume. By varying the amounts of baking powder while keeping other ingredients constant, this research aims to quantify the effect of baking powder on roll volume. The study not only illustrates the practical application of mathematical concepts in culinary context but also offers insight into optimizing baking processes for desired outcomes..

MP113. EARNING PIZZA WITH MATH: A CALORIE- BURNING EXPLORATION

Dora Franki, Vibor Galjanić
Prva riječka hrvatska gimnazija u Rijeci, Croatia

Ever wondered how many slices of pizza your daily walk could "earn" you? Or if lifting weights burns more calories than vacuuming your house? This project takes you on a journey into the hidden math behind the calories we burn, revealing how everyday activities and gym workouts contribute to energy expenditure in ways that are as surprising as they are relatable.
By applying mathematical methods to real-world scenarios, we use MET (Metabolic Equivalent of Task) values to calculate the energy cost of various activities. From walking, cooking, and playing with pets to gym favorites like bench pressing, running, and cycling, each action is broken down into measurable calorie burns. These calculations are transformed into clear, engaging graphs and striking visual comparisons that bring the data to life.
But it doesn't stop there—what makes this exploration truly unique is how we translate these numbers into something we all understand: food. Discover how your efforts stack up against pizza slices, burgers, or chocolate bars, offering a fun, tangible look at the balance between energy output and indulgence.
This project isn't just about crunching numbers—it's about showing how mathematics connects to our daily lives in meaningful and entertaining ways. Through creative visualizations, relatable examples, and practical applications, we unlock the hidden stories math can tell, proving that even the most ordinary routines can hold extraordinary insights.

MP114. X^x APPROACHING ZERO

Laura Lipovšek, Ula Košir
Srednja šola Domžale, Slovenia

When we think about limits and powers, we usually expect straightforward behaviour. But what happens when we look at the expression x^x as x approaches 0? At first, it might seem like the result should be either 0 or infinity. After all, when we divide by smaller and smaller numbers, we often think of approaching infinity, right? But surprisingly, as x gets smaller (but still positive), the value of x^xapproaches something unexpected 1. For example, 〖(0.1)〗^0.1 ≈ 0.794, and 〖(0.01)〗^0.01 ≈ 0.954, both of which seem to settle near 1 rather than going to 0 or infinity.
Now, here's where it gets even more interesting: what happens if x is negative? We might think we can apply the same reasoning, but negative numbers raised to fractional powers don't behave the same way. In fact, they become undefined in the real number system, leading to questions about what happens when we try to evaluate this limit from both sides of 0.
This topic dives into the surprising behaviour of x^x, challenging our initial assumptions and showing how limits can reveal unexpected results. Let's explore why x^x approaches 1 as x nears 0 from the positive side, and why it's not as simple as we might have expected when negative values are involved.

MP115. HOW THE GOLDEN RATIO PHI(Φ) AND THE GOLDEN PARALLELOGRAM HELPED BUILD THE PARTHENON

Skliras Christos, Antonopoulos Alexandros, Kollias Alexandros
Doukas School, Athens, Greece

In this presentation, we will talk about the golden ratio of Phi (Φ)and the parallelogram and how they were used in building the Parthenon by the ancient Greeks. The golden ratio is about 1.618(or 1.618033988749894...) and is a special number that has amazed architects, artists, and mathematicians for a very long time because of its beauty and unique properties some may call it the perfection of imperfection. The Parthenon, one of the most famous if not the most famous buildings in ancient Greece, is believed to include the golden ratio in its design. We will look at its proportions and show how the golden ratio can be found in many parts, like the size of its front and the shape of its columns. We will also use a model of the Parthenon to show where and how the golden ratio and the golden parallelogram have been used. Our goal as a team is to show how math and art can work together to create balance and beauty. Through the Parthenon, we will see how math has inspired humankind to be more creative and create amazing architectural designs.

MP116. EATING PIZZA TO LEARN FRACTIONS: USING REAL-LIFE EXAMPLES TO SIMPLIFY FRACTION CONCEPTS

Ilias Giannakakos, Athanasios Vaitoudis, Elvira Gavriil, Pantelis Letsas, Loukas Nikas, Marilia Kazalaki, Theodora Bintza
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Fractions are a fundamental concept in mathematics, yet students often face significant challenges in understanding and working with them. These difficulties include defining fractions, comparing fractions, performing operations, and solving problems involving fractions. This study explores the roots of these challenges, focusing on students' first encounters with fractions in primary education. By examining the underlying causes, we propose solutions based on the use of games and interactive applications to enhance comprehension and engagement. Finally, we present our educational initiative, "Eating Pizza to Understand Fractions," as a practical example of our approach.

MP117. MATHS ∩ SPORTS

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The English school Nicosia, Cyprus

How do sports intersect with mathematics? Sports and math are deeply connected in many interesting ways, showing how numbers can improve an athletes' performance. Probability helps us understand the likelihood of different outcomes during games. This helps players and coaches change their strategies to increase their probability of winning. For example, probability is used to show how likely a basketball player is to make a free throw or what the odds are for any sports team to win, based on past performances. Statistics add to this by giving detailed information about how players and teams perform. This can help athletes understand their strengths and weaknesses in order for them to improve. Geometry plays an important role too, especially in sports like football, where analyzing angles can help with scoring or passing, taking into account how to avoid defenders. The shape of fields and courts also involves geometric shapes and angles, which can influence how players move and position themselves. The mix of sports and math not only helps improve games, but also makes them more exciting for fans, allowing for deeper discussions about strategies and performances. By recognizing the role of math in sports, we get a clear view of competition and skill, making every play more exciting. In conclusion, math not only measures athletic skills but also adds another layer of enjoyment and understanding to the world of sports.

MP118. SLIDING ON SAND: ANOTHER SECRET OF PYRAMIDS CONSTRUCTION

Nana Trapaidze, Nikoloz Chkareuli, Daviti Bitsadze, Lekso Pitskhelauri, Paata Liklikadze
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Introduction:
The construction of Egyptian pyramids remains one of the greatest engineering mysteries. Transporting massive stone blocks across the desert posed a significant challenge. A hypothesis suggests that ancient Egyptians may have used water to reduce friction, making it easier to move heavy loads. This research experimentally examines the validity of this hypothesis.
Methodology:
To test the hypothesis, we built a small wooden sled and spread sand on a track. The sled was loaded with a mass significantly heavier than itself and was slid across both dry and wet sand. In each case, the friction force (as well as the coefficient) was measured to determine the effect of sand moisture on sled movement.
Significance:
Understanding ancient engineering techniques is not only important for archaeology but also for modern science and technology. This friction-reduction technique could be useful for transportation on sandy surfaces, benefiting construction, logistics, and rescue operations. Moreover, this study highlights how ancient civilizations managed to build large-scale structures.
Conclusion:
The experiment demonstrated that moderately wet sand significantly reduces friction, facilitating sled movement, whereas excessive water hinders the process. The findings support the idea that ancient Egyptians may have indeed used water to reduce sand friction, explaining how they transported massive stone blocks. This research not only helps solve the mystery of pyramid construction but also offers practical applications in modern.

Keywords: Egyptian pyramids, Ancient World, Multi-ton stone blocks, Desert terrain, Friction reduction, Moistening sand, Wooden sled, Dry sand, Wet sand, Friction coefficients, Heavy loads, Sand cohesion, Ancient engineering techniques, Modern applications, Sandy surfaces

STUDENT PRESENTATIONS IN SCIENCE

SP1. LIVING AMONG THE STARS: UNLOCKING THE MYSTERY OF LIFE

Loukianna Kyzouride, Marisa Hadjivarnava, Anastasia Papaevelthontos,
Charis Lefkariti, Maritina Koukouma, Ioli Venezi
American Academy Larnaka, Cyprus

Have you ever looked up at the stars and wondered if we are alone? The universe is a giant, endless place filled with stars, planets, and galaxies, stretching farther than we can imagine. Scientists have been exploring it for years, trying to find out if there are other living things—maybe on faraway planets using powerful telescopes, robotic spacecraft, and even giant radio antennas. Could there be creatures who live differently than us, or maybe even ones who look like us? Could there be civilizations out there, looking back at us and wondering the same thing? In this theme, we're going to explore the big question: Is there life beyond Earth? We'll think about what life needs to survive, like water, air, and energy, and where we might find those conditions in space. Let's step into the unknown and see if we can uncover some answers to one of the biggest mysteries of all time. The search for life beyond Earth is one of the most exciting journeys sciences have ever taken, and it might change everything we know about our place in the cosmos. What do you think—weird aliens, distant civilizations, or are we truly on our own?

SP2. MAPPING THE PATHWAYS OF MEMORY

Katerina Demetriou, Nikolina Sklavouri
American Academy Larnaka, Cyprus

"The brain is a world consisting of a number of universes."— Antonio Damasio (Portuguese Neuroscientist). Brain mapping involves creating comprehensive representations of the brain's structure and functions. Brain mapping not only provides insights into normal brain function but also aids in understanding neurological disorders such as Alzheimer's disease. The brain is a highly complex organ responsible for managing cognitive processes, emotions, and bodily functions. Memory, a critical aspect of brain function, involves encoding, storing, and retrieving information. It is broadly categorised into short-term and long-term memory. What causes a memory to be embedded into our brain? Are there differences between the two sexes and our lifestyles? Aspects of memory differ between men and women as women tend to connect every action with emotions. Therefore, some memories have more value in their brain than in men. A regular sleeping schedule also affects our memories as without adequate sleep, learning and recalling suffer, leading to forgetfulness and reduced cognitive function. Shaping and forming memories also changes as people age. The development of a foetus' brain and as it grows up in early childhood and how getting old affects memory will be discussed. Lastly, we will delve into some ways in which memory loss can be prevented.

SP3. TIME DILATION

Elizaveta Veselik
The Island Private School of Limassol, Cyprus

Time dilation, one of the most fascinating predictions of Einstein's theory of relativity, challenges our intuitive understanding of time by revealing that it is not absolute but relative. In this presentation I will explain the physics of how motion and gravity influence the passage of time. Using the equations from special relativity, I will mathematically demonstrate how time slows down for objects traveling at speeds approaching the speed of light: the closer an object's velocity is to the speed of light (c), the greater the time dilation effect. Similarly, using equations from general relativity, I will show how time is affected by strong gravitational forces, like near black holes. Beyond its theoretical elegance, I will explore real-world applications of time dilation, such as how it's been experimentally confirmed with atomic clocks in the Hafele-Keating experiment. Additionally, I'll discuss its vital role in the accuracy of GPS systems. Satellites in orbit experience both gravitational and relative velocity time dilation (due to their high speeds). If these effects were not accounted for using Einstein's equations, GPS systems would drift by kilometers each day, rendering them useless. Finally, I will discuss the implications of time dilation for the future of science and technology. In this presentation I aim to explore time dilation from multiple perspectives and hope to demonstrate not only the profound beauty of Einstein's work but also its enduring relevance in shaping our understanding of the universe and advancing modern technology.

SP4. THE ART OF DYEING WITH NATURAL DYES

Nita Veshapidze, Giorgi Malania, Elena Bitsadze
Tbilisi International School, Tbilisi, Georgia

The tradition of using natural dyes is as old as human civilization. Since ancient times, people have been obtaining colors from nature. The main sources of colors were plants, minerals, and animal products, i.e., pigments obtained from natural materials. Dyeing with natural dyes is not only a technique but also a creative process and an art. Each color has its own unique depth and texture, allowing the creation of individual and original works.

The goal of this research was to study the traditional dyeing art spread in Georgia, revive and popularize the dyeing methods used by our ancestors, and create a catalog of colors we received. Traditional techniques involved the use of plants such as andro, ansli, walnut, chamomile, pomegranate, tea, onion, citrus, ivy, acacia, laurel, turmeric, vine, red cabbage, beetroot, and carrot. During the research process, we found that both the coloring pigment and the color-fixing agent (vinegar, salt water, white shab, etc.) must be carefully selected to ensure the resulting color is stable.

In a world with increasing ecological problems, the art of dyeing with natural dyes offers a sustainable alternative. This method does not harm the environment, as it avoids harmful chemicals found in synthetic dyes. Natural pigments are biodegradable, non-toxic, and safer for the skin and health. Furthermore, renewable resources are used to create these art materials.

By rediscovering and supporting these art methods, we honor the insight of our ancestors and create a more creative and green future. The art of painting with natural dyes bridges the past and the future celebrates culture, and promotes sustainable living.

SP5. TIME TRAVEL

Orestis Themistocleous
The English School Nicosia, Cyprus

Space is full of curiosities which might not be practical, but have you ever wondered about the possibility of humans being able to travel back or forward in time? In today’s space science, time travel is one of the most prioritized topics. In the past years, many theories and ways of time travel have occurred, with a lot of them based on Einstein’s theory of relativity. Theories like wormholes, cosmic strings and Tipler cylinders claim to be one of the possible ways time travels can happen, even If none of them have been visually proven before. While analyzing the types of existing wormholes and how they might be able to make travel through space practical, other matters like gravity and distance must be explored. They can be described as something as simple as a tunnel, but they are much more than that. Behind each theory, a whole new chapter awaits, answering more questions while you dive deeper into it. Many physicists needed to work on each theory to prove it, while they had to get into other topics as well, like exotic matter, the gravitational pull and even the environment that was needed. All these questions had to be answered and later explained, so anyone could understand the way they worked. Space is still full of wonders, so why don't we start with time travelling, to find out more about the history of the world itself?

SP6. HOW CAN AN F1 CAR GO OVER 500 KM/H

Aris Moyseos, Paris Sokratous
The English School Nicosia, Cyprus

How can an F1 car go over 500km/h? Do you think is possible? The fastest an F1 car has ever reached is 378 km/h by the Mercedes driver Valtteri Bottas. McLaren's model known as MCL60 can go over 500 km/h with the right engine. Using the SSC Twin-Turbo flat-plane crank V8 engine, the MCL60 surpasses with 1650 kW (about 2,212 horsepower), a combination of Formula 1 aerodynamics. This trial looks at and redefines vehicle dynamics, mechanical performance, and alternative setups for cars. With the engine famous for its high-grade construction and engineering, it ensured the powers are delivered without the car being disturbed or shaken in case of further ambient instabilities. The MCL60 features high-tech active aerodynamics, which expands or contracts, according to the vehicle's speed, to achieve the right aerodynamics and balance at such speeds. It is no wonder that the MCL60 covers more ground at a given time thanks to the use of ultra-light materials that are carbon composites and others to decrease weight against integrity. Driving beyond 500 km/h requires more things than mechanical horsepower, like invention in tire tech, dynamic chassis, and heat management. Originally designed for high-speed circulation with both static and dynamic stresses for varying surface temperatures, the project gained a full-complement of different wear-resistant tires. Simultaneously, testing showed the success of the cooling systems not only

on the engines but also on the airfoils that got the chance to undergo heating stress at high speed over a lengthy period. This ambitious venture shows the great extent of automotive engineering, giving proof of the possibility of blending principles from motorsport and hypercar technologies.

SP7. SYSTEM OF MANAGEMENT AND CONTROL OF THE BEE VENOM HARVESTING PROCESS

Andria Kostava, Makrine Todua, Lazare Chachua
American International School Progress, Tbilisi, Georgia

Beekeeping involves rearing bees to obtain products vital for nutrition and health, such as bee venom, widely used in medicine. Venom is secreted when a bee contacts a special wire plate made of a glass surface, paper, and wires 2 mm apart. A generator connected to the wires delivers impulses of 30-90 volts.

The irritated bee leaves its venom on the plate's glass. Impulse frequencies range from 800 to 1200 Hz, with packet durations of 1-3 seconds and pauses of 1-5 seconds. While venom secretion increases with voltage, excessive voltage, especially in high humidity, can kill bees-a drawback of current methods.

Our innovative device prevents bee deaths while maintaining venom extraction efficiency. This is achieved by keeping a constant frequency in high-voltage packets. By reducing voltage impulse duration through transverse impulse modulation (where pulsation increases inversely with humidity), the risk of bee mortality is minimized.
During pauses, bees are exposed to 30 Hz audio impulses to sustain irritation. The fully automated system ensures controlled venom collection without beekeeper involvement, protecting beekeepers from irritated bees.

SP8. THE USE OF MOSSES AND LICHENS AS NATURAL FOOD PRESERVATIVES

Tekla Bandzeladze,Ana Mariami Kiparoidze, Nino Skhiladze
American International School Progress, Tbilisi, Georgia

One of the main challenges of the 21st century is extending the shelf life of food products. To achieve this, many companies add special preservatives to food, which prolongs the product's usability but also pose risks like allergic reactions, asthma, a higher carcinogenic potential, and effects on the digestive system's microbiota. Research indicates that food preservatives contribute significantly to chemical environmental pollution. Some sulfites affect specific groups of living organisms, causing changes in the environment and disrupting ecological balance.
The addition of preservatives in food also has an impact on the human nervous system. A study published by AAAS shows that if young children frequently consume products containing sodium benzoate, they are more likely to develop symptoms of ADHD.
The presented research demonstrates how food preservatives can be replaced with natural materials, such as mosses and lichens. The focus will be on food packaging/labeling and replacing synthetic preservatives that increase the levels of benzoates and nitrites in food. The production process of packaging materials and labels emits harmful gases, while replacing them with organic products will also contribute to reducing harmful emissions.
By using mosses and lichens, food industry entrepreneurs can shift toward more sustainable natural preservation methods, which will benefit both consumers and the environment. This will promote and foster the achievement of sustainable development goals.

SP9. INFINITE LABYRINTHS

Aleksandra Panchova Vaneva, Nikola Stanislav Vasilev
125th Secondary School "Boyan Penev", Sofia, Bulgaria

For centuries, the labyrinth (λαβύρινθος) has been used worldwide as a tool to challenge creativity, enhance insight, calm the mind, and restore balance. Classic depictions of labyrinths date back over 4,000 years. During the Middle Ages, nearly 25% of cathedrals included labyrinths as integral features. Since 2009, the first Saturday of May has been celebrated as World Labyrinth Day, with people across the globe walking the winding paths of countless labyrinths that have been built or rediscovered around the world. Today, a global network identifies approximately 6,400 labyrinths in over 90 countries.
This project presents and analyzes the extraordinary architecture and ingenious engineering behind various types of labyrinths: Cretan and Chartres patterns; single-path and multi-directional designs; those with Eulerian or Hamiltonian cycles; symbolic, underground, and above-ground structures. We explore the application of graph theory in constructing complex pathway systems and optimizing routes through them. Additionally, we investigate the technologies employed in the construction and discovery of labyrinths – drawings, blueprints, acoustic surveys, ground-penetrating radar, scanners, and computer simulations.
We compare the techniques and designs used throughout history, from petroglyphs and mosaics to mole tunnels and cave systems, and even to the intricate cycles of quasicrystals and the cosmos. The project also summarizes the oldest, most picturesque, and largest labyrinths in an engaging mini-encyclopedia and demonstrates practical methods for navigating entrance-to-exit routes.

SP10. SUSCEPTIBLE, INFECTED, REMOVED (SIR)

Raya Aleksandrova Aleksieva, Samuil Ivanov Terziyiski
125th Secondary School "Boyan Penev", Sofia, Bulgaria

In this report, we present the mechanisms by which pathogens spread and enter the human body – whether they encounter barriers that must be overcome or enter freely without obstruction. We examine in detail and analyze the process of viral infection: how viruses penetrate the host cell, how they use enzymes to replicate their nucleic acids, and how they multiply.
We trace the infection process and answer the following questions: How does the body respond? What is the outcome of an infection? What happens within the organism when it is invaded by pathogens?
In the section dedicated to the types of immunity, we address an important question:
How can we acquire immunity without being exposed to the disease?

SP11. HERBOLOGY

Vasilena Georgieva Chakarova
125th Secondary School "Boyan Penev", Sofia, Bulgaria

Plant Study in Medicine (Herbology), a branch of botanical science, focuses on the properties, applications, and interactions of plants, particularly within the framework of human health. This field investigates the medicinal uses of plants by analyzing the bioactive compounds that produce therapeutic effects.
Herbology blends traditional knowledge with modern scientific methodologies to study plant cultivation, accurate identification, and the extraction of natural compounds. It underscores the symbiotic relationship between humans and plants, advocating for sustainable practices to conserve biodiversity.
Through the integration of phytochemistry, pharmacology, and ethnobotany, herbology makes significant contributions to medical advancements. It provides a holistic perspective on leveraging the potential of plants to address health challenges and improve well-being.

SP12. CANCER PHYSIOLOGY

Vasilena Georgieva Chakarova
125th Secondary School "Boyan Penev", Sofia, Bulgaria

Cancer is a complex group of diseases characterized by uncontrolled cell growth and the potential to invade or spread to other parts of the body. It arises from genetic mutations and environmental factors that disrupt normal cellular functions.

Research into cancer focuses on understanding its biological mechanisms, including tumor development, progression, and metastasis, as well as the role of the immune system. Advances in diagnostics, targeted therapies, and immunotherapy are improving treatment outcomes.

Emphasizing prevention through lifestyle changes and early detection remains vital. Cancer studies unite molecular biology, genetics, and clinical research to combat this global health challenge effectively.

SP13. FROM THE BEEHIVE TO INNOVATIONS AND TECHNOLOGIES

Iskren Nikolaev Gyurov, Lachezar Orlinov Ivanov
125th Secondary School "Boyan Penev", Sofia, Bulgaria

This project focuses on the most remarkable insects living on our planet – bees. In Europe, there are over 800 species of wild bees, seven of which are classified as critically endangered, 46 as endangered, 24 as vulnerable, and 101 as near-threatened. Our goal is to unveil some lesser-known facts about these little "robots" that work tirelessly to sustain our ecosystems. "If bees disappear, humanity will survive for only four more years before it vanishes," said Einstein.

Believe it or not, bees possess innate intelligence and adaptability to various situations. Numerous examples illustrate this: Scarlett Howard’s experiments that revealed their mathematical abilities, the fascinating phenomenon of scout bees performing the "bee dance," the specific wing motion during flight, their skill to hover in mid-air, and many other unique, significant traits not just fascinating but also critical for humans. The exceptional hexagonal shape of honeycomb cells is a true wonder of nature. These tiny "engineers" serve as an inspiration for humans working in diverse fields such as mechanical engineering and medicine. Transport and design companies find technological inspiration in honeycomb structures – hexagonal coverage is always more optimal and cost-effective. Modern architects are profoundly influenced by the captivating appearance and efficiency of hexagons. Scientists draw inspiration from the bees’ extraordinary flight mechanics, which have been utilized in numerous innovations for aerial vehicles with various purposes. The report also presents mathematically supported technological and architectural solutions based on the perfect natural hexagon and the intricate spiral honeycombs of Tetragonula bees.

To provide the audience with the fullest understanding, they will have the opportunity to examine honeycombs from agricultural beehives, which will help them fully visualize the practicality of the six-sided cells.

SP14. RECONSTRUCTION OF MOSAICS

Anton Georg Borislavov Vasilev, Hristo Kostadinov Kostadinov, Iskren Nikalaev Gyurov
125th Secondary School "Boyan Penev", Sofia, Bulgaria

The prepared project focuses on a team-assigned task related to an ancient mosaic from the Roman city of Serdica. The mosaic comprises various geometric motifs. Our goal is to present the processes, technologies, and composition of mathematical transformations employed in the restoration of ancient mosaics.

The project provides a detailed account of historical information, restoration techniques, and architectural features, emphasizing the creation of a dynamic file for reconstructing a specific mosaic fragment. The team's work includes a technical dossier and a mathematical description with detailed steps for the restoration process. The objective of this research task is to virtually reconstruct a Roman mosaic in its original scale and colors.

An additional section has been included in the project, linking it to the culture and history of the region where the EUROMATH & EUROSCIENCE 2025 conference will take place – Thessaloniki, Greece. Thessaloniki is a city where ancient culture and technology merge to elevate civilizations.

SP15. MAGNUS EFFECT

Hristo Kostadinov Kostadinov, Rumen Yulianov Rumenov, Boyan Hristov Valkov
125th Secondary School "Boyan Penev", Sofia, Bulgaria

The project focuses on the physical phenomenon known as the "Magnus Effect." This effect represents the curvature in the trajectory of an object moving through a fluid. While the movement of objects through fluids like air and water is generally straightforward, the trajectory of a moving object changes significantly when it rotates.

The manifestation of this effect is most noticeable in sports such as football, baseball, basketball, tennis, and other ball sports, due to the unpredictability it adds to the ball's trajectory. Why does the trajectory of a rotating object change? What factors influence this change? Where can it be observed? What are its practical applications?

These are the questions we aim to answer in our presentation through the use of original videos and images. We trace the fundamental principles behind the Magnus Effect, explaining how a spinning ball creates a pressure difference that generates a lateral force and alters its trajectory. Additionally, the project explores the limitations of the Magnus Effect and how external conditions can impact its influence.

Finally, we analyze the significance of different spinning techniques to achieve tactical advantages and enhance ball control depending on the sport. We will also conduct a demonstration with the audience to visually illustrate the phenomenon.

SP16. ROBOT GUIDE

Luka Naborashvili, Saba Bandzeladze, Lile Kacharava, Temur Chitaia
American International School Progress, Tbilisi, Georgia

Technological advancements and innovative methodologies are increasingly shaping various industries, with a strong emphasis on enhancing service quality and overall efficiency. The tourism sector, in particular, is highly dependent on service excellence for its development. Consequently, the integration of technology in tourism presents a valuable opportunity to address existing challenges and elevate service standards.

In many tourist destinations, a significant number of small, family-owned hotels operate in rural or suburban areas. These establishments often face limitations in offering guided services due to a shortage of multilingual personnel or insufficient financial resources to employ professional tour guides.

The objective of this project is to develop an innovative technological solution that effectively addresses these issues.

The proposed device will enhance service accessibility, improve the overall tourist experience and modernization of the tourism industry.

Our project features a compact robotic guide doll. It will be integrated with a custom-developed mobile application to enhance its functionality.

The robotic guide will be capable of identifying the tourist’s current location during travel. Additionally, it will assist with route planning, ensuring a seamless travel experience. The guide will also include interchangeable accessories, which, when changed, will modify the language and content of the narration accordingly.

SP17. WAVE ENERGY

Nino Sulamanidze, Andria Kostava, Makrine Todua, Lazare Chachua
American International School Progress, Tbilisi, Georgia

Our project is about water energy, more specifically, getting energy from waves.

It is worth noting that getting energy from sea waves is a much more difficult task than from rivers. Since the wave performs an oscillatory motion, it is necessary to create a special mechanism that converts the oscillatory motion into rotation to make it possible to set the turbine of the electric generator in rotation, as is done on the river.

There are several ways to solve this problem, examples of which are:

1. The principle of oscillation of the water column - where the air in the column is compressed by the energy of the wave, which creates excess pressure, which causes the turbine to rotate periodically.
2. The use of the oscillatory motion of the float. The mechanism is a combination of several floats. Each float is connected to the pistons of the hydrogenerator, and their activation causes the turbine of the electric generator to rotate.

3. The use of electro-magnetic induction. The movement of powerful magnets attached to the float in a high-inductance coil.
The innovation of our project lies in the fact that the above projects are freed from such complex mechanisms that ensure the rotation of the generator in one direction, when it rotates in opposite directions, the generated voltage is rectified (the direction of rotation does not matter) and accumulated. Only after that it is converted into alternating current with a frequency of 50-60 Hz. This ensures stable electric energy generation.

SP18. ILLUSIONS

Aleksandra Frolova
The Junior & Senior School, Nicosia, Cyprus

Have you ever looked at a still picture and felt like it was alive? Welcome to the world of illusions! Illusions are so powerful - they can trick your brain in many ways. There are three main types of illusions: auditory illusions (illusions of sound), tactile illusions (illusions of touch), and the most common type, the one we see everyday – optical. There are certain things that cause us to see illusions. Like colour, size and perspective, context and surroundings, movement, light and brightness, patterns and repetition. Together they confuse our brain, and we get tricked. Have you ever noticed how wheels in cartoons sometimes seem to spin backward? That's the Wagon-Wheel effect. Or have you seen the Checker-Shadow Illusion, where two identical squares look like they're different colors because of shadows? In my presentation, you will find out about a lot of fun illusions and understand why we see them.

SP19. CAN WE HEAR TO SEE?

Ivan Symeonides, Polina Lebedeva, Ioannis Episkopou
The Senior School, Nicosia, Cyprus

What if sound could replace sight for the millions living in darkness, offering a revolutionary way to perceive and interact with the world? By 2050, the number of people living with complete vision loss is expected to triple, leaving countless struggling to navigate a world built for sighted. Despite technological advancements, current assistive devices often fail to provide the detailed spatial awareness essential for these individuals' independence and quality of life. Inspired by the astounding way bats navigate their surroundings in pitch-dark caves precisely using echolocation, we devised 'Can We Hear to See?'. Our project leverages the human brain's remarkable ability to create mental "images" based on audio feedback alone. By designing a "sound-laser helmet" that emits directional sound waves, which bounce off the environment and into the users' ears, get translated into meaningful auditory signals which get interpreted by the user. This will enable individuals living with profound vision loss to "see" through sound, just like bats. This innovative approach mimics nature's most ingenious sensory system, with the potential to theoretically transform accessibility and redefine independence for visually impaired individuals by turning sound into a new dimension of sight…

SP20. ALL-NATURAL MOUTHRINSE

Anastasia Ioannidou, Nereis Georgia Ioannidou
The Senior School, Nicosia, Cyprus

Have you ever come across the term "oral biofilms"? If so, are you familiar with the serious side effects that go along with them, not only regarding your oral health, but also your general wellness? Oral Biofilms are microbial communities adhered to oral surfaces, which cause dental caries, gum disease and infections like gingivitis, periodontitis, and in some cases antimicrobial resistance. We are currently preparing a mouth rinse which targets and destroys oral biofilms rapidly, in an all-natural manner! This study consists of extensive research through trusted sources that were recommended by professional Microbiologists, Pharmacists, and Doctor of Dental Surgery, with whom we have had the amazing opportunity to immerse ourselves into their professional lifestyle. Additionally, we performed laboratory work under scientific supervision, where we had lots of opportunities for trial and improvement. Isn't that how we grow, by making mistakes and achieving excellence? We must emphasize that this mouth rinse is in no way a replacement for regular dental check-ups and daily oral care. Our natural mouthwash is a simple, high-quality addition that effortlessly enhances and elevates your daily oral care routine. Now, you may ask, what makes our mouth rinse jump a milestone compared to other typical brands? This mouthwash contains minimal ingredients yet is packed with all-natural substances that excel in maintaining a healthy smile. We won't

reveal everything just yet, but here's a sneak peek: get ready to experience the power of tea tree, ginkgo, and eucalyptus! In conclusion, our natural mouthrinse is designed to prevent our peers from any oral related issues caused by the formation and buildup of the oral biofilm which could potentially lead to other health issues such as antimicrobial resistance, streptococcus and even heart problems.

SP21. ARTIFICIAL INTELLIGENCE, FOR BETTER OR FOR WORSE?

Loizos Theodotou
Solea Gymnasium, Nicosia, Cyprus

Artificial intelligence! Everyone has heard about it, everybody has used it, few actually understand how it works and how the future can be shaped by it.
The presentation will start by exploring how artificial intelligence operates by introducing artificial neural networks and explaining how they process human concepts to carry out their assigned tasks.
Moreover, this presentation will include many ways in which AI can or has already shaped the future of everything and everyone, from the way we work, to its role in schools and even how it helps make scientific advancements.
Additionally, the presentation will discuss the difference between human and artificial intelligence.
Finally, the presentation will delve into some of the moral problems that AI brings to the table. Such as its immense water consumption, the unauthorized use of artists' and writers' works that are used to train AI models, some discriminatory biases that AI systems have been shown to exhibit and what measures we should take to fix these.

SP22. CLASSROOM ASSISTANT

Evaggeliou Alexandra, Evaggeliou George, Spiridakis George, Ilias Antonis, Malamateniou Fotoula-Ioanna
I.M. Panagiotopoulos School, Athens, Greece

The development of a humanoid Classroom Assistant robot aims to bridge the gap in education accessibility for students unable to attend classes due to health or mobility constraints. Leveraging the open-source InMoov model, the project focuses on creating a remote-controlled robot capable of immersive classroom interaction.
The robot integrates a Logitech camera with a built-in microphone and speaker to enable two-way audiovisual communication. Using an Arduino Nano ESP32, it incorporates servo motors for eye and neck movement, enabling dynamic interaction and engagement. Additional functionalities include a light indicator to signal participation and motorized components allowing directional adjustments. By connecting to online platforms such as Microsoft Teams, the robot facilitates seamless remote attendance, ensuring students remain actively involved in classroom activities.
This project emphasizes modularity, accessibility, and ease of use, providing an innovative solution for inclusive education. Preliminary results demonstrate the robot's potential to foster real-time interaction, bridging physical distances and enriching the learning experience for all participants. Further development will explore expanded functionalities and broader application scenarios.

SP23. BIONIC FISH

Dimitrios-Romanos Tsianakas, Christoforos Rentzios, Efstathia-Electra Tsakagianni, Isavella Avramidi, Theodoros Kortselis, Georgios Masouras
I.M. Panagiotopoulos School, Athens, Greece

The Bionic Fish project is an innovative robotic solution designed to address the critical issue of microplastic pollution in seawater. The robot mimics the form and motion of a fish, enabling it to navigate aquatic environments effectively while collecting microplastics using an integrated filtration system. By actively removing pollutants, the Bionic Fish contributes to the preservation of marine ecosystems and improves water quality.
The design incorporates advanced robotics technology, including precise movement mechanisms for realistic swimming and environmental adaptability. The filtration system is engineered to capture and retain microplastics without harming marine organisms. Sensors and software ensure efficient navigation, obstacle avoidance, and data collection regarding water quality and pollution levels.

The Bionic Fish offers a sustainable and scalable approach to mitigating marine pollution, demonstrating the potential of robotics in environmental conservation. This project highlights the integration of engineering, environmental science, and technology to create a practical solution for a pressing global issue.

SP24. VITA VAPOUR

Elena Floridou, Nefeli Kakoyianni
The GC School of Careers, Nicosia, Cyprus

Smoking and vaping has gained significant attention nowadays. This has a tremendous adverse impact on human health. In recent years, a new type of vape product has emerged which incorporates a single vitamin into its vapour. This project aimed to create a multivitamin vape aiming to reduce tar that has built up over the years. These vitamin-enriched vapes are marketed as a healthier alternative, promoting wellness benefits. Vita Vapour consists of a battery, a vaporizer unit, a cartridge containing liquid formula enriched with vitamins, and an atomizer. The key appeal of these devices is the promise of delivering essential vitamins, such as B12, C, and D, directly to the bloodstream through the lungs. Proponents argue that this method bypasses the digestive system, offering more efficient absorption. Users may be attracted to the potential benefits of these vitamins, such as boosting energy, supporting immune function, and enhancing overall mood. Furthermore, these vapes appeal to individuals seeking a healthier lifestyle alternative, with claims that they help combat deficiencies without the risks associated with traditional smoking. However, there are substantial concerns surrounding the safety and efficacy of inhaling vitamins. Research on the absorption and bioavailability of vitamins through vaping is limited, and the long-term effects of inhaling vitamin-infused aerosols are largely unknown. Experts caution that the inhalation of any substance, even vitamins, may pose respiratory risks. In conclusion, while vitamin-based vapes may offer novel benefits, further research is needed to fully understand their impact on health, efficacy, and safety.

SP25. TIME'S PRISONER

Meifan Han, Chuqiao Jin
The GC School of Careers, Nicosia, Cyprus

This study explores the history, structure and impact of, as well as alternatives to plastic polymers. The research aims to discuss pollution caused by plastic waste and showcase innovative, impactful, and viable plastic alternatives. One of the key findings is squid protein plastics, where proteins found in squid can be made into a durable, environmentally friendly, and interesting plastic alternative.
Another impactful polymer is PDK, short for polydiketoenamine, a bio-based plastic discovered in 2019 that can be recycled indefinitely without losing any of its function due to its unique chemical structure. Bioplastics and edible alternatives are becoming increasingly more prevalent. They are manufactured from natural sources and are widely accepted and adopted as seen in coffee shops serving edible coffee spoons. Plastic waste takes eons to degrade, accumulates in food chain and eventually damages our health and that of other animals. Their environmental persistence means future generations will also face the consequences of irresponsible plastic use. By spreading the cutting edge technology of plastics it is hoped that an increasing number of people will make more thoughtful choices when it comes to plastic use.

SP26. THE EVOLUTION OF THE HUMAN SPECIES AND HOW THEY ARE PREDICTED TO EVOLVE IN THE FUTURE

Sophia Evangelou, Maria Vasiliki Metti, Christina Poursaitidou, Georgia Zachariadou
The GC School of Careers, Nicosia, Cyprus

The evolution of the human species has been taking place over millions of years and is destined to continue to do so over the course of its existence. The purpose of this project was to study how the species has evolved from an early primate to hominid and make predictions on traits that will evolve further in the future. The term evolution will be explained and the key stages will be exhibited along with the physical changes that have taken place to form the current day homo sapiens including bipedalism, brain size, cognitive ability and culture.
Studying the past will shine light into the future of the evolution of the species. Through studying the past evolution stages, six main predictions of how the species may evolve in the future will be illustrated. The main areas that will be pivotal in determining future alterations are based on technology and medicine, genetic adaptions to new environments, cognitive evolution and brain changes, genetic engineering and designer babies, social and cultural evolution and finally evolutionary stagnation and directional change.

SP27. PLANTS TALK - MAYBE IT'S TIME WE LISTEN

Evalena Papadopoulou
The GC School of Careers, Nicosia, Cyprus

Being able to support the health of the planet and its ecosystems is a global dream. Innovative solutions for food security, biodiversity conservation, and environmental sustainability are ultimate goals. Plant communication - how plants exchange information and respond to their environment - offers numerous benefits by advancing our understanding of ecology, agriculture, medicine, and climate resilience.
Plants emit and receive volatile organic compounds (VOCs) and electrical impulses. VOCs are airborne chemical molecules that plants release into their surroundings, most commonly from damaged plant tissues, often in response to herbivore attack. Electrical signaling in plant communication refers to the transmission of electrical impulses within and between plant tissues to convey information about environmental stimuli or internal states. Plant communication also encompasses communication through common mycorrhizal networks. Mycorrhizal networks, are underground fungal networks that connect the roots of different plants, facilitating communication and resource exchange. These networks are formed by mutualistic relationships between plants and mycorrhizal fungi.
Understanding how plants communicate could help us increase arable lands to feed the earth's growing population and adapt to climate change. In addition, respecting plants' complex communication systems can lead to groundbreaking advancements in technology and sustainability, demonstrating the importance of bridging the gap between human activity and the natural world.

SP28. ORBITAL SOLAR ENERGY HARVESTING

Alexandros Spanos
The GC School of Careers, Nicosia, Cyprus

The growing global energy demand and the environmental impact of fossil fuels highlight the urgent need for sustainable energy solutions. Current renewables, like solar and wind, face challenges due to their dependence on weather and daytime availability. Orbital solar energy harvesting offers a ground-breaking solution by deploying satellites with solar panels in geostationary orbit to collect continuous sunlight. This energy is converted into microwaves or lasers and transmitted to ground stations on Earth for use. This technology provides constant energy, reduces greenhouse gas emissions, and minimizes land use. However, challenges include ensuring safe and efficient transmission, managing satellite heat, avoiding space debris, and addressing high initial costs. With advances in materials, transmission systems, and reusable rockets, orbital solar energy could become a practical and transformative solution, powering a sustainable future.

SP29. MELODY IN MIND

Marcos Demetriou, Achilleas Kroushovski, Nicolina Nicolaou, Antonia Stylianou
The GC School of Careers, Nicosia, Cyprus

In this project we will present our research on how music affects learning environments. The inspiration for this research emerged from prior studies examining the Mozart effect, which suggests that classical music may enhance IQ performance in adults. Motivated by this intriguing finding, our study aimed to explore whether the same benefits extend to young teenagers aged 12-13.

In a carefully designed experiment, one group of students took an IQ test in silence, while another completed the test with classical music playing in the background. To eliminate any differentiating factors, we repeated the experiment with the same participants, allowing them to perform under both conditions, silence and under classical background music. In both trials, students in the music group demonstrated improvements in both the speed and accuracy of their performance compared to those tested in silence in many but not all questions.

These exciting findings offer further evidence that background classical music may not only enhance cognitive performance in adolescents but also unlock the potential for optimizing brain function. The implications of this study are far-reaching, offering promising avenues for improving learning environments and teaching methods, ultimately supporting students in achieving their fullest cognitive potential.

SP30. KECOHOT

Myrto Sarpetsa
The GC School of Careers, Nicosia, Cyprus

The growing demand for coffee around the world is pushing the expectations for flavour. A hot coffee served in a takeaway cup cools down in minutes, while a cold coffee will soon warm up and dilute. We conducted experiments to simulate the cooling of a coffee in real conditions at a coffee shop and in a commute. Our results show that, most of the time, our coffee cannot be enjoyed at its ideal temperature, causing us to throw it away, buy a new one or re-heat it, wasting time money and alterations in taste of the coffee.
We propose the creation of a new product, KECOHOT, to maintain the temperature of the beverage. KECOHOT is going to be a mobile, rechargeable device to heat or cool any beverage at home, on the go or even outdoors. Its capsule shape provides space for the insertion of a take away cup into an enclosed, heat-conductive and removable jacket that allows heat transfer to the drink without damaging its container. The Peltier modules surrounding the cup heat or cool the air that is enclosed in the container. Other devices have been proposed to tackle this problem, but only manage to slow the process of heat transfer. Furthermore, heating mugs are too expensive, require cleaning and insulate poorly.

SP31. ISOTRETINOIN: THE ACNE GAME-CHANGER

Alexandros Koudounas
The GC School of Careers, Nicosia, Cyprus

Acne is a disease that has affected humans for hundreds of years, most commonly developed by teenagers. Acne, as a skin disorder, is well known for causing severe irritations and scaring on the skin of patients. Whilst acne itself isn't deadly, acne can have severe effects on mental health, evident from the fact that 12% of acne patients have suicidal ideations, and 4% attempt suicide. The worrying part is that commonly distributed acne medication can be in some cases completely ineffective at curing acne for a plethora of reasons. Up until Isotretinoin.
Throughout the course of the presentation the differences of Isotretinoin from other acne treatments will be discussed, showing how it can completely cure even the most severe cases of acne, where no other treatment option could help. The biochemical mechanisms of the retinoid family of medicines, in which isotretinoin belongs, will be presented in order to illustrate how this tiny molecules functions within the body. Its binding to certain molecules and receptors causes transcription of certain proteins which are responsible for its beneficial as well as its numerous side effects. Overall, Isotretinoin is one of the best treatments for acne one can find, although is definitely not without its drawbacks.

SP32. FROM DROPS TO DESIGNS: CRACKING THE CODE OF WATER SHAPES

Iolie Demetriou, Danae Loizou, Jessica Makariou, Francesca Szofia Michaelides
The GC School of Careers, Nicosia, Cyprus

What if thoughts and emotions could shape the world around us? Dr. Masaru Emoto's fascinating experiments reveal that they can, starting with water. He discovered that water exposed to positive words like "love" and "gratitude" or soothing music forms stunning, snowflake-like crystals. In contrast, harsh words, chaotic sounds, and negativity create jagged, disorganized patterns.
This project explores the idea that our emotions influence not just water but our health and environment. It also examines how modern technology, like phones, microwaves, and televisions, impact the structure of water and therefore humans. Since water makes up 60-70% of the human body, Emoto's findings suggest that positivity can enhance bodily functions such as digestion, promoting harmony and overall well-being. On the other hand, negativity and stress can disrupt these processes, leading to imbalance. His work serves as a reminder that positivity is a force of nature. It shows us that kindness, gratitude, and harmony are more than just uplifting emotions, they shape the very molecules that make up our world. This project inspires a deeper understanding of the connection between emotions and the physical world, offering a simple yet powerful message: the energy you put out truly matters.

SP33. CHEMICALS AND TREATMENTS INVOLVED IN SCHIZOPHRENIA

Anthea Americanou, Melanie Charalambous
The GC School of Careers, Nicosia, Cyprus

Mental disease is often ignored, misdiagnosed and persons are often ridiculed. Schizophrenia is a quite overused term and sometimes used as a humorous word to show that a person is mentally unwell. In reality, schizophrenia is an overly complex term. Schizophrenia is a disease as a result of an imbalance in brain chemistry affecting the behaviour of a person and consequently its lifestyle. Overexpression or deficiency of dopamine and glutamate, two major neurotransmitters, leads to many symptoms accompanying the disease. The aim is to illustrate the complexity of mental disorders, specifically schizophrenia which is used as a joke which contrasts the real complexity behind it.
Based on current understanding of brain chemistry current medical treatments will be discussed and how they attempt to restore the balance of the two chemicals. The treatments involve drugs, psychosocial therapy and electroconvulsive therapy and pros and cons of each will be discussed.
Lastly, current state of the art science will be showcased to give a glimpse of hope for currently incurable diseases. A new approach to disease therapy is gene editing, a process where faulty genes are cropped from the DNA and a new sequence of functional DNA replaces it. Although an extremely promising scientific advancement, it faces legal and ethical issues which will be presented.

SP35. SMART WASTE SEPARATION DEVICE

Demetre Artsividze, Andria Avetyan
Innovative Lab – KinderLab, Telavi, Kakheti, Georgia

As urbanization and industrialization accelerate, improper waste management contributes to significant environmental and public health challenges. Effective waste segregation at the source is critical to reducing landfill dependency and enhancing resource recovery.

Our project introduces a unique Smart Waste Separation Device that stands out by integrating real-time waste monitoring, data analytics, and personalized user feedback—a comprehensive approach rarely seen in similar devices. Utilizing advanced sensors, machine learning algorithms, and cloud connectivity, the system not only identifies and sorts waste into organic, recyclable, and general categories but also provides users with insights about their waste habits via a companion app, encouraging sustainable practices.

Built on an Arduino microcontroller, the device features compact modular design, enabling easy upgrades and repairs to extend its lifecycle, further contributing to sustainability. Additionally, its adaptive sensor calibration ensures reliable operation in diverse environments, from households and schools to public spaces.

This project aligns with Sustainable Development Goals (SDG 11: Sustainable Cities and Communities, SDG 12: Responsible Consumption and Production) while emphasizing accessibility, affordability, and education. By integrating smart technologies and offering real-time insights, our device not only provides practical waste management solutions but also fosters environmental awareness and responsibility, setting it apart in the growing field of smart waste solutions.

SP36. ELECTRIC VEHICLES AND THEIR IMPACT ON ECOLOGY

Stepan Trofimov, Anastasia Pacheva
Med High Private English School, Larnaca, Cyprus

People used to think that Evs have zero impact on ecology, since they don’t burn gas and have no exhaust emissions. However, electricity that EVs use to run, is generated mainly by burning fossil fuels on power stations, which produce more emissions than an average ICE.

EVs use electric engines, which are extremely efficient due to their structure, which has less drag or temperature losses than ICE engines. However, lithium batteries that are used to supply energy for these engines weight a lot, which leads to a high usage of tires and braking paddles that produce hard particles.

In this project, we are going to discuss:
1.What is the impact of Evs on the ecology?
2.How do EVs work?
3.How is power generated for Evs?
4.What are profits and disadvantages of Evs?

*EV - electric vehicle
**ICE - inner combustion engine

SP37. DARK MATTER AND DARK ENERGY

Volosian Oleksandra, Kalchynskaya Taisiya
Med High Private English School, Larnaca, Cyprus

When we look out in the Universe, we see lots of things. For example, the speed that galaxies rotate, the direction in which they move or the speed at which they move.

Sometimes, we can notice that the mass that we can see is too small to explain the speed of the rotation of galaxies. This factor is suggestive of there being some kind of particle that is quite heavy and does not interact with light. That is what is called Dark Matter, which is about 27% of the Universe and which can be seen by gravitational influence on different objects.

But that's not all!

Everyone already knows that the Universe is expanding. However, not everyone knows that the expansion accelerates. It came as a complete surprise to the scientists, since previously it was believed that gravity should, on the contrary, slow down the expansion of the Universe. To explain the increase in the speed of expansion, a theory about the existence of a certain energy responsible for the acceleration was proposed. That is what is called Dark Energy, which is about 68% of the Universe.

In this presentation, we are going to talk about these two mysterious components of the Universe, namely about the general idea of Dark Matter and Dark Energy, the historical context – the process of discovery, their characteristics and modern detection and exploration methods.

SP38. LIFE CYCLE OF A STAR

Kira Garshina, Agapi Theodorou
Med High Private English School, Larnaca, Cyprus

When you think of a star, the first thing that comes to your mind are paparazzi, the red carpet, studio lights and actors. Now, let me stop you there, because we are talking about a different type of stars.
Most people imagine stars as the small dots scattered across the midnight sky, the Sun or just a massive fireball floating in outer space. In reality, stars are enormous clusters of gaseous elements that turned to plasma due to the high pressure and temperature. We will dig deeper into the chemical compositions of a star, considering the chemical reasons for their deaths. In our project we are going to talk about the classification of stars, their life cycle, especially concentrating on their death, different types of it and extracting energy from this process, and how the different deaths of stars could affect life on earth if the sun was replaced by them**.**

SP39. ELECTRIC VEHICLES AND THEIR IMPACT ON ECOLOGY

Stepan Trofimov, Anastasia Pacheva
Med High Private English School, Larnaca, Cyprus

People used to think that Evs have zero impact on ecology, since they don't burn gas and have no exhaust emissions. However, electricity that EVs use to run, is generated mainly by burning fossil fuels on power stations, which produce more emissions than an average ICE.

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*EV - electric vehicle
**ICE - inner combustion engine

SP40. SCIENCE AND HAPPINESS

Noam Minujin, Andriana Kkanti, Ori beresy, Viktor Velikov
Med High Private English School, Larnaca, Cyprus

A key component of human wellbeing, happiness is a complicated and intriguing idea. Research indicating that children today are less joyful than they were ten years ago served as the impetus for our investigation. We engaged pupils of all ages in our own research at our Cyprus school to investigate this matter. Understanding what makes kids happy or unhappy, spotting patterns, and figuring out possible causes for the drop in happiness levels were the objectives. Through our research, we found that a mix of internal biological processes and external factors, such relationships and the school environment, affect happiness. According to science, some hormones in the brain, such as serotonin, dopamine, oxytocin, and endorphins, are intimately linked to happiness. Together, these "happy hormones" help control mood, produce joy, and lessen stress. According to our research, children's happiness may be declining as a result of contemporary issues including social comparisons and rising academic pressure. This study highlighted the significance of creating happy settings for emotional well-being in addition to providing us with scientific insights into how happiness functions. By comprehending happiness and how it relates to both science and daily life, we hope to stimulate more conversations about enhancing young people's happiness and mental health.

SP41. THE FIFTH TASTE: UMAMI

Anja Horvat, Antea Jelović, Mia Gregurina
Grammar School "Fran Galovic", Koprivnica, Croatia

Uncovering the secret of the mysterious fifth taste umami, which we can roughly translate as deliciousness. A taste used and loved in many cultures and cuisines dating back to ancient Rome, but identified and optimally utilised in Japanese cuisine. The umami taste represents the taste of the amino acid glutamate and ribonucleotides. Scientists have debated the existence of umami as a basic taste because glutamate alone does not give off the umami taste without the presence of table salt ions, instead presenting as sour. However, seeing as umami taste is recognised by its unique taste receptors instead of a combination of the traditional ones, it is officially considered one of the five basic tastes. Umami is a part of our everyday lives as it is found in fish, cheese, tomatoes, green tea, cured meats and fermented foods.

SP42. ACNE

Una Bebek
Grammar School "Fran Galovic", Koprivnica, Croatia

In this presentation, I will discuss the issue of acne, one of the most common skin conditions that leads to the formation of whiteheads, blackheads, pimples, or cysts. I will explain how acne develops, its causes, and why it occurs. Additionally, I will address the hormones that contribute to acne and their effects on the skin. Currently, three out of five people aged 12 to 24 experience acne, so I will share the experiences of my friends with this condition and how they cope with it. Furthermore, I will outline the chemical peels that can be used to combat acne effectively. For those who prefer natural methods, I will discuss how nutrition can help and which natural remedies can be utilized to tackle acne safely. In today's world, where acne is an increasingly common problem, it is essential to provide comprehensive information about it and its development. With this presentation, I aim to share as much relevant information as possible to make the fight against this unpleasant and uncomfortable skin condition easier for everyone who struggles with it.

SP43. THE GOD'S PARTICLE

Matteo Del Gaudio, Salvatore Guerrera, Domenico Landolfi, Mario Petraccaro
Liceo Scientifico "G. Rummo", Benevento, Italy

What's the Higgs Boson, and why is it so important for our universe? Often dubbed as "God's Particle", it stands as one of the fundamental discoveries of modern physics, and we will give you an engaging overview about the topic. Being theorized by Peter Higgs in 1964, the journey to its discovery, culminating in 2012 at Geneve's CERN, opened new adventures for the scientific community.
Rather than focusing on complex theoretical details, we will empathize the revolutionary scientific and cultural impact of the discovery. To easily understand the nature of the Boson, we describe it as related to an invisible energy field that permeates every corner of our universe, giving particle mass once they interact with the field itself. But, how can such a tiny element influence the matter around us? Without it particles wouldn't have mass, bringing matter, stars, planets, everything around us, to not exist.
What mysteries does it still hold? And what could it mean for the future of science and technology?

SP44. ALICE IN QUANTUMLAND

Martina Cocca, Giulia Coletta, Matteo De Gaudio, Caterina Mucci, Vittoria Panarese
Liceo Scientifico "G. Rummo", Benevento, Italy

The aim of our project is to creatively explore the fascinating world of Quantum Physics through the lens of the story and characters from Alice in Wonderland. Our research has been inspired by the reading of Alice in Quantumland by Robert Gilmore, as well as scientific articles.
The study focuses on the fundamental concepts of Quantum Physics, including energy barriers and electron behavior, the Heisenberg Uncertainty Principle, and the famous Schrödinger's cat thought experiment. By following Robert Gilmore's imaginative approach, our goal is to make the complex world of Quantum Physics both innovative and accessible.
With Alice's boundless curiosity as our guide, we journey into Quantumland, a realm of the infinitely small, where the mysteries of quantum phenomena come to life.
By intertwining storytelling with science, we hope to inspire others to view Quantum Physics not as a complex barrier but as an exciting adventure into the unknown.

SP45. FROM PHOTON TO QUANTUM: LOOKING FOR THE SECRETS OF LIGHT

Castiello Cristina, Ciarlo Asia, D'Orsi Irene, Voli Alessandra
Liceo Scientifico "G. Rummo", Benevento, Italy

Quantum mechanicsis a branch of physics that studies the behaviour of light and matter on a microscopic scale. This revolutionary field led to the understanding of the dual nature of light, a phenomenon that highlights its inherent complexity.Light can behave both as a particle and as a wave. The corpuscular nature of light is descrive through quanta, small particles of energy. A significant exampleis the photoelectric effect, observed by Einstein, where light hits a metallic surface and free selectrons. This conceptthas roots in the thought of Leonardo da Vinci, whoexplored the relationship between form (macro) and matter (micro), anticipating the idea that the visible can be broken down intofundamental units.On the other hand, the wave nature of light is manifested through phenomena such asdiffraction, in which the light waves bendth rough obstacles or slits. In addition, the study of the visible spectrum has made it possible to understand the decomposition of light intocolours, offering a key to exploring reality through chromatic analysis.This double nature of light is the basis of quantum mechanics, opening up new perspectives on the microscopic world and its link with our macroscopic universe.

SP46. FROM CHAOS TO HARMONY: THE BUTTERFLY EFFECT

Cotugno Martina, Matarazzo Alice, Orlacchio Serena, Panella Michela
Liceo Scientifico “G. Rummo”, Benevento, Italy

Have you ever fondere what would’ve happened if you didn’t do a specificthing? How thingswould’ve changed because of it?
This is the butterflyeffect, a fascinating concept illustratinghow minor actions can lead to significant and unforeseenconsequences. Rooted in chaos theory, itsuggeststhat a seeminglytrivial event, like the flap of a butterfly'swings, can trigger a chain of events resulting in monumental changes, suchas a tornado forming else where. This idea captivates scientists and resonates acrossvarious fields, including meteorology, economics, and personal decision-making.
What makes the butterfly effect particularly intriguingi sits demonstration of interconnectedness within complex systems. It challenges our understanding of causality and encouragesus to consider how our choices, no matter how insignificant they may appear, can ripple through time and space, influencing outcomes in ways wemight never foresee
In this exploration of the butterfly effect, we will delve into its origins, examinereal-world examples, and discuss its implications across different disciplines. By understanding the intricate dance of cause and effect, we gain insight into the interconnected nature of reality, promptingus to recognize the potential impact of our everyday choices. Join us as we uncover the profound implications of the butterfly effect and its relevance in ourlives.

SP47. COSMIC WONDERS: BLACK HOLES AND TIME TRAVEL

De Nisi Vincenzo, Lanzotti Davide, Madonna Giuseppe, Mauta Mario
Liceo Scientifico “G. Rummo”, Benevento, Italy

Black holes are extraordinary cosmic phenomena, forming when massive stars collapse under their gravity. They trap everything, including light, within the event horizon, a boundary of no return. At their core lies a singularity, where physics as we know it ceases to apply. Black holes vary in size, from stellar remnants to supermassive giants at galactic centers. Their immense gravity slows time (time dilation) and bends light (gravitational lensing). White holes, theoretical opposites of black holes, could emit matter and energy instead of trapping them. While unobserved, some theories suggest that black holes might connect to white holes via wormholes—tunnels through space-time. Wormholes, or Einstein-Rosen bridges, could link distant parts of the universe or even different times. However, stable, traversable wormholes require exotic matter with negative energy, a concept not yet proven. Space-time travel remains a captivating possibility. Traveling into the future is achievable through relativistic time dilation: moving near the speed of light slows time relative to stationary observers. Traveling to the past is more speculative, facing paradoxes and requiring extreme physics, like traversing wormholes or closed time loops. From black holes to time travel, these phenomena push the boundaries of human knowledge and inspire the exploration of the universe’s mysteries.

SP48. PHYSICS AND MATHS BEHIND A CAR

Domenico Buonanno, Alessio Calandrelli, Andrea Carbone, Lorenzo Meoli,
Gabriele Zampelli
Liceo Scientifico “G. Rummo”, Benevento, Italy

In our work we are going to explore the car world to try to explain some of the physics principles that make our car work. As the first thing we are going to expose some of its story and after explaining how a standard four stroke car engine works and its basic components, like bearing connecting Rod, pistons, crankshaft, camshaft... We are going to focus on how the force Is produced and transferred to the wheel thanks to the transmission whose working principles are ratios. Explained this we are going to talk about the braking system and how it’s strictly related to basic physics principles such as the hydraulic press.

SP49. X-RAYS: A TRAVEL TO THE INVISIBLE

Danae Alexopoulou, Agiannitis Konstantinos
Doukas School, Athens, Greece

This presentation explores the pivotal role of x-rays in medical imaging, emphasizing their permeability and non-invasive nature. The ability of x-rays to penetrate soft tissues while producing detailed images has revolutionized healthcare diagnostics. From detecting fractures to guiding surgical procedures, x-rays contribute significantly to accurate diagnosis and treatment planning, shaping advancements in patient care. We are going to find and analyze the importance of its usage. But even though it is a revolution in medical world there are side effects. With our presentation we are here to present the other side of the point and the potential risks associated with the exposure to x-rays. While acknowledging the transformative impact of x-rays on medical diagnostics, it is crucial to address concerns such as radiation exposure and its potential adverse effects on patients and healthcare professionals. By examining both the benefits and drawbacks, this presentation aims to provide a comprehensive understanding from x-rays baby's steps to our current era.

SP50. RHYTHM IN CHAOS

Giorgi Tchiabrishvili, Tevdore Namgaladze, Nia Iluridze, Nino Akhalmosulishvili, Salome Gogilava
Saint King Tamar Gymnasium of Patriarchate, Tbilisi, Georgia

The prevalence of psychological disorders and disorders increased dramatically in the late twentieth and early twenty-first centuries.. Sometimes, we overlook the obvious symptoms, which can lead to disastrous consequences. One such condition frequently seen in society is Attention Deficit Hyperactivity Disorder (ADHD). Today, this psychological disorder is a topical issue, yet many people fail to realize how harmful it can be and what it might lead to. (ADHD) is a brain disorder characterized by neurochemical and structural changes that affect the attention, control, and self-awareness systems. The core characteristics of ADHD—inattention, hyperactivity, and impulsivity—are largely caused by an imbalance in neurotransmitters in the brain, such as dopamine and norepinephrine. These chemicals are important for the parts of the brain responsible for memory, concentration, and emotional responses.It is one of the most common neurological diagnoses in children, but it often continues into adolescence and adulthood. Despite the existence of various treatment methods, managing ADHD as an ongoing, lifelong process requires an individualized approach and diverse interventions. Research has led to a greater understanding of ADHD, which has enabled the development of more effective treatment and support programs. Through this project, we aim to explain the significance of ADHD, its causes, and its consequences, helping to raise awareness about this disorder, which is highly relevant today."

SP51. THE SCIENCE AND MAGIC OF ORIGAMI ROBOTS

Alkinoos Christodoulides*, Ariel Makri Levy**,
The Grammar School Nicosia*, AISC Nicosia & Stanford OHS**

Origami robotics combines folding techniques with modern engineering to create lightweight, flexible, and adaptable robots. Unlike traditional robots with rigid parts and complex joints, these robots use folds to move and change shape. This makes them compact, cost-effective, and ideal for tight spaces. We need origami robots because they offer smarter, more efficient solutions in many fields. In medicine, they help with minimally invasive surgeries using self-unfolding stents and surgical tools. In space, they allow satellites and solar panels to expand once in orbit. In disaster zones, they navigate through debris where regular robots struggle. By removing bulky components, origami robots are reshaping automation. As materials and designs improve, they will transform healthcare, space travel, and rescue missions—leading to a future where robots are smarter, more adaptable, and inspired by nature.

SP52. TARTRATES AN EMOTION TRAPPED IN A JEWEL

Anastasia Bolkvadze, Nene Zubashvili, Sofio Chkheidxe
Servantes Gymnasium AIA-GESS, Tbilisi, Georgia

We live in a historical, old country Georgia. Tourists visit us often. Once we traditionally wanted to gift our guests something special. We went on a hunt for the perfect gift and stumbled upon a strange jewel – wine sediment taken from Kvevri and put into jewelry and that's when the idea was born. The designer talked us through the complex process of preparing stones for the jewelry. It turned out that the formation of the stone starts after the fermentation and aging of the wine and the color depends on the species of the grapes, but

not only. We aimed to study the relationship between the colorful diversity of wine stones, formed from grapes harvested in different locations and grape varieties and their chemical composition.
We visited a chateau to witness the process by ourselves and see the species that the jewelry is made out of. The underground environment of the ‘’Kvevri“ keeps a stable cool temperature, helping the slow and uniform formation of the well-shaped salts of wine acids - tartrates. Kvevris, an egg-shaped earthenware made from clay is rich in minerals, during the fermentation process these minerals interact with the wine, impacting the structure and the texture of the crystals, which can’t be achieved in stainless steel and other materials. Clay ‘’Kvevris’’ in which wine is fermented and aged can impact the degree of color absorption. Our main discovery was that Crystals, formed in Kvevri are unique and advantageous.

SP53. UNIQUE GEORGIAN HERBS VS TEENAGERS’ EVERYDAY LIFE SCARRED BY ACNE

Anano Sheverdashvili, Liliana Pindishvili, Mariam Chubinidze, Mate Mosakhlishvili
Servantes Gymnasium AIA-GESS, Tbilisi, Georgia

Acne might sound purely like a skin condition to most human beings, but in reality, it leaves an everlasting scar on teenagers’ lives. The constant worry of having acne turns permanent and teens slowly fall into depression. Although existing in a highly technologically advanced century might sound like a privilege, it forces us to live an inactive lifestyle. This could easily be the main source of problems regarding acne. The discussed problem is also widely spread in Georgia. Being teenagers ourselves, we were interested in the situation in our homeland. We carried out a study about the causes of acne in four significantly different regions from each other, by culture, cuisine, climate, and environmental factors, mostly endangered and prone to causing acne problems to resident teenagers turned out to be Tbilisi, Samegrelo, Svaneti, Samtskhe-Javakheti. We began our research with a survey, results indicated that teens from Tbilisi struggle the most and those from Svaneti struggle less. We studied their habits, lifestyle, and food diet and decided to use traditional Georgian herbs from Svaneti to develop our anti-acne cream. We selected volunteers who used our lotion to cleanse their faces. Our cream demonstrated an approximately 85% efficiency rate. Our research introduces a handcrafted face cream and lotion derived from a combination of plants found in Georgia, designed to deal with the frequent problem of acne in teenagers. We hope our product will bring light to the lives of many teenagers.

SP54. BIOFUEL AND RESTORING BIOMES

Christina Lamprianou, Louisa Liapis
The Senior School, Nicosia, Cyprus

For decades we have stripped our earth of its natural resources, such as fossil fuels, and we are now forced to face the consequences of our actions. The overconsumption of fossil fuels has an incredibly detrimental effect on our environment.
Fortunately, it is not too late and there is a multitude of alternatives to the harmful substance that will contribute to ameliorating the condition of the earth. For the purposes of this study, we will be focusing on different types of biomasses.
We aim to investigate Mediterranean alternatives to fossil fuels. We will follow an experimental method, the energy test, to compare the energy released by similar quantities of samples of seaweed, potatoes, weeds and olives. The purpose of our study is to identify the most environmentally friendly and financially viable alternatives to fossil fuels, based on the Mediterranean climate.
We will use current economic data to estimate the financial cost of each of the four different alternatives (i.e., seaweed, potatoes, weed and olives). At the end of our presentation we will demonstrate that different types of biomasses have different cost vs benefit characteristics. To implement this on a larger scale, the industry will need to proceed to more studies to decide on the most efficient and financially sustainable biofuel options in the Mediterranean area.

SP55. ONLINE ECO-ABSORB

Matheos Gedeon
The Senior School, Nicosia, Cyprus

Oil spills are a major threat to ocean life, causing long-lasting damage to ecosystems. Cleaning them up is often challenging because many traditional methods create new environmental issues which quite often end up being worse than those caused by the oil will itself. Finding a solution that is both effective and environmentally friendly is critical. I focused on exploring natural ways to address this problem, aiming for a simpler and more sustainable approach that could minimize harm to the planet while protecting marine life through the use of cost friendly and easy to find materials that can, with little difficulty, become a large-scale solution.

SP56. THE SCIENCE BEHIND AN AEROPLANE

Iacovos Malekkos, Andreas Chimarides
The Senior School, Nicosia, Cyprus

The fascination with aeroplanes and their ability to defy gravity has captivated humanity for generations. In our presentation, we chose to explore how aeroplanes fly to uncover the science and engineering behind this remarkable achievement. This topic was selected because it bridges the gap between complex physics principles and real-world applications, making it both intellectually stimulating and universally relevant.

The presentation delves into the core principles of flight, including lift, thrust, drag, and weight, as well as the role of aerodynamics and engine technology. By understanding these elements, one gains insight into how human innovation has overcome natural limitations to create one of the most transformative modes of transportation.

We aim to make the topic accessible and engaging for audiences of all backgrounds, highlighting not only the technical aspects but also the ingenuity and creativity that have driven advancements in aviation. This subject resonates with us because it reflects our collective pursuit of discovery and progress, offering a powerful example of how science and technology shape the modern world.

SP57. UNVEILING THE SECRETS OF SKYSCRAPER STABILITY

Chunghwan Lee, Chunghun Lee
Apgujeong Elementary School, Korea

This study investigates how skyscrapers maintain stability, focusing on their resistance to wind forces. We explored the structural elements that enable tall buildings to withstand environmental challenges, with a particular emphasis on wind effects over earthquakes.
Our research questions centered on the mechanisms that allow skyscrapers to stand, the comparative dangers of wind versus earthquakes, and specific strategies for wind resistance. We examined concepts such as natural frequency, vortex shedding, and innovative design solutions including Tuned Mass Dampers (TMD), tapered and twisted designs, and wind holes.
The methodology involved extensive paper research and experiments. Key findings highlight the importance of reinforced concrete, the critical role of wind-resistant designs, and the effectiveness of various architectural strategies in mitigating wind effects.
This study concludes that wind resistance is crucial for skyscraper stability, achieved through a combination of structural engineering and innovative design. Future research will focus on detailed analysis of specific buildings, such as the Shanghai Financial Tower, and explore the potential for even taller structures in the future.

SP58. FINDING THE PERFECT FLIP

Dajin Lim, Gyobin Kang, Yejin Han
Amanda Moon Education

Do you remember when bottle flipping challenge was so popular? A bottle partially filled with water is thrown, it flips, and lands perfectly upright. It is quite a striking phenomenon, since at first sight, it appears rather improbable that a rotating bottle could make such a stable landing. Yet, the principle is quite simple. As the water sloshes around inside the bottle, it spreads out, increasing the moment of inertia and slowing the rotation. This reduction in speed makes the landing more stable, following the conservation of angular momentum.
To explore this further, our project investigates how varying the amount of water in a bottle affects its ability to land upright after being flipped. We hypothesized that the success rate would differ depending on the water level inside the bottle. To test this, we conducted an experiment by flipping bottles filled with different amounts of water 100 times each. Our aim was to observe the effect of water levels on the success rate and determine the optimal amount of water for achieving the best flip.

SP59. DOES SUGAR MAKE US HYPER?

*Yuha Kwon, **Jane Shin
*Seoul Academy, **KIS, Korea

This study investigates the relationship between sugar consumption and hyperactivity, prompted by observations of siblings experiencing sugar crashes after consuming sugary snacks. We explored sugar's nature, its effects on the human body, and the scientific basis behind the belief that sugar induces hyperactivity.
Our research focused on sugar's chemical composition and the physiological processes triggered by its consumption. We conducted experiments comparing sugar, high-fructose corn syrup (HFCS), and artificial sweeteners, measuring their effects on blood glucose levels, blood pressure, and reaction times.
Findings revealed that sugar consumption leads to a temporary state of hyperactivity ("sugar rush"), followed by a "sugar crash." Experiments showed sugar intake resulted in an average decrease of 25ms in reaction time and an increase of about 50 mg/dL in blood glucose levels.
We explored sugar's benefits and disadvantages, its potential for addiction, and its role in conditions like diabetes and obesity. The study also examined the efficacy of sugar substitutes.
This research contributes to understanding sugar's impact on human physiology and behavior, providing insights into sugar-induced hyperactivity and its health implications. It underscores the importance of moderate sugar consumption and highlights the need for further research into healthier alternatives.

SP60. RELATION BETWEEN URBAN HEAT ISLAND AND ALBEDO EFFECT

Jihoon Kim, Jiseop Kim
Amanda Moon Education

Have you ever felt hotter in summer when wearing dark clothes? We have, and that is because darker colors absorb more light and heat. This phenomenon is called the albedo effect. With this in mind, we wondered if the same effect occurs in cities, where dark surfaces like asphalt roads take up a significant portion of the land. Could these surfaces be making cities hotter than natural environments?To better understand this idea, we planned a simple experiment. We placed equal amount of ice on three colored paper- white, green, and black. Then, we measured how long it took for the ice to melt in each container to show how different colors affect heat absorption.Using reflecting materials and expanding green spaces helps some cities solve this problem already. Our experiment demonstrates how surface color directly influences temperature and shows how cities may use the albedo effect to lower heat. By understanding this connection, we can explore strategies such as incorporating lighter-colored materials and increasing green spaces to cool cities. These strategies can be useful in making cities more resistant to the effects of climate change.

SP61. EXPLORING PAST CREATURES THAT LIVED IN KOREA

Jaeyoung Cheon
Dusil Elementary School Busan

Ancient creatures have always interested me. Therefore, I chose to explore past creatures that lived in my country of Korea. I dld this in several steps. First, I visited the fossil exhibition hall and studied literature. For example, I read books related to the Marine Natural History Museum and fossils. Second, I viewed and collected fossils. In fact, when I personally excavated a fossil, I investigated its characteristics and length, and wrote an explanation based on that fossil. Finally, I drew descriptions of fossils and Identified them. To be specific, I investigated and described fossil layers and lengths of bracken, trilobites, dragonflies, clams, and fish, examining them in detail. Overall, collecting and breaking fossils was exciting, drawing pictures was fun, and I think these projects gave me some great memories.

SP62. HARNESSING NOISE-CANCELING TECHNOLOGY: EXPERIMENTS WITH FXLMS AND REAL-WORLD APPLICATIONS

Hajoon Lee, Hyeonho Kwon
Saint Paul Academy Daechi

Noise-canceling structure is important for increased concentration, transportation, and also keeping people safe from many different kinds of loud sounds. Noise-canceling, focused on ANC, are mostly in earphones and headsets. We minded our experiment based on the noisy sound during the school class, and I expected this technology to be possible for all environments.Our experiment mentions ways of performing destructive interference from a big frame called ANC, which is “threshold” and “FxLMS.” We used a MacBook, Python,

and PyCharm to perform noise-canceling experiments. After explaining noise-canceling algorithms and their characteristics, we designed our experiments to make effective and effective use of Python and PyCharm. The experiments started with recorded sound sources and progressed to real-time processing. We ran the experiment using the FxLMS algorithm.We conducted three experiments: in the first experiment, we generated an inverse phase for a recorded sound and observed that the sound was completely removed. In the second experiment, we applied FxLMS to a recorded everyday sound source and found we could remove some noise. Finally, in the third experiment, we discovered that real-time FxLMS can effectively cancel noise, but it has limitations when it comes to controlling instantaneous noise Noise-canceling technology can be used in a variety of applications. For example, it can be used in noise-canceling beds for babies, baseball fields to provide a quieter environment, and devices to quiet animals when they are breeding. These examples show how technology can provide more silent and comfortable spaces in a variety of environments.

SP63. MICROPLASTICS, THE BIG PROBLEM

Ha Jihoon, Park Junseo, Jo Seongwon
Amanda Moon Education

Microplastics are literally on everyone's lips. We now know that microplastics are present in all areas of the environment - from water to sediments and soils to the atmostphere - and can also be absorbed by humans. We recently came over an article revealing that microplastics are also found in brain tissue. This was not only alarming but also raised concerns about how these particles accumulate and what health risks they bring. What is even more worrying is that, although there are methods to reduce microplastic exposure, there are no clear solutions to stop.As we researched further, we found that microplastics may adhere more to fat-rich tissues due to their hydrophobic nature. That means they cling to fats. This led us to hypothesize that high fat organs like the liver or adipose tissues would attract more microplastics. To test this, we designed a simplified experiment using sponges to simulate body tissues. By mixing water and oil to replicate body fluids with fat content, we wanted to show how microplastics accumulate in fat-rich environments.Our project aims to investigate this connection between microplastics and fat absorption, highlighting how these
particles may accumulate in particular organs and what this could mean for long-term health risks.

SP64. DANGERS OF SMOKING

Heather Bellizzi, Antonia Golea, Antrea Kritioti, Mia Sidhu
International School of Paphos, Nicosia

Smoking is a dangerous and addictive habit that affects people of all ages. While it may seem harmless at first, offering a sense of relief or relaxation, it hides the harmful effects of toxic substances. Our presentation aims to reveal the truth about smoking and its impact on health.
We will explore the different devices used for smoking, the substances they contain, and their flavors. The presentation will also highlight the stages of addiction and compare the lungs of smokers and non-smokers. We'll discuss both the short-term and long-term effects of smoking on health, including severe illnesses and life-threatening conditions. Statistics on smoking by age and gender will show how widespread the problem is.
Importantly, we'll share ways to quit smoking. From understanding nicotine's effects to using devices like nicotine necklaces, we'll explain practical steps to help people overcome addiction. The goal is to encourage everyone to take smoking seriously, recognize its dangers, and find the strength to quit.
Smoking ruins lives, but with the right information and support, it's possible to stop. Our presentation will provide tools and insights to help make that change.

SP65. DNA

Alina Trofimchuk
International School of Paphos, Nicosia

Chemistry is captivating because it helps us understand the building blocks of life—including DNA, the fascinating molecule that makes us who we are right now! Did you know that even tiny bacteria and humans share the same basic building blocks of life? That's all because of this minute particle! DNA stands for Deoxyribonucleic Acid. It is a bunch of atoms stuck together, in the case of DNA, they are combined to form a long spiraling ladder. My scholastic presentation's objective is to engage the audience by exploring what is the essential role of DNA in our lives!

The presentation will guide the young learners through fun, DIY experiments, and mind-blowing facts. I will demonstrate how DNA works: the secrets of our genetic code; how DNA helps in forensics; and why we are like our parents. Genetics in action; genetic mutations: what makes us unique; DNA and the future of medicine!
My goal is to convince young learners that chemistry is not just a set of equations and formulas to memorize, but instead, they need to view it as a thrilling adventure into the unknown!

SP66. THE SOLAR SYSTEM

Christos Tofarides
International School of Paphos, Nicosia

This abstract aims to provide a comprehensive overview of the solar system, exploring its vast complexity and unique characteristics. It will delve into a detailed description of the solar system's structure, including the sun, the planets, and other celestial bodies such as moons, asteroids, and comets. Each planet will be examined individually, highlighting its distinct features, atmospheric conditions, and the role it plays within the system. Additionally, this presentation will discuss how these celestial bodies influence Earth, from gravitational effects to climate patterns and potential for future exploration.
Furthermore, the abstract will cover key historical and scientific discoveries that have shaped our understanding of the solar system, including theories of its formation and significant astronomical events that have impacted planetary evolution. By showcasing the diversity and uniqueness of each planet, this discussion will emphasize the intricate and dynamic nature of our cosmic neighborhood. Ultimately, this abstract aims to foster a deeper appreciation for the solar system and the ongoing research that continues to uncover its mysteries.

SP67. SCHRÖDINGER'S THEORY: THE PARADOX OF QUANTUM SUPERPOSITION

Andreas Demosthenous
Pagkyprion Gymnasion, Cyprus

Schrödinger's paradox, also known as the Schrödinger's cat thought experiment, illustrates the strange nature of quantum superposition. In this scenario, a cat is placed inside a sealed box with a radioactive atom, a Geiger counter, poison, and a vial that breaks if the atom decays. According to quantum mechanics, until observed, the atom exists in a superposition of decayed and undecayed states, meaning the cat is simultaneously alive and dead. This paradox highlights the conflict between quantum mechanics and classical intuition, questioning when and how quantum possibilities collapse into a single reality. It remains a central topic in quantum theory discussions.

SP68. WHY CAN'T YOUR DOG EAT CHOCOLATE?

Eva Pavlović, Petra Požgaj
Gimnazija "Fran Galović", Koprivnica, Croatia

Have you ever wondered why can't your dog eat chocolate? The fact is that the chocolate contains two harmful substances: theobromine and caffeine. Both of these compounds are stimulants found in cacao from which is chocolate made. Humans can metabolize them efficiently, while dogs process them much more slowly. It is because of this slow metabolization that theobromine builds up to a level that is toxic to their system, resulting in chocolate toxicity. Caffeine, while also toxic to dogs, is present in much smaller concentrations. The darker the chocolate the more poisonous it is for them. If your dog has accidently got hold of some, their reaction will depend on their weight, the type of chocolate and the amount they have eaten. Reactions can range from mild stomach problems to heart failure and even death. If your dog eats chocolate, it may become extremely thirsty, have diarrhea and become hyperactive. If things get really bad, this hyperactivity can turn into seizures that go beyond arrhythmia and heart attack.

SP69. THE SECRETS OF THE ANTIKYTHERA MECHANISM

Eleana Voutsadaki, Orestis Georgilidakis, Nino Pefanis, Maximos Tilemachou
Europaiko Protypo, Athens, Greece

Astronomy has captivated many civilizations from ancient times to the present day. Beginning with the Babylonians and the Sumerians, who made the first significant contributions, it was further advanced by Ancient Greece through the geometric model, particularly by Hipparchus. He is regarded as the Father of Modern Astronomy due to his insights, including the Almagest, the concepts of latitude and longitude in geography, and the measurement of the calendar year as we know it today. Hipparchus's astronomical theories formed the foundation for the construction of the most important mechanism of the ancient world, the Antikythera Mechanism.
The Antikythera Mechanism was discovered over 120 years ago on the island of Antikythera by a team of sponge divers exploring the rocky reef below. The mechanism was found alongside other treasures within a Roman shipwreck that had sunk near Antikythera. The Antikythera Mechanism was a mechanical device made of wood and copper; it was damaged at its corners, and some parts have been lost. The Antikythera Mechanism is considered the oldest astronomical device ever found.
The purpose of this paper is to present information about the Antikythera Mechanism, including its origins, discovery, and construction, while also providing insight into its use and general purpose. Its influence on human history and science will also be discussed.

WORKSHOPS

WS1. CALCULATE AND COLOR

Iva Özaltın, Mara Grašić
Osnovna skola "Braca Radic" Koprivnica, Croatia

Through this workshop, students will review arithmetic operations with whole numbers. Each student receives a sheet with tasks and a coloring book. First, they solve the tasks and then match the task number to its solution in the table, which is provided on the task sheet. After that, they color the task numbers in the coloring book with the given color. The number 25 in the coloring book remains uncolored.

Workshop for students

Duration: 45 minutes

WS2. KINGS OF FRACTIONS

Mara Grašić, Iva Özaltın
Osnovna skola "Braca Radic" Koprivnica, Croatia

The goal of this game is to move your piece from the 'Start' square to the starting position, moving clockwise. Each player has their own colored piece and begins by placing their piece on the 'Start' square. Players move one step at a time and then draw a card of the corresponding color, after which they solve the task written on the card. If the player solves the task correctly, they move to the next square, take a crown, and wait for their turn in the next round. The winner is the player who first returns to the 'Start' square and collects the most crowns.

Workshop for students

Duration: 45 minutes

WS3. ACID RAIN: CHEMISTRY, IMPACT, AND SUSTAINABLE SOLUTIONS

Loukia Louka
International School of Paphos, Cyprus

This presentation explores the chemistry behind acid rain, its environmental impact, and sustainable mitigation strategies. The session outlines the formation of acid rain through atmospheric reactions involving sulfur dioxide (SO_2) and nitrogen oxides (NOx), leading to the creation of sulfuric (H_2SO_4) and nitric acids (HNO_3). The focus will be on how acid rain affects ecosystems, soil, water bodies, and infrastructure, using experimental simulations to demonstrate its corrosive effects on limestone structures and changes in soil pH.
The presentation also draws a connection to Leonardo da Vinci's holistic approach to studying natural phenomena, emphasizing the importance of interdisciplinary learning in addressing modern environmental challenges. Participants will gain insight into practical solutions to reduce acid rain, including cleaner energy sources and emission control policies. The aim is to foster environmental responsibility and critical thinking among students while demonstrating how historical perspectives can enhance modern scientific approaches.
This talk will highlight how hands-on experiments, outdoor activities, and group discussions can effectively engage students in understanding complex environmental issues, encouraging them to develop actionable solutions to mitigate the impact of acid rain in real-world contexts.

Workshop for students

Duration: 45 minutes

WS4. RECURRING DECIMALS

Marios Nye
International School of Paphos, Cyprus

Recurring decimals are a common occurrence in mathematics and can appear in various forms, especially when dealing with certain fractions or divisions. In this presentation, we will explore the nature of recurring decimals, focusing on how their repeating patterns emerge and what these patterns signify. This topic is important as recurring decimals often represent irrational numbers or ratios that are not immediately intuitive but are fundamental to understanding number systems. The study of recurring decimals gives insights into their unique properties and behaviour in both theoretical and applied contexts.
A key skill in working with recurring decimals is the ability to convert them into fractions. This process is essential for simplifying calculations and accurately expressing repeating decimal values. During the presentation, we will demonstrate how this conversion can be accomplished through a straightforward method. This method is versatile and can be used for decimals with single-digit repetitions or more complex patterns with multiple digits. Converting recurring decimals into fractions makes it easier to perform arithmetic operations and ensures precision in mathematical work.
By the end of the presentation, participants will understand the significance of recurring decimals and how to effectively convert them into fractions. This understanding is valuable not only in mathematics but also in various practical fields such as engineering and finance, where precise numerical representations are crucial. Mastering the conversion of recurring decimals is an essential tool for anyone involved in mathematical problem-solving or quantitative analysis.

Workshop for students

Duration: 45 minutes

WS5. HOW IMPORTANT IS A QUESTION IN YOUR LESSON?

Claire Polycarpou
International School of Paphos, Cyprus

When we teach, we have a short amount of time to ensure the information is given to our students. What is the best use of that time? If we are using questions then what are their use? If a question is asked then surely it is important for all students to have the opportunity to answer. How is that possible when we have so many students and so little time. Ensure that you prepare your questions so that they have the maximum impact and you illicit the answers you want. To prepare these questions AI can help and save our time in planning lessons. Know the most effective way of using AI to impact all students by considering all of the needs within the class; include ability and language considerations for all students when trying to teach and plan. From this session know how to plan your lesson to ensure the best learning, apply pertinent questioning and how to flip the classroom to improve your lesson time and boost your learning outcomes.

Workshop for teachers

Duration: 45 minutes

WS6. ARSTEAMAPP: ENRICHING OUR SUSTAINABLE FUTURE

Elena Matroana Hreciuc, Mihalache Iuliana Mihaela
Secondary School Ion Creanga Suceava, Romania

ARSTEAMapp, developed under the Erasmus+ initiative (Project No. 2021-1-ES01- KA220-SCH-000030257), co-funded by the European Union, represents an innovative educational approach that integrates Augmented Reality with STEAM (Science, Technology, Engineering, Arts, Mathematics) subjects. The project stimulates scientific curiosity among students aged 12 to 16, connecting STEAM education with European cultural heritage. ARSTEAMapp emphasizes the integration of arts and cultural dimensions within core STEM subjects. The application contributes to the development of a valuable educational environment: ✓ Promoting scientific literacy through hands-on engagement with emblematic monuments. ✓ Improves understanding of engineering, material science and geometry principles through AR interactions. ✓ Promotes a multidisciplinary perspective by integrating history and artistic analysis into STEAM learning. ✓ Enables interactive, technology-enhanced learning experiences to motivate students and modernize classroom practices. The project also emphasizes alignment with national and international educational programs, encouraging intercultural awareness and innovation among participating students and educators. Key features of ARSTEAMapp • Integrating STEAM with European cultural heritage. ARSTEAMapp allows students to explore and analyze UNESCO-listed monuments, which serve as practical case studies for examining engineering techniques, geometric patterns, artistic designs, and historical narratives. For example, students can study ten iconic European buildings, exploring, for example, the structural design and acoustics of the Roman Colosseum, delve into the light phenomenon used in Hagia Sophia, Istanbul, Turkey, or explore the artistic symbolism of the Palace of Parliament in Bucharest, Romania. ARSTEAMapp uses AR technology to transform classroom learning, providing accessibility on Android devices and tablets. Its flexible design supports different instructional settings, from classroom discussions to independent study, while aligning with partner countries' educational standards to reinforce key STEAM competencies. With tutorials, pedagogical guides and references, the app ensures seamless adoption by educators and stimulates students curiosity, creativity and critical thinking, essential 21st century skills. The app supports interdisciplinary education and innovation, inspiring engagement at the nexus of science, culture and technology.

Workshop for teachers and students

Duration: 75 minutes

WS7. IS TASTE JUST SMELL?

Claire Polycarpou
International School of Paphos, Cyprus

Is taste a result of sensors on the tongue or sensors in our nose? How do we taste and does it matter? Investigate how you taste, where your enjoyment of food comes from and how food companies work hard on making you choose their brand. Does airplane food really taste so bad and can it be improved? Do we have to hire new chefs for this or can we never have good food in a plane? Discover how the future of food technology will look and if taste testers can be replaced by machines. During this practical session we will look at different foods and their tastes. We will look at how we can be tricked into tasting one thing when really it is another. See how the texture of food matters and if we are producing plant protein to replace

meat what really are people looking for. If I am Vegan do I really want a plant to look like meat? If I do then what will make it taste like meat?

Workshop for students

Duration: 45 minutes

WS8. INTERACTIVE LEARNING THROUGH PLAY

Željka Hanžek*, Iva Özaltın**
Osnovna škola "Antun Nemčić Gostovinski" Koprivnica*, Osnovna skola "Braca Radic" Koprivnica**, Croatia

Mathematical workshops with cards offer students a fun and interactive way to acquire basic math skills through play and collaboration. This workshop, designed for primary school students, focuses on addition and subtraction, with flexibility for adapting to various skill levels. The goal is to develop mathematical abilities and encourage critical thinking through activities that involve creating and solving tasks using number and symbol cards.
Students work in teams, creating problems, verifying, and correcting answers. Activities include a competitive element, where students earn points for correct answers, as well as variations like "Quick Answer" and "Question Cards." An advanced version incorporates fractions and more complex expressions.
The workshop concludes with a review of tasks and recognition of effort, motivating students and fostering further learning. This approach allows for the reinforcement of basic mathematical operations, strengthens teamwork, and enhances mathematical skills in a dynamic and engaging environment.

Workshop for students

Duration: 45 minutes

WS9. THE MAGIC OF π: A JOURNEY THROUGH NUMBERS, POETRY, AND FUN

Georgios Tzachristas
Student, School of Electrical and Computer Engineering - National Technical University of Athens

Join us in an exciting and interactive workshop where we explore the fascinating world of π (Pi)!
Designed for students aged 9-14, this session combines math, creativity, and hands-on activities to bring the magic of π to life. We will begin by uncovering the history and mathematical significance of π, from its ancient origins to its role in modern science.
Then, we will dive into a unique challenge: writing a Pi Poem, where each word follows the digits of π in letter count! Participants will get the chance to express their creativity while deepening their understanding of this mysterious number.
Next, we will put our memory skills to the test with the Pi Memory Challenge, where students compete to recall as many digits of π as possible.
Finally, teamwork and quick thinking will be key in the Human π Game, where participants arrange themselves in the correct sequence of π digits.
This workshop is dynamic, educational and fun, ensuring that students not only learn about π but also experience it through engaging activities.
Small prizes will be awarded to winners, making this an unforgettable celebration of mathematics!
Are you ready to discover the infinite wonders of π? Join us and let's explore together!

Workshop for students

Duration: 30 minutes

WS10-A/WS10-B. BLINKING LIGHTS: SOLDER YOUR OWN CIRCUIT

*Deutschmann Bernd, **Maier Christoph, **Juch Nikolaus**
**TU-Graz, Head of Institute, **TU-Graz, Master Student, ***TU-Graz, Bachelor Student, Austria

Can you imagine a world without electronics? Without electronics, there would be no smartphones, computers, tablets, televisions, etc.

In this workshop you will learn about the fascinating world of electronics and build your own electronic circuit. You will see that it is very easy to build a circuit, a so-called astable multivibrator, yourself. We will help you with this and first explain the various electronic components used, such as resistors, capacitors, transistors, etc. Then we will start soldering these components onto a printed circuit board together with the help of a soldering iron. If all the components are connected correctly at the end and we connect a battery, two LEDs should flash. If not, we will be on hand to help you find the fault. With a little patience and our help, you will certainly succeed in bringing your circuit to life. Of course you can take the circuit you have built home with you.

Workshop for students (20 students (4 groups with 5 people))

With repetition in the programme

Duration: 75 minutes each workshop

WS11. TEAM BUILDING FOR PROJECT BASED LEARNING IN STEAME EDUCATION

Ioannis Lazarou
Cyprus Mathematical Society, Cyprus

This workshop explores the crucial role of team building in fostering successful Project-Based Learning (PBL) within a STEAME (Science, Technology, Engineering, Arts, Mathematics, and Entrepreneurship) education framework. Effective PBL requires students to collaborate effectively, and this workshop will equip teachers with practical strategies and activities to cultivate strong teamwork skills in their classrooms. Participants will delve into the theoretical underpinnings of collaborative learning, examining different team roles, communication strategies, and conflict resolution techniques. The workshop will focus specifically on the unique challenges and opportunities presented by STEAME-focused projects, where interdisciplinary collaboration is paramount. Through interactive sessions, teachers will experience hands-on team-building activities adaptable for various age groups and subject areas. Participants will leave with a toolkit of resources and a deeper understanding of how to design and implement PBL projects that not only integrate STEAME concepts but also explicitly develop the essential teamwork skills necessary for student success in the 21st century. This workshop aims to empower teachers to create dynamic learning environments where students thrive through collaborative, project-based exploration.

Workshop for teachers

Duration: 45 minutes

WS12. EMPOWERING STEAME EDUCATION WITH AI TOOLS

Kyriacos Matheou
Cyprus Mathematical Society, Cyprus

AI tools are transforming STEAME education by enabling personalized learning, identifying gaps, and providing tailored feedback. They enhance creativity and problem-solving through simulations and interactive content while automating administrative tasks, allowing educators to focus on mentoring. By integrating AI, STEAME education becomes more inclusive, effective, and future-ready, equipping students and teachers for a technology-driven world.
This workshop will showcase practical AI tools designed to empower both teachers and students, fostering innovation and enhancing learning outcomes in STEAME education.

Workshop for teachers

Duration: 60 minutes

WS13. STEAME EVALUATION METHODS with emphasis in PBL

Andreas Skotinos
European Association of Career Guidance, Cyprus

The workshop will introduce STEAME EVALUATION METHODS with emphasis in PBL.
The topic of STEAME evaluation methods with emphasis in PBL is obviously a huge issue that has to reflect and investigate on methods for assessing the STEAME approach and its effectiveness. Furthermore, it aims at the identification of the various actors that are involved in the process and organize the means that are going to provide information for the various associates in the approach. In this context the effort should be with the extent of achievement of the goals and objectives that are set for it. For this the presentation provides elements for the identification of important criteria or aspects that are determining or reflecting the distinguishing aspects that led to the adoption of the STEAME approach. Additionally, it is important to identify who are the various partners involved, ranging from the students and the teachers that have to be engaged, as well as other contributors. Moreover, the presentation is to address the outcomes involved and which are major component in the learning process as well as the tools and methods for assessment. In this context reference will be made to rubrics, portfolios, and other approaches for assessment. Particular emphasis will be given to the STEAME PBL Competence Framework, which provides ample ideas that are setting the forum for the certification of the STEAME teachers. This framework provides a basis covering a set of four areas that are essential for the STEAME approach and reflect the elements that can provide the source for assessing the effectiveness of teachers as well as the degree of efficacy of students and methodologies.

Workshop for teachers

Duration: 30 minutes

WS14. PROJECT-BASED LEARNING: AUTHENTIC LEARNING ADVENTURES

Eleni Papageorgiou
Cyprus Pedagogical Institute, Cyprus

This module is designed to enhance educators' understanding and proficiency in Project Based Learning (PBL), equipping them with the necessary knowledge and skills to effectively create, implement, and evaluate Project-Based Learning activities in their classrooms. Throughout this module, educators will delve into the core principles of PBL and explore pedagogical approaches aimed at designing tasks that promote deeper student engagement and improve learning outcomes. Special attention will be given to Inquiry Based Learning (IBL), Problem Solving Based Learning (PSL), and Context Based Learning (CBL), as well as fostering cooperation, collaboration, reasoning, and creativity.
This course will be highly interactive and practical, structured as a PBL simulation where participants will collaborate in small groups to navigate through the various stages of a PBL project. Additionally, it will offer tangible examples, ideas, and tools to inspire and assist educators in planning their own PBL units.

Workshop for teachers

Duration: 90 minutes

WS15. AI-ENHANCED DEVELOPMENT OF STEAME LEARNING & CREATIVITY PLANS

Thomas Economou, Elpiniki Margariti
Doukas School, Athens, Greece

The workshop will highlight the importance of documenting STEAME learning activities in a consistent and structured way to promote collaboration and sharing among teachers, enabling the effective design and development of project-based STEAME activities. Participants will be introduced to the STEAME Learning and Creativity Plan (L&C Plan), with a focus on its various sections and ensuring the interdisciplinary nature of the activities. Key topics will include setting interdisciplinary learning objectives, aligning with the

STEAME ACADEMY and STEAME in Life (SiL) framework, selecting tools, materials, and resources, and outlining the sequence and context of project-based activities.

Additionally, the workshop will showcase user-friendly generative AI platforms that pre-service and in-service STEAME teachers can use to enhance the development of STEAME L&C Plans. Participants will learn how to choose the most suitable platform—whether general or education-specific—and craft effective prompts to generate valuable responses for their STEAME L&C Plans.

Workshop for teachers

Duration: 60 minutes

WS16. STE(A)M Learning Ecologies (SLEs), by SCIENTIX

Ioana Caraghiozov
Project officer at the Science Education Department of European Schoolnet

STE(A)M Learning Ecologies (SLEs) is a EU funded project that aims to use open schooling to develop science learning opportunities for all, connecting formal and informal learning environments, as well as enterprises and the civil society – and giving all actors space and motivation to take initiative and central roles. Read more about the project and its main achievements at this link.

During the workshop, participants will be briefly introduced to the main elements of the SLEs methodology, to delve right after into its practical aspects through an interactive role-play. Teachers, students and researchers will be tasked with creating their own SLEs following our pedagogical toolkit, and reflect on the experience in groups.

Workshop for teachers and students

Duration: 90 minutes

WS17. THE INS AND OUTS OF EMBRACING NATURE-BASED SOLUTIONS IN SUSTAINABILITY EDUCATION AS SEEN THROUGH THE LENS OF NBS EduWORLD AND SCIENTIX®

Ivelina Ivanova
Project manager at the Science Education Department of European Schoolnet

This workshop, powered by the Horizon Europe project NBS EduWORLD, and Scientix® - the community for Science education in Europe, will introduce nature-based solutions (NBS) to teachers interested in environmental sustainability education. Participants will familiarise themselves with a range of tools, resources, and strategies to help integrate NBS into their activities, combining GreenComp and STE(A)M approaches. The workshop will also provide best practice examples of NBS implementation by schools.

Workshop for teachers

Duration: 90 minutes

WS18. GENDER PERSPECTIVES AND TOOLS IN STEM EDUCATION: INSIGHTS AND PRACTICES FROM THE STREAM IT PROJECT

Katalin Oborni
HETFA Research Institute, Hungary

This interactive workshop, organized by the STREAM IT project, aims to empower teachers with practical tools and strategies to support girls and disadvantaged groups in overcoming the challenges they face in STEM education. By combining knowledge sharing, collaborative dialogue, and real-world problem-solving, the workshop equips educators to integrate gender-sensitive approaches into their teaching practices.
The session begins by exploring the barriers girls encounter in STEM fields, such as societal stereotypes, unconscious biases, and limited institutional support. Participants will then discuss actionable steps that

teachers can take at the classroom, school, and community levels to counteract these challenges. Through group discussions and brainstorming activities, participants will share their experiences and expertise, identify challenges, and co-create solutions to promote gender equality in STEM education.
By the end of the workshop, participants will have gained a deeper understanding of gender-sensitive teaching practices and practical tools they can implement in their classrooms and schools. Join us to join the movement to create inclusive and equitable learning environments that inspire and support the next generation of diverse STEM leaders.

Workshop for teachers

Duration: 45 minutes

WS19. Workshop on "ΕΠΙ – STEAME"

Sotos Voskarides
Affiliate Professor, Cyprus University of Technology, Cyprus

The term ”ΕΠΙ-STEAME”, which adds to the Latin name ”STEAME”, the Greek letters: E [Editing (Logistics)], then three consecutive Π’s [Environment, Play, Education (Ethics, taken from the family and from the enlightened Masters) and the letter ”Ι” [History]: ”ΕΠΙ-STEAME”,= I stand at the top and thus means “I am an expert”.

This idea, of course, is not a new idea: Some 2500 years ago Pythagoras founded his School (the “Omakoeion”) in Crotona in southern Italy (of Greater Greece), which was essentially a university. It offered not only science, technology, engineering, engineering, arts, mathematics, and entrepreneurship, but also knowledge about administration (diligence), ethics, Environmental Studies, History (along with Geography) and other subjects, which, in the end, led students to Philosophy.

The workshop under the title ‘ΕΠΙ- STEAME’ refers, inter alia, to the need to apply at least a large part of Pythagoras’ approach and philosophy to education today. Otherwise, an engineer, a scientist, a doctor, a businessman or an artist without moral values or without knowledge of logistics or history (and geography) or without love for Mother Earth and all living creatures, will not only be practically unsuccessful in his career and personal life, but may be dangerous for society and the planet.

Besides the above, if during the school curriculum, at any level, some alternative methods of teaching and learning, including Gamefigation, are sometimes introduced, then the chances of the graduates being ethical, skilled, and useful professionals who will contribute positively to the existence of a better world are expected to be increased.

Workshop for teachers and students

Duration: 30 minutes

WS22. TRANSFORM YOUR CLASSROOM: LEVERAGING VR FOR ENGAGED LEARNING

Dr. Vlasios Kasapakis
Assistant Professor, Department of Cultural Technology and Communication, University of the Aegean, Greece

Revolutionize your teaching with virtual reality (VR)! This workshop equips educators with the tools and strategies to integrate VR into their lessons effectively. Discover how immersive learning environments can boost student engagement and understanding across subjects like science, history, and art. Gain hands-on experience with practical VR applications and explore real-world success stories.

Learn to inspire creativity, critical thinking, and collaboration in your classroom. By the end of the session, educators will feel confident in using VR to create dynamic and impactful learning experiences for their students. Unlock the potential of VR and transform education for the digital age.

Workshop for teachers

Duration: 60 minutes

WS23. STEP INTO THE FUTURE: EXPLORING VIRTUAL REALITY LEARNING ENVIRONMENTS

Dr. Vlasios Kasapakis
Assistant Professor, Department of Cultural Technology and Communication, University of the Aegean, Greece

Experience the magic of learning through virtual reality (VR)! This workshop takes students on an immersive journey where history, science, and art come alive. Explore ancient civilizations, dive into oceans, or venture into space—all within a virtual world.

Engage in challenges, collaborate with peers, and see how VR transforms education into a fun and interactive adventure.

Discover how this cutting-edge technology can inspire creativity, curiosity, and a passion for learning. By the end, students will understand how VR is shaping the future of education and opening doors to new possibilities.

Workshop for teachers and students

Duration: 120 minutes

EUROPEAN STEAME ACADEMY SYMPOSIUM

SY1. STEAM BASED LEARNING LESSON (The Detective of the Bell)

Kyriaki Evripidou
Physics Teacher, Pancyprian Gymnasium, Cyprus

The students initially study what a bell is, how it sounded in the past, and how it sounds today. They try to explain whether they like the sound and how it influences their behavior.Next, students research what sound is, how it propagates, and its characteristics. They analyze where the bell is placed and why, aiming to select the best location for optimal sound distribution, ensuring it reaches all students, even those furthest away.

Students calculate the characteristics of sound as a wave, including wavelength and speed. They study that sound travels at 340 m/s and conclude how far the sound of the musical instrument will reach for everyone to hear.Through mobile or tablet simulations they examine wavelength and frequency values. They observe how changing the frequency affects how far the sound travels. They adjust settings to ensure the sound reaches all students.In teams, students perform a theatrical play presenting their research on the Bell Detective. To conclude, students create posters summarizing their theatrical presentation and research findings.

SY2. SUSTAINABLE DEVELOPMENT GOALS AND STEM EDUCATION FOR GIFTED CHILDREN

Çelebi Kalkan
Murat Kantarcı Science and Art Center, Turkiye

Gifted children possess exceptional cognitive abilities and creative potential, making them key contributors to solving global challenges. To harness their talents effectively, integrating Sustainable Development Goals (SDGs) with STEM education offers a powerful approach to developing innovative, problem-solving mindsets.

This presentation explores how STEM-based activities can be designed to empower gifted students in tackling real-world sustainability issues. By integrating SDGs into STEM curricula, we foster critical thinking, interdisciplinary learning, and hands-on innovation, encouraging students to develop solutions for climate change, clean energy, and responsible consumption.

We will present best practices from our sustainability-focused STEM workshops, where gifted students engage in project-based learning, robotics, and entrepreneurship applications. Through these activities, students not only gain scientific knowledge but also develop leadership and collaborative skills essential for driving positive change.

Additionally, we will highlight the importance of mentorship, industry-academia partnerships, and digital tools in enriching STEM education for gifted learners. Our aim is to create a framework where STEM education aligns with SDGs, ensuring that gifted students become the future innovators and change-makers for a more sustainable world.

SY3. EXPLORING INSTITUTIONAL VIEW ON THE UNDER-REPRESENTATION OF GIRLS AND WOMEN IN STE(A)M: FINDINGS FROM THE 2024 STREAM IT STUDY

Katalin Oborni
HETFA Research Institute, Hungary

The presentation unveils key insights from a 2024 sociological study conducted within the STREAM IT project. The study investigated the status of girls and women in STEAM fields across Europe. The research explores the challenges, opportunities, and interventions necessary to foster inclusion and equity in STEAM education and careers by analysing empirical data collected from expert interviews. Our findings reveal persistent barriers to gender equity, including societal stereotypes, family expectations, unconscious educator biases, and insufficient institutional support. Despite notable progress in gender equality within STEAM education, various factors deter girls from pursuing and sustaining careers in STEAM. Additionally, we found complex institutional perspectives on increasing women's participation in STEAM from emphasizing individual empowerment to systemic reforms. The findings highlight critical intervention points and recommendations for educators, policymakers, and institutions to drive meaningful change.

SY4. THE ROLE OF MICROELECTRONICS IN STEAM EDUCATION

Bernd Deutschmann
Head of Institute of Electronics, Graz University of Technology, Austria

There is currently a large skills gap in microelectronics in Europe and it is expected that by the end of 2030 there will be a shortage of around 200,000-300,000 engineers in the microelectronics industry. Therefore, there are currently several initiatives to get young people interested in microelectronics. I would be happy to give a brief overview of the current situation in Europe and report on the EU's so-called Chips Act. However, the main focus should be on the importance of initiatives to inspire students and teachers for microelectronics and to address the many career opportunities.

SY5. EuropeAn NETWORK OF STEAM EDUCATORS: ADVANCING STEAM EDUCATION ACROSS EUROPE

Dr. Iro Koliakou
Head of STEM Anatolia College | Anna Papageorgiou STEM Center
EASE- EuropeAn network of STEAM Educators

The European Association of STEAM Educators (EASE) is a non-profit organization dedicated to enhancing the work of educators in promoting STEAM skills among learners of all ages in both formal and non-formal education settings. Since its inception, EASE has undertaken several initiatives to support and connect STEAM educators across Europe. Notably, the association has organized annual European Summits for STEAM Educators, providing a platform for sharing insights and methodologies. Additionally, EASE has developed resources such as lesson plans, training programs, and an AI Experimental Lab to assist educators in integrating STEAM approaches into their teaching. This presentation will delve into EASE's mission, highlight key projects and achievements from recent years, and discuss future plans aimed at fostering a collaborative and innovative STEAM education community across Europe

SY6. ENHANCING MATHEMATICAL GIFTEDNESS: THINKING TASKS AS A TOOL FOR IDENTIFICATION AND DEVELOPMENT

Valentina Gogovska, Daniela Stojanovska
UKIM, Faculty of Natural Sciences and Mathematics-Skopje, North Macedonia

Mathematical tasks and their solutions are fundamental tools in mathematics education, particularly in identifying and nurturing gifted students. This paper focuses on the selection and analysis of specific mathematical problems that serve as effective instruments for detecting, stimulating, and guiding students with advanced mathematical abilities. Through carefully chosen examples of solved problems, we demonstrate how particular types of tasks can support gifted students in acquiring deep, structured, and lasting mathematical knowledge.

The study examines the key characteristics of tasks that foster critical thinking, logical reasoning, and creative problem-solving. It explores the cognitive impact of such tasks on students and their ability to tackle complex mathematical challenges. Additionally, the paper discusses the role of educators in this process and presents strategies for seamlessly integrating these tasks into the curriculum to enhance teaching practices and fully develop the potential of mathematically gifted students.

The findings of this research provide actionable recommendations for instructional methods and pedagogical approaches that can be implemented in mathematics education. By adopting these strategies, educators can create a dynamic and intellectually stimulating learning environment that nurtures curiosity, independent thinking, and advanced analytical skills among gifted students.

SY7. BLOOMING THE FUTURE: EMPOWERING GENDER EQUALITY IN STEAM EDUCATION

Dr. Iro Koliakou
Head of STEM Anatolia College | Anna Papageorgiou STEM Center
EASE- EuropeAn network of STEAM Educators

An innovative approach to fostering diversity and inclusion in STEAM (Science, Technology, Engineering, Arts, and Mathematics) through the Blooming the Future project. We will explore tools and resources from the Blooming STEAM toolkit, designed to promote gender equality and empower young girls in STEAM fields. The workshop will showcase stories of influential STEAM women from history, a curated collection of scientific articles written by women leaders, and practical guidelines for educators on fostering an inclusive classroom environment. Join us in cultivating a sustainable, gender-balanced future in STEAM by empowering students and educators alike to champion inclusion and diversity in science and technology. https://www.erasmusblooming.eu/